

APPENDIX N

Noise Technical Report

Noise Technical Report

Belcaro at Sand Canyon Project

JUNE 2026

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
ACC	Air-cooled condensers
ADT	Average Daily Traffic
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
City	City of Santa Clarita
CNEL	Community Noise Equivalent Level
County	Los Angeles County
SCMC	Santa Clarita Municipal Code
dB	decibel
dBA	A-weighted decibel
DOT	Department of Transportation
FICON	Federal Interagency Committee on Noise
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HVAC	Heating, ventilation, and air conditioning
ips	inches per second
ISO	International Organization of Standardization
L _{dn}	day-night average noise level
L _{eq}	equivalent noise level
L _{max}	maximum sound level
L _{min}	minimum sound level
LT	Long-term
OBCF	Octave-band center frequency
OPR	Governor's Office of Planning and Research
Belcaro at Sand Canyon Project	proposed project
PPV	peak particle velocity
PWL	Sound power level
RCNM	Roadway Construction Noise Model
SLM	Sound level meter
SPL	Sound pressure level
ST	Short-term
TNM	Traffic Noise Model
VdB	Velocity Decibel

1 Introduction

1.1 Report Purpose and Scope

The purpose of this technical report is to assess the potential noise impacts associated with construction and operation of the Belcaro at Sand Canyon project (project). This analysis uses the significance thresholds in Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.).

1.2 Regional and Local Setting

The project is located in the City of Santa Clarita, Los Angeles County, California (Figure 1, Project Location). The project proposes the private development of approximately 193.8 acres of vacant land located along the southern edge of the Santa Clara River in the City of Santa Clarita, California (Figure 2, Project Area).

1.3 Project Description

The proposed project involves the development of existing, vacant parcels with 341 dwelling units (age-restricted detached single-family homes), an approximately 3.1-acre recreation center, public and private trails, an emergency evacuation center, and off-site roadway improvements. The proposed project is located within Sections 13 and 24 of Township 4 North and Range 15 West of the Mint Canyon, California USGS 7.5 Minute Series Quadrangle (Figure 1). The project involves the development of a new residential community that encompasses approximately 193.8 gross acres of land located on the south side of the Santa Clara River. Development is proposed for a new roadway alignment, “J Street”, that would connect Oak Springs Canyon Road to Robinson Ranch Road and provide an ingress/egress point for the project. The project area is bound by low-density residential development to the west, Robinson Ranch Golf Course to the south, and generally undeveloped land to the east (Figure 2).

Overall, the project area remains undeveloped, although there is evidence to indicate that some areas of the project have been disked and plowed in the past for agricultural uses. The project is also bisected by numerous dirt roads and above ground utilities. To note, an operational railway trending on an east to west axis bisects but is not contained within the project area. For the purposes of this report, the project area is further defined/identified by its northern-most project area (northern parcel) that sits to the north of the railway, and its southern-most project area (southern parcel) that sits to the south of the railway.

1.4 Fundamentals of Noise and Vibration

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

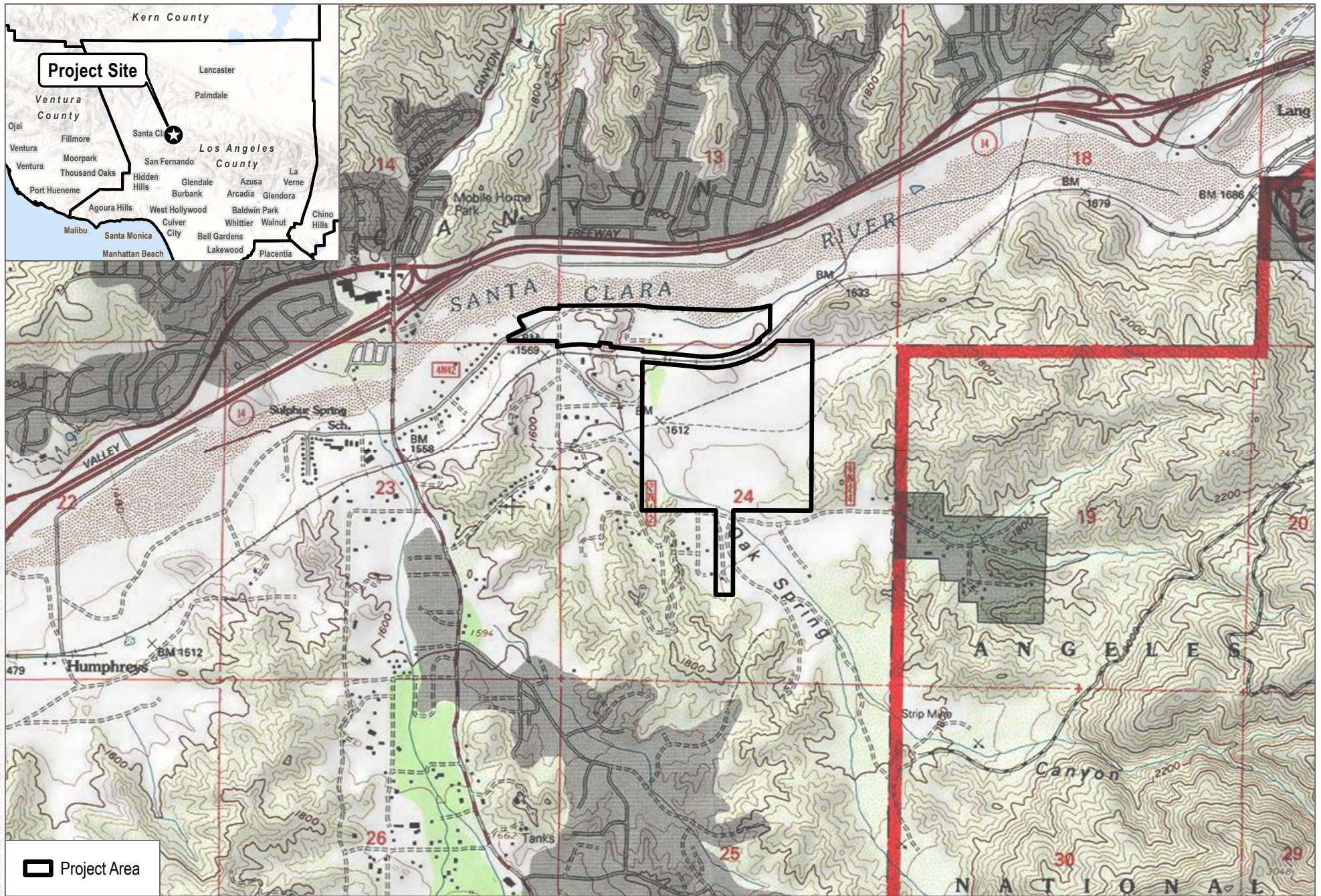
1.4.1 Sound, Noise, and Acoustics

Sound is actually a process that consists of three components: the sound source, sound path, and sound receptor. 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 wave determines its loudness. Loudness of sound increases with increasing amplitude. Sound pressure amplitude is measured in units of micronewtons per square meter, also called micropascals. One micropascal is approximately one-hundred billionth (0.0000000001) 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 and the sensitivity of human hearing to changes in micropascals is rather coarse (e.g., a doubling of micropascals is just audible to most people), sound pressure level 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).



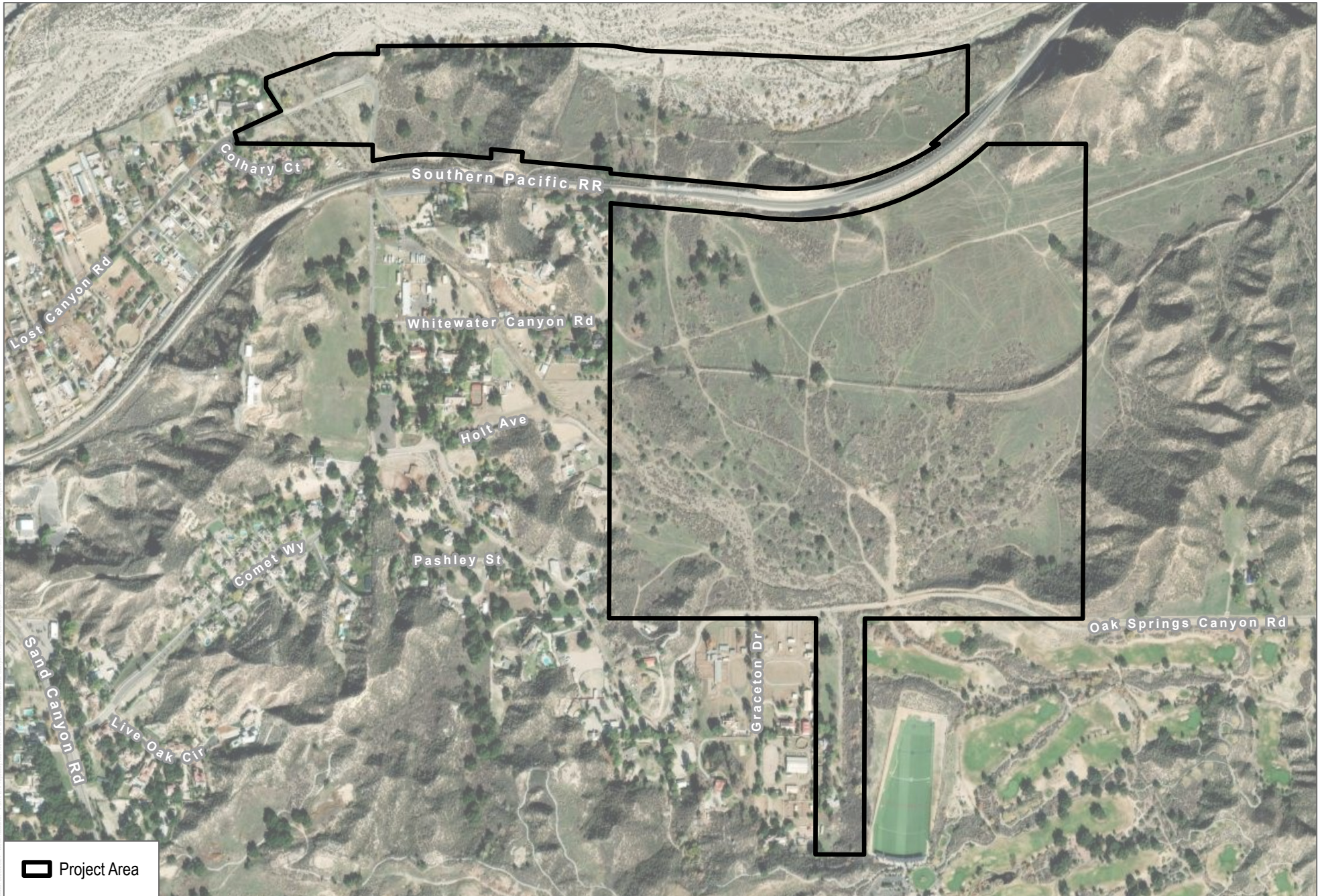
SOURCE: USGS Topo 7.5-Minute Series
 Mint Canyon Quadrangle - Township 4N Range 15W Section 24



FIGURE 1

Project Location

Belcaro Sand Canyon Project



SOURCE: Maxar 12/8/2022



FIGURE 2

Project Area

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, and 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 (dBA)	Common Indoor Activities
—	110	Rock band
Jet fly over at 300 meters (1,000 feet)	100	—
Gas lawn mower at 1 meter (3 feet)	90	—
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)
—	10	Broadcast/Recording studio
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Source: Caltrans 2020.

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 pressure levels of 1 dBA when exposed to steady, single-frequency signals in the mid-frequency range. Outside such controlled conditions, the trained ear can detect changes of 2 dBA in normal environmental noise. It is widely accepted that the average healthy ear, however, can barely perceive noise level changes of 3 dBA. 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. A doubling of sound energy results in a 3 dBA increase in sound, which 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.

1.4.5 Noise Descriptors

Additional 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 equivalent sound level, $L_{eq(h)}$, is the energy average of the A-weighted sound levels occurring during a 1-hour period, and is the basis for most of the City Noise Ordinance standards.

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 p.m. to 10 p.m.) and nighttime (10 p.m. to 7 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. Whereas CNEL is used mostly in California, the L_{dn} descriptor (day-night average noise level, which is the same as CNEL with the only exception of not including the 5 dBA evening correction) is used more often for environmental noise evaluations for federal projects.

1.4.6 Sound Propagation

Sound propagation (i.e., the traverse of sound from a noise emission source position to a receptor 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 stationary point-type source due to the spherical spreading of sound energy with increasing distance travelled. 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 receptor 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) are peak particle velocity (PPV), in units of inches per second (ips), and velocity decibel (VdB) that is based on a root-mean square (RMS) of the vibration signal magnitude. The calculation to determine PPV at a given distance is as follows:

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

Where:

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

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

D = the distance from the equipment to the receptor

2 Regulatory Setting

2.1 Federal

2.1.1 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.

2.1.2 Federal Interagency Committee on Noise

Some guidance regarding the determination of a substantial permanent increase in ambient noise levels in the project vicinity above existing levels is provided by the 1992 findings of the Federal Interagency Committee on Noise (FICON 1992), which assessed the annoyance effects of changes in ambient noise levels resulting from aircraft operations. The FICON recommendations are based upon studies that relate aircraft and traffic noise levels to the percentage of persons highly annoyed by the noise. Annoyance is a qualitative measure of the adverse reaction of people to noise that generates speech interference, sleep disturbance, or interference with the desire for a tranquil environment.

The rationale for the FICON recommendations is that it is possible to consistently describe the annoyance of people exposed to transportation noise in terms of L_{dn} . The changes in noise exposure that are shown below are expected to result in equal changes in annoyance at sensitive land uses. Although the FICON recommendations were specifically developed to address aircraft noise impacts, they are used in this analysis to define a substantial increase in community noise levels related to all transportation noise sources and permanent non-transportation noise sources.

- Outdoor ambient sound level without the project is less than 60 dBA L_{dn} , then a project-attributed increase of 5 dBA or more would be considered significant;
- Outdoor ambient sound level without the project is between 60 and 65 dBA L_{dn} , project-attributed increase of 3 dBA or more would be considered significant; and
- Outdoor ambient sound level without the project is greater than 65 dBA L_{dn} , then project-attributed increase of 1.5 dBA or more would be considered significant.

2.2 State

2.2.1 California Code of Regulations, Title 24

Title 24 of the California Code of Regulations sets standards that new developments in California must meet. According to Title 24, interior noise levels are not to exceed 45 dBA CNEL in any habitable room (ICC 2022).

2.2.2 California Department of Health Services Guidelines

The California Department of Health Services has developed guidelines of community noise acceptability for use by local agencies (OPR 2017). Selected relevant levels are listed here:

- Below 60 dBA CNEL: normally acceptable for low-density residential use
- 50 to 70 dBA CNEL: conditionally acceptable for low-density residential use
- Below 65 dBA CNEL: normally acceptable for high-density residential use and transient lodging
- 60 to 70 dBA CNEL: conditionally acceptable for high-density residential, transient lodging, churches, educational, and medical facilities

The normally acceptable exterior noise level for high-density residential use is up to 65 dBA CNEL.

2.2.3 California Department of Transportation

In its Transportation and Construction Vibration Guidance Manual (Caltrans 2020), the California Department of Transportation (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 0.2-0.6 ips PPV would find it “unpleasant or “annoying” and thus a likely significant impact. 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

2.3.1 City of Santa Clarita Municipal Code

The City of Santa Clarita Noise Ordinance (Santa Clarita Municipal Code [SCMC] Section 11.44) (City of Santa Clarita 2024) contains regulations restricting land use related noise-generating activities and operations, so as to avoid noise nuisance in the community. Section 11.44.040 of the SCMC establishes the maximum allowable exterior noise limits, based upon the classification of the receiving land use. These standards typically apply to stationary sources such as noise from mechanical equipment (including mechanical ventilation and air conditioning noise, pool pump noise, etc.) or event noise, as opposed to traffic noise. For instance, a school, commercial enterprise, or

industrial operation must not generate noise that exceeds a certain specified noise level at any property boundary where an adjacent residential use exists. The property-line noise standards are presented in Table 2.

Table 2. City of Santa Clarita Exterior Property-Line Noise Limits

Receiving Land Use Category	Noise Level (dBA)	
	Night (9 p.m. to 7 a.m.)	Day (7 a.m. to 9 p.m.)
Residential Zone	55	65
Commercial and Manufacturing	70	80

Note: dBA = A-weighted decibels

SCMC 11.44.040A also stipulates that, at the boundary line between a residential property and a commercial and manufacturing property, the noise level of the quieter zone shall be used.

SCMC 11.44.040B, Corrections to Noise Limits, specifies that the numerical limits shown in Table 2 shall be adjusted by the following corrections where the following noise conditions exist:

- Repetitive impulsive noise = -5 dB correction; and
- Steady whine, screech or hum = -5 dB correction.

The following corrections apply to the daytime period only:

- Noise occurring more than 5 but less than 15 minutes per hour = +5 dB correction;
- Noise occurring more than 1 but less than 5 minutes per hour = +10 dB correction; and
- Noise occurring less than 1 minute per hour = +20 dB correction.

Although the City does not set specific numerical limits for noise associated with temporary construction activities, it can be perceived as a nuisance; thus Section 11.44.080 of the SCMC restricts the times of day when construction may occur (7:00 a.m.–7:00 p.m., Monday–Friday, and 8:00 a.m.–6:00 p.m., Saturday).

2.3.2 City of Santa Clarita General Plan

The City of Santa Clarita General Plan establishes multiple goals, objectives, and policies that are relevant to the project.

Goal N1: A healthy and safe noise environment for Santa Clarita Valley residents, employees, and visitors.

Objective N 1.1: Protect the health and safety of the residents of the Santa Clarita Valley by the elimination, mitigation, and prevention of significant existing and future noise levels

Policy N 1.1.1: Use the Noise and Land Use Compatibility Guidelines contained on Exhibit N-8, which are consistent with State guidelines, as a policy basis for decisions on land use and development proposals related to noise.

Policy N 1.1.2: Continue to implement the adopted Noise Ordinance and other applicable code provisions, consistent with state and federal standards, which establish noise impact thresholds for noise abatement and attenuation, in order to reduce potential health hazards associated with high noise levels.

Policy N 1.1.3: Include consideration of potential noise impacts in land use planning and development review decisions.

Policy N 1.1.4: Control noise sources adjacent to residential, recreational, and community facilities, and those land uses classified as noise sensitive.

Policy N 1.1.5: Monitor and update data and information regarding current and projected noise levels in the planning area.

Policy N 1.1.6: Provide development review comments on projects proposed by other agencies and special districts that may generate noise impacts affecting land uses within the Santa Clarita Valley, including any freeway and high-speed rail projects.

Table 3. Summary of Land Use Noise Compatibility Guidelines

Land Use Category	Community Noise Exposure (dBA L _{dn})			
	Normally Acceptable ¹	Conditionally Acceptable ²	Normally Unacceptable ³	Clearly Unacceptable ⁴
Residential—Low-Density Single-Family, Duplex, Mobile Home	<60	55–70	70–75	75+
Residential—Multifamily	<60	60–70	70–75	75+
Transient Lodging—Motel, Hotel	<60	60–70	70–80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	<60	60–70	70–80	80+
Auditoriums, Concert Halls, Amphitheaters	—	<65	65+	—
Sports Arena, Outdoor Spectator Sports	—	<75	75+	—
Playgrounds, Neighborhood Parks	<65	—	65–75	80+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<75	—	75–80	80+
Office Building, Business Commercial, and Professional	<70	70–75	75+	—
Industrial, Manufacturing, Utilities, Agriculture	<75	75–80	80+	—

Source: Santa Clarita 2010, Exhibit N-8.

Notes: dBA = A-weighted decibels; L_{dn} = day-night average noise level.

¹ Specified land use is satisfactory, based on the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

- 2 New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.
- 3 New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor areas must be shielded.
- 4 New construction or development should generally not be undertaken.

Goal N3: Protect residential neighborhoods from excessive noise.

Objective N 3.1: Prevent and mitigate significant noise levels in residential neighborhoods.

Policy N 3.1.1: Require that developers of new single-family and multi-family residential neighborhoods in areas where the ambient noise levels exceed 60 CNEL provide mitigation measures for the new residences to reduce interior noise levels to 45 CNEL, based on future traffic and railroad noise levels.

Policy N 3.1.2: Require that developers of new single-family and multi-family residential neighborhoods in areas where the projected noise levels exceed 65 CNEL provide mitigation measures (which may include noise barriers, setbacks, and site design) for new residences to reduce outdoor noise levels to 65 CNEL, based on future traffic conditions. This requirement would apply to rear yard areas for single-family developments, and to private open space and common recreational and open space areas for multi-family developments.

Policy N 3.1.3: Through enforcement of the applicable Noise Ordinance, protect residential neighborhoods from noise generated by machinery or activities that produce significant discernable noise exceeding recommended levels for residential uses.

Policy N 3.1.4: Require that those responsible for construction activities develop techniques to mitigate or minimize the noise impacts on residences and adopt standards that regulate noise from construction activities that occur in or near residential neighborhoods.

Policy N 3.1.5: Require that developers of private schools, childcare centers, senior housing, and other noise sensitive uses in areas where the ambient noise level exceeds 65 dBA (day), provide mitigation measures for these uses to reduce interior noise to acceptable levels.

Policy N 3.1.6: Ensure that new residential buildings shall not be located within 150 feet of the centerline for Interstate 5.

Policy N 3.1.7: Ensure that design of parks, recreational facilities, and schools minimize noise impacts to residential neighborhoods.

Policy N 3.1.8: As a condition of issuing permits for special events, require event promoters to mitigate noise impacts to adjacent sensitive uses through limiting hours of operation and other means as appropriate, which may include notification to affected residents.

Policy N 3.1.9: Implement a buyer and renter notification program for new residential developments where appropriate, to educate and inform potential buyers and renters of the sources of noise in the area

and/or new sources of noise that may occur in the future. As determined by the reviewing authority, notification may be appropriate in the following areas:

- Within one mile of Six Flags Magic Mountain theme park, potential buyers and renters should receive notice that noise may occasionally be generated from this facility and that the frequency and loudness of noise events may change over time.
- Within 1,000 feet of the railroad, potential buyers and renters should receive notice that noise may occasionally be generated from this facility and that the frequency and loudness of noise events may change over time.
- Within 200 feet of commercial uses in mixed-use developments, potential buyers and renters should receive notice that the commercial uses within the mixed-use developments may generate noise in excess of levels typically found in residential areas, that the commercial uses may change over time, and the associated noise levels and frequency of noise events may change along with the use.
- Within 1,000 feet of the Saugus Speedway, in the event speedway operations are resumed in the future.

Commercial and Industrial Noise

Goal N 4: Protection of sensitive uses from commercial and industrial noise generators.

Objective N 4.1: Prevent, mitigate, and minimize noise spillover from commercial and industrial uses into adjacent residential neighborhoods and other noise sensitive uses.

Policy N 4.1.1: Implement and enforce the applicable Noise Ordinance to control noise from commercial and industrial sources that may adversely impact adjacent residential neighborhoods and other sensitive uses.

Policy N 4.1.2: Require appropriate noise buffering between commercial or industrial uses and residential neighborhoods and other sensitive uses.

Policy N 4.1.3: Adopt and enforce standards for the control of noise from commercial and entertainment establishments when adjacent to residential neighborhoods and other sensitive uses.

3 Existing Conditions

Sound pressure level (SPL) measurements were conducted near the proposed project site on November 21 and 22, 2024, to quantify and characterize the existing outdoor ambient sound levels in the project area.

Short-term measurements were conducted using a Rion NL-52 model sound level meter (SLM) equipped with a 0.5-inch, pre-polarized condenser microphone with pre-amplifier. The NL-52 SLM meets the current American National Standards Institute standard for a Type 1 (Precision) SLM. Long-term measurements (24 or more consecutive hours) were conducted using SoftdB Piccolo II model SLMs equipped with a 0.5-inch, pre-polarized condenser microphone with pre-amplifier. The Piccolo II SLMs meet the current American National Standards Institute standard for Type 2 (General Use) sound level meters. The accuracy of all SLMs 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.

Eight (8) short-term (ST) noise level measurement locations were conducted in the project area, intended to be representative of the outdoor ambient sound environment. These locations are depicted as receivers ST1 through ST8 on Figure 3. The measured L_{eq} , L_{max} , and L_{min} noise levels at these surveyed locations are provided in Table 4. As shown in Table 4, the measured SPL ranged from approximately 42 dBA L_{eq} at ST7 to 71 dBA L_{eq} at ST4. Beyond the summarized information presented in Table 4, detailed noise measurement data is included in Attachment A.

Table 4. Measured Baseline Outdoor Ambient Noise Levels

Site	Location/Address (and noted sounds)	Time (hh:mm)	L _{eq} (dBA)	L _{max} (dBA)	L _{min} (dBA)
ST1	On the northeast corner of the Oak Springs Canyon Rd. and the trail to Whitewater Canyon Rd. intersection (traffic, birds, landscaping, rustling leaves)	11:10 a.m. to 11:25 a.m.	53.4	73.1	31.4
ST2	On the northern side of the Oak Springs Canyon Rd. and Pashley St. intersection (birds, distant conversation/yelling, rustling leaves)	11:34 a.m. to 11:49 a.m.	55.7	76.4	29.8
ST3	Located adjacent to the front yard of the residence at 16115 Lost Canyon Rd. (traffic, dog barking, landscaping, rustling leaves)	12:36 p.m. to 12:51 p.m.	52.9	73.4	43.6
ST4	On the northeast corner of the Sand Canyon Rd. and Lost Canyon Rd. intersection (traffic, rustling leaves)	12:54 p.m. to 1:09 p.m.	71.0	94.0	49.8
ST5	North of Robinson Ranch Rd., south of the Sand Canyon Country Club overflow lot (traffic)	11:57 a.m. to 12:12 p.m.	48.7	66.0	35.0
ST6	Adjacent to the Sand Canyon Resort and Spa maintenance building south of Robinson Ranch Rd. (traffic, birds, distant conversations/yelling, dog barking, rustling leaves)	Investigator was asked to leave			
ST7	On the northeast corner of the Holt Ave. and Whitewater Canyon Rd. intersection (traffic, birds, dog barking, rustling leaves)	10:39 a.m. to 10:54 a.m.	41.9	55.0	35.6
ST8	Adjacent to the community pool on Rosehaven Ln. (traffic, birds, rustling leaves)	1:17 p.m. to 1:32 p.m.	55.8	73.0	46.4

Source: Dudek 2024, Appendix A.

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

Generally, the measured samples of daytime L_{eq} agree with expectations: all of the measured locations are fairly rural, with roadway traffic making up the majority of the noise contribution at each site.

Long-term (LT) noise monitoring was conducted at two locations with instruments configured to operate in a continuous manner, cataloging all noise metrics pertinent to identification and evaluation of noise levels (i.e., L_{eq}, L_{max}, L_x, etc.) in the project vicinity. Ambient noise levels recorded at the long-term noise monitoring locations are presented in Table 5 and the monitor positions are shown in Figure 3. Exhibits I and II display an hourly chart of the long-term measurement data for LT1 and LT2, respectively. More detailed information for the long-term noise measurements can be found in Attachment A.

Table 5. Summary of Long-Term Ambient Noise Measurements

Site	Location	L _{dn}	Average Noise Levels (dBA)							
			Daytime			Nighttime				
			L _{eq}	L _{max}	L ₅₀	L ₉₀	L _{eq}	L _{max}	L ₅₀	L ₉₀
LT1	On the northeast corner of the Oak Springs Canyon Rd. and the trail to Whitewater Canyon Rd. Intersection	61	50	92	45	43	55	89	50	48
LT2	On the northeast corner of the Holt Ave. and Whitewater Canyon Rd. intersection	52	49	56	41	39	44	58	41	40

Source: Dudek 2024, Appendix A.

Notes: dBA = A-weighted decibels; L_{dn} = Day Night noise level; L_{eq} = average equivalent noise level; L_{max} = maximum noise level; L₅₀ = sound level exceeded 50% of the period; L₉₀ = sound level exceeded 90% of the period; LT = long-term noise measurement locations.

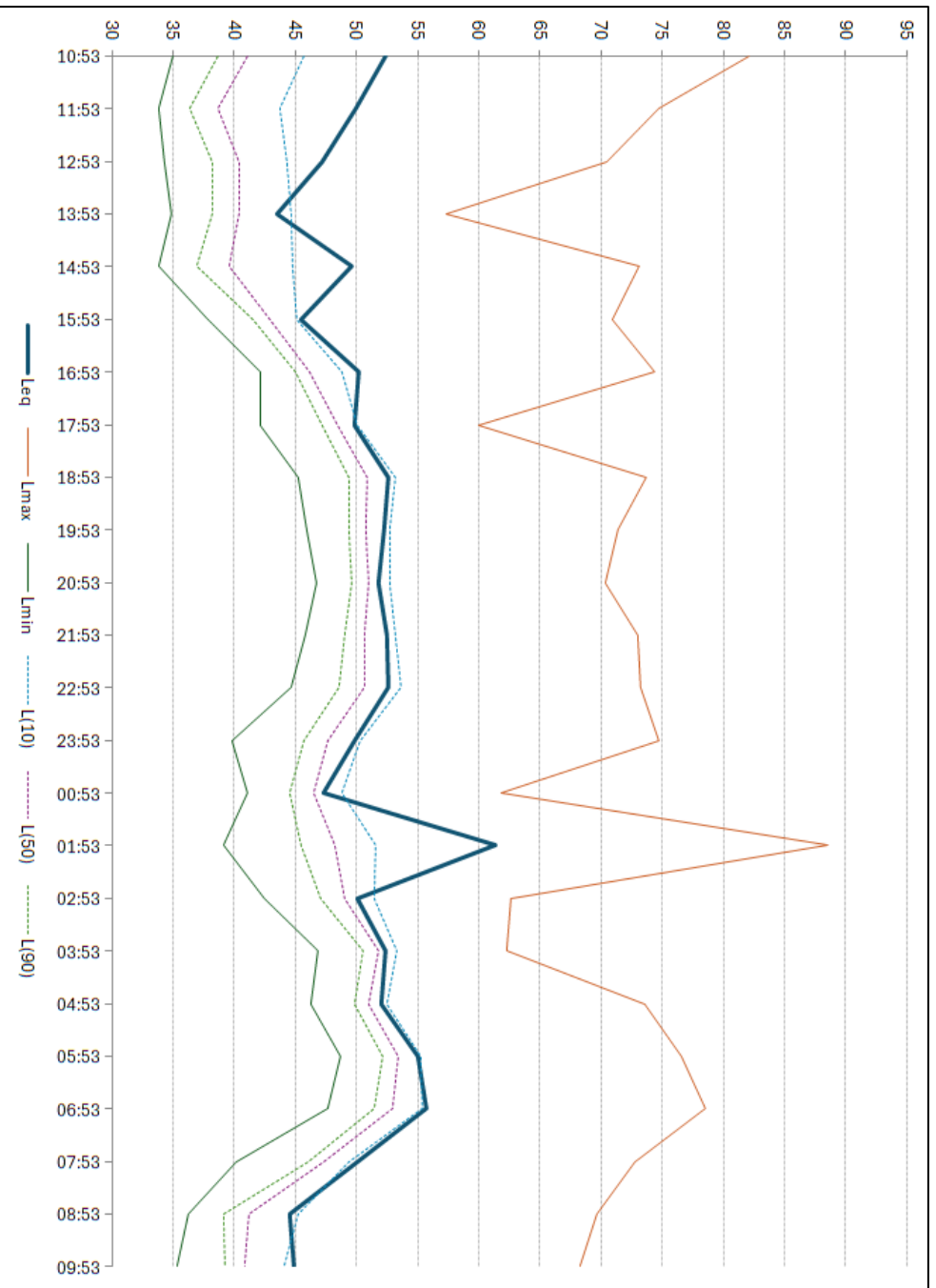


Exhibit I: Long-Term Measurement 1 (11/21/24 to 11/22/24) Hourly Data Chart

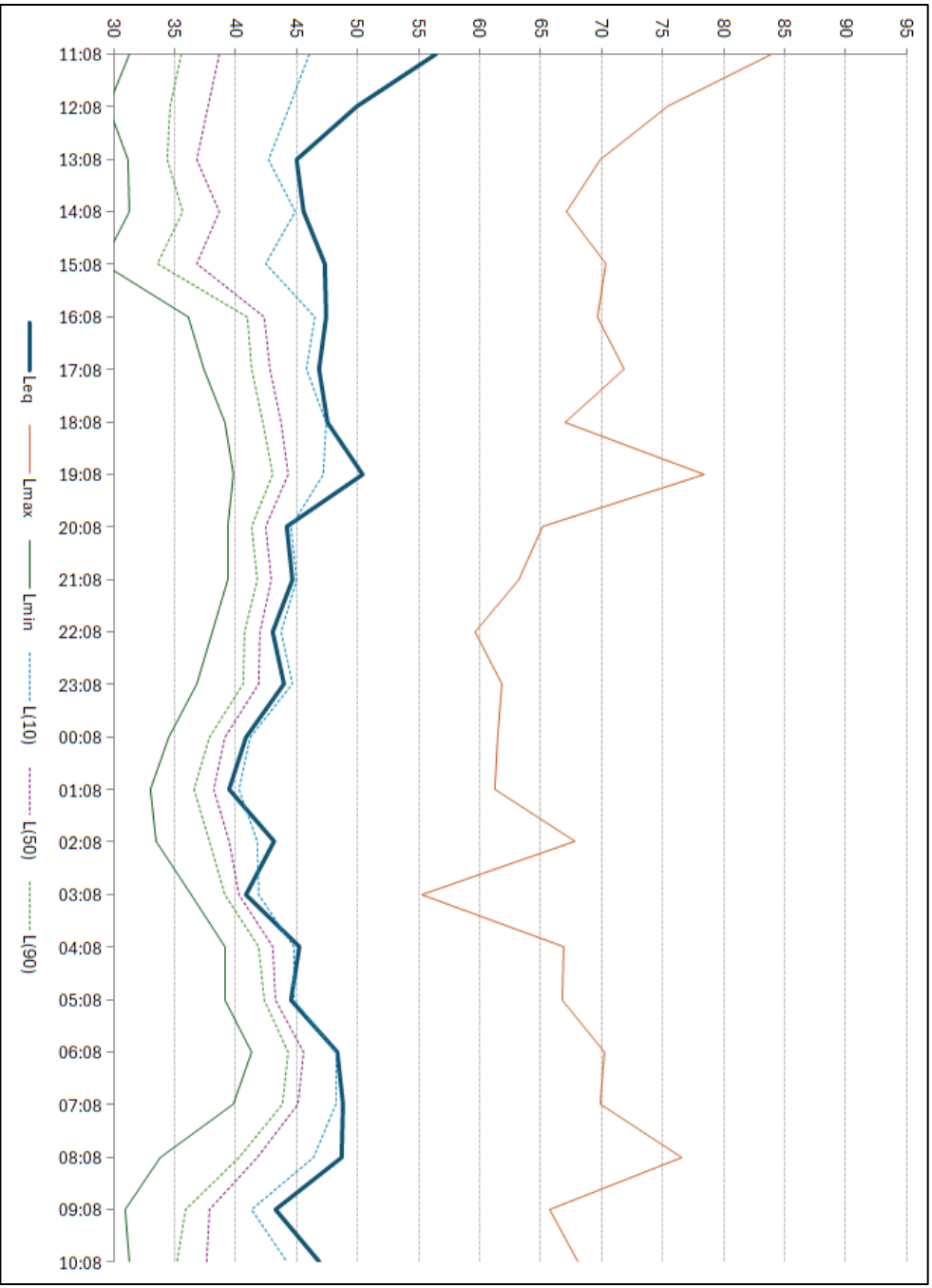


Exhibit II: Long-Term Measurement 2 (11/21/24 to 11/22/24) Hourly Data Chart

The primary noise source affecting the long-term noise monitoring locations was apparent vehicular traffic on the local roadway network and rail noise from the Metrolink rail line bisecting the project. During the long-term noise monitoring, the day-night (L_{dn}) noise level ranged from approximately 52 dBA at LT2 to 61 dBA at LT1.



SOURCE: Google 2024; Dudek 2024

DUDEK

Figure 3

Ambient Noise Level Measurement Locations

Belcaro at Sand Canyon Project

4 Thresholds of Significance

The following significance criteria are based on Appendix G of the California Environmental Quality Act Guidelines (14 CCR 15000 et seq.) and will be used to determine the significance of potential noise and vibration impacts. Impacts associated with noise and vibration would be significant if the proposed project would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Generation of excessive ground-borne vibration or ground-borne noise levels.
- Exposing 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 these above significance criteria, this analysis uses the following standards to evaluate potential noise and vibration impacts.

- Construction noise –The proximity of single-family residences to the west of the project suggests that closest source-to-sensitive-receptor distances are a minimum of approximately 10 feet during the paving phase. Therefore, consistent with the FTA guidance mentioned in Section 2 (Regulatory Setting), this analysis will use 80 dBA L_{eq} over an 8-hour period as the construction noise impact criterion during the City’s allowable hours as described in Section 2.3.1 (7:00 a.m. to 7:00 p.m. Monday through Friday and 8:00 a.m. to 6:00 p.m. on Saturday).
- Off-site project-attributed transportation noise – For purposes of this analysis, a noise impact due to transportation noise would be considered significant if predicted noise levels exceeded the FICON thresholds noted in Section 2.1.2. More specifically, an impact due to the project contribution to existing and future predicted ambient noise levels would be considered significant if it meets the following criteria:
 - Outdoor ambient sound level without the project is less than 60 dBA L_{dn} , then a project-attributed increase of 5 dBA or more would be considered significant;
 - Outdoor ambient sound level without the project is between 60 and 65 dBA L_{dn} , project-attributed increase of 3 dBA or more would be considered significant; and
 - Outdoor ambient sound level without the project is greater than 65 dBA L_{dn} , then project-attributed increase of 1.5 dBA or more would be considered significant.

- Off-site project-attributed stationary noise – For purposes of this analysis, a noise impact would be considered significant if noise from typical operation of heating, ventilation, and air conditioning (HVAC), and other electro-mechanical systems associated with the proposed project exceeded 65 dBA L_{eq} during daytime hours (7:00 a.m. to 9:00 p.m.) or 55 dBA L_{eq} during nighttime hours (9:00 p.m. to 7:00 a.m.) at the property line of the nearby single-family homes.
- Construction vibration – Guidance from Caltrans indicates that a vibration velocity level of 0.2 ips PPV received at a structure would be considered annoying by occupants within (Caltrans 2013). 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.

For purposes of disclosure, while the current CEQA noise criteria listed above do not consider the impact of offsite noise on project residents and users, this analysis also evaluates compatibility of on-site noise exposure levels (e.g., from roadway traffic and from Metrolink rail operations) with the City of Santa Clarita exterior and interior noise standards of 60 dBA CNEL and 45 dBA CNEL, respectively.

5 Impact Discussion

Potential noise and vibration impacts attributed to project construction and operation are studied in the following subsections that are categorized by the CEQA Guidelines Appendix G significance for noise.

- 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?*

Short-Term Construction

Less Than Significant. 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 6. Note that the equipment noise levels presented in Table 6 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 6. 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
Concrete Saw	90
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
Scraper	84
Welder / Torch	73

Source: DOT 2006.

Note: L_{max} = maximum sound level; dBA = A-weighted decibels.

For purposes of this study, and in a manner resembling the “general assessment” methodology per FTA guidance, this analysis assumes that among what may be a quantity of mobile heavy construction equipment active onsite, only two of the loudest type of equipment per phase would be located at the nearest possible distance to a sensitive receptor (as close as 10 feet to the nearest receptors along Lost Canyon Road when paving activities occur and as close as 30 feet to the nearest residence west of the project when site preparation and grading occur at the pickleball courts, horseshoe pit, and dog park, but dependent on the distance from the phase work to the nearest sensitive receptor at any one time) for some portion or the entirety of the 8-hour evaluation period. The remainder of active equipment would be operating, on a time-average basis over the course of the same 8-hour evaluation period, at distances further (and thus too distant to affect the calculation of the noise level) from a given noise-sensitive receiver than those appearing in Table 7.

Table 7. Estimated Distances between Construction Phase and the Nearest Noise-Sensitive Receiver Positions

Construction Phase (and Equipment Types Involved)	Distance From Noise-Sensitive Receptors to Construction Phase Boundary (Feet)
Initial Phase – Grading, Offsite Infrastructure, Onsite Utilities, Paving	
Site Preparation (dozer, backhoe, tractor, excavator)	10
Grading (excavator, grader, dozer, scraper, backhoe)	10
Utilities/Trenching (slurry trenching machine, backhoe, scraper, ground compactor, air compressor, pumps, man lift)	200
Paving (paver, roller, backhoe)	10 to 30
Home Construction – Phase 1	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	850
Architectural Coating (air compressor)	850
Home Construction – Phase 2	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	690
Architectural Coating (air compressor)	690
Home Construction – Phase 3	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	200
Architectural Coating (air compressor)	200

A Microsoft Excel-based noise prediction model emulating and using reference data from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) (FHWA 2008) was used to estimate construction noise levels at the nearest occupied noise-sensitive land use. Although the RCNM was funded and promulgated by the FHWA, it is often used for non-roadway projects, because the same types of construction equipment used for roadway projects are often used for other types of construction. Input variables for the predictive modeling consist of the equipment type and number of each (e.g., a dozer, a backhoe, a tractor, and an excavator) the duty cycle for each piece of equipment (e.g., 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 6), and the distance from the noise-sensitive receptor. 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 or structural shielding was assumed in the modeling. The RCNM 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, and produced the predicted results displayed in Table 8.

Table 8. Predicted Construction Noise Levels per Activity Phase (Unmitigated)

Construction Phase (and Equipment Types Involved)	8-Hour Leq at Nearest Receptors to Construction Phase Boundary (dBA)
Initial Phase - Grading, Offsite Infrastructure, Onsite Utilities, Paving	
Site Preparation (dozer, backhoe, tractor, excavator)	86
Grading (excavator, grader, dozer, scraper, backhoe)	88
Utilities/Trenching (slurry trenching machine, backhoe, scraper, ground compactor, air compressor, pumps, man lift)	66
Paving - Nearest at 10 Feet (paver, roller, backhoe)	84
Paving - At 30 Feet (paver, roller, backhoe)	82
Home Construction – Phase 1	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	46
Architectural Coating (air compressor)	43
Home Construction – Phase 2	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	48
Architectural Coating (air compressor)	45
Home Construction – Phase 3	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	60
Architectural Coating (air compressor)	57

Notes: Leq = equivalent noise level; dBA = A-weighted decibels. **Source:** Appendix B.

Although noise from construction would be exempt from the City’s noise standard during the specified hours (7:00 a.m. to 7:00 p.m. on weekdays and 8:00 a.m. to 6:00 p.m. on Saturday), to be consistent with CEQA expectations regarding “applicable standards of other agencies” this project has adopted quantified construction noise thresholds per Federal Transit Administration (FTA) guidance, which recommends 80 dBA 8-hour Leq at the exterior of a residence during daytime hours (FTA 2018). As presented in Table 8, the highest estimated construction noise levels are predicted to be higher than the FTA 80 dBA Leq limit over an 8-hour period at the nearest noise-sensitive receptors when construction activities take place. Mitigation is therefore required to reduce construction noise to equal to or lower than the FTA threshold of 80 dBA Leq over an 8-hour period.

As such, MM-NOI-1 requires noise reduction techniques and the use of temporary noise barriers at the project site's western property line adjacent to noise-sensitive receptors.

MM-NOI-1 Temporary Construction Noise Reduction. The Project contractor shall ensure that the following measures are implemented and monitored for compliance throughout construction:

- During the paving phase, construction equipment must have supplier-approved sound muffling devices (e.g., engine air intake or exhaust treatment) installed and used in compliance with relevant industry standards and California Occupational Safety and Health (Cal/OSHA) regulations pertaining to construction noise, which shall be properly maintained and used at all times such equipment is in operation. The combination of these techniques shall reduce construction noise levels by a minimum of 4 dBA.
- During the paving phase and at the nearest receptor distances (i.e. 10 feet from the construction equipment), operation of construction equipment shall be limited to a maximum of 1 hour per day.
- Stationary construction equipment shall be placed so that emitted noise is directed away from noise-sensitive receptors.
- Equipment staging areas shall be located so as to maximize the distance between construction-related noise sources and noise-sensitive receptors nearest the project site during the construction period.
- All noise-producing construction activities, including warming-up or servicing equipment and any preparation for construction, shall be limited to between 7:00 a.m. and 7:00 p.m. on weekdays and 8:00 a.m. to 6:00 p.m. on Saturdays.
- An eight (8) foot tall temporary noise barrier shall be erected along the western project boundary for the site preparation and grading construction phases.

Table 9. Predicted Construction Noise Levels per Activity Phase (Mitigated)

Construction Phase (and Equipment Types Involved)	8-Hour Leq at Nearest Receptors to Construction Phase Boundary (dBA)
Initial Phase - Grading, Offsite Infrastructure, Onsite Utilities, Paving	
Site Preparation (dozer, backhoe, tractor, excavator)	73
Grading (excavator, grader, dozer, scraper, backhoe)	75
Utilities/Trenching (slurry trenching machine, backhoe, scraper, ground compactor, air compressor, pumps, man lift)	66
Paving – Nearest at 10 Feet (paver, roller, backhoe)	80
Paving – At 30 Feet (paver, roller, backhoe)	78
Home Construction – Phase 1	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	46
Architectural Coating (air compressor)	43
Home Construction – Phase 2	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	48
Architectural Coating (air compressor)	45
Home Construction – Phase 3	
Building Construction (crane, man lift, generator, backhoe, welder/torch)	60
Architectural Coating (air compressor)	57

Notes: Leq = equivalent noise level; dBA = A-weighted decibels.

Source: Appendix B.

As demonstrated in Table 9, implementation of MM-NOI-1 would reduce project construction noise to less than significant levels. As shown, noise levels for each construction phase would meet FTA requirements for construction noise at the nearest noise-sensitive receptors. It is noted that residents in the area would have the option to remain indoors during construction hours to avoid potential annoyance or disruption of outdoor speech or other activities. Indoors, and after being attenuated by the process of exterior-to-interior noise intrusion through the envelope of a receiving enclosed structure, the resulting construction noise exposure levels would not be anticipated to exceed 60 dBA Leq, which would not interfere with conversations or other daytime indoor activities (FHWA 2011).

Construction noise impacts are thus considered **less than significant with mitigation incorporated.**

Best Practices for Limiting Construction Noise

The following is a list of best practices for limiting construction noise that should be implemented by the contractor:

- The project contractor shall, to the extent feasible, schedule construction activities to avoid concurrent operation of several pieces of construction equipment at the nearest distance to an offsite noise-sensitive receptor.
- Construction noise reduction methods such as shutting off idling equipment, maximizing the distance between construction equipment staging areas and adjacent residences, and use of electric air compressors and similar power tools, rather than diesel equipment, shall be used where feasible.
- Construction hours, allowable workdays, and the phone number of the job superintendent shall be clearly posted at all construction entrances to allow surrounding property owners to contact the job superintendent

if necessary. In the event the City receives a complaint, appropriate corrective actions shall be implemented by the contractor, and a report of the action provided to the reporting party.

Off-Site Construction Activities

The project would result in local, short-term increases in roadway noise as a result of construction traffic. Based on information developed as part of the project's air quality analysis, project-related traffic would include workers commuting to and from the project site as well as vendors bringing materials. The highest number of average daily worker trips would be 92 one-way trips and the highest number of average daily vendor truck trips would be 16 one-way trips, occurring during the Building Construction phase in Phase 1.

Based upon data from the project Transportation Assessment, Lost Canyon Road east of Sand Canyon Road carries approximately 910 daily trips (converted to average daily traffic from PM peak traffic using a 10% k-factor) in the project vicinity for the year 2025. Comparing the maximum number of daily construction-related trips (92 worker trips and 16 vendor trips, for a total of 108 construction-related trips; or a passenger car equivalent (PCE) of 216 trips) to the average daily traffic volume, the additional PCE vehicle trips would amount to an increase of approximately 19%. As shown in Table 9, the predicted existing (2025) traffic noise level on Lost Canyon Road from Sand Canyon Road to the project boundary is 51.2 dBA CNEL 50 feet from the centerline. Based on the total number of project construction trips at its highest being 216 PCE trips per day, the predicted existing (2025) plus project construction trip noise level is approximately 52.0 dBA CNEL 50 feet from the centerline, which is a difference in noise level of 0.8 dBA, and lower than the FICON threshold of 5 dBA when the ambient sound level is less than 60 dBA $L_{dn}/CNEL$.

Therefore, impacts from project-related construction traffic noise would be **less than significant**. No mitigation measures are required.

Long-Term Operational

Off-Site Traffic Noise Exposure

The project is expected to generate a subtotal of 1,596 average daily trips to the roadway system, as shown in the project Transportation Assessment. During the afternoon (PM) peak hour (the highest of the AM and PM peak hours), approximately 116 passenger car equivalent vehicles are estimated to enter or exit the project site. Utilizing this information as well as additional traffic data provided in Appendix C, of this technical report, the FHWA's Highway Traffic Noise Prediction Model RD-77-108 was used to estimate potential noise impacts at adjacent noise-sensitive uses. Information used in the model included Average Daily Traffic (ADT), posted traffic speeds, truck mix percentage, and day/evening/night mix percentage.

Consistent with Caltrans guidance (Caltrans 2013), this analysis assumes 80% of the ADT occurs during daytime hours (7:00 a.m. to 7:00 p.m.), 5% during the evening (7:00 p.m. to 10:00 p.m.), and 15% during the nighttime (10:00 p.m. to 7:00 a.m.). The future modeled traffic speed was assumed to be the anticipated speed limit for the studied future roads, which is 45 miles per hour (mph) for Sand Canyon Road and, 25 mph for Lost Canyon Road. The truck percentages used in the noise model were 1% medium trucks and 2% heavy trucks. This truck mix is based on vehicle surveys conducted for similar roadways within the state of California.

The change in roadway noise levels was predicted for four conditions: existing (2025), existing (2025) plus project, future (2032), and future (2032) plus project. Traffic noise levels were calculated for roadway segments bounded by intersections within the project area and are listed as follows:

- Sand Canyon Road – From Lost Canyon Road to SR 14; and
- Lost Canyon Road – East of Sand Canyon Road.

Based upon the FICON thresholds presented in Section 2.1.2 above, an increase of less than 5 dBA when the ambient sound level is less than 60 dBA $L_{dn}/CNEL$, less than 3 dBA when the ambient sound level is between 60 and 65 dBA $L_{dn}/CNEL$, or less than 1.5 dBA when the ambient sound level is greater than 65 dBA $L_{dn}/CNEL$ would not be significant. Utilizing the traffic noise modeling worksheets found in Appendix C, Table 10 shows that the calculated future year 2032 with project traffic noise level for noise-sensitive land uses adjacent to Sand Canyon Road is 0.27 dBA greater than the future year 2032 traffic noise level without project, which is less than the 1.5 dBA FICON increase threshold when the ambient sound level is greater than 65 dBA $L_{dn}/CNEL$. Additionally, the calculated future year 2032 plus project increase for noise-sensitive land uses adjacent to Lost Canyon Road and east of Sand Canyon Road is 2.74 dBA, which is less than the 5 dBA threshold when the ambient sound level is less than 60 dBA $L_{dn}/CNEL$. Therefore, potential impacts at existing off-site noise-sensitive land uses adjacent to the project with respect to project-generated changes to future traffic noise would be **less than significant**.

Table 10. Predicted Traffic Noise Levels

Modeled Roadway Segment	From	To	Existing (dBA CNEL)	Existing Plus Project (dBA CNEL)	Delta (dBA)	Future (dBA CNEL)	Future Plus Project (dBA CNEL)	Delta (dBA)
Sand Canyon Road	North of Lost Canyon Road		68.05	68.51	0.47	70.49	70.76	0.27
Lost Canyon Road	East of Sand Canyon Road		51.18	54.75	3.57	52.79	55.53	2.74

Source: Appendix C.

Exterior Rail Noise Analysis

Utilizing schedule information for the nearby rail station at Santa Clarita, the Federal Railroad Administration (FRA) CREATE Railroad Noise Model was used to predict the existing noise level due to rail operations at adjacent project exterior areas, the closest of which is approximately 150 feet from the centerline of the rail line. Appendix C provides the input and output data from the CREATE model.

As shown in Appendix C, the predicted daytime (7:00 a.m. to 10:00 p.m.) railroad noise level was 46 dBA and the predicted nighttime (10:00 p.m. to 7:00 a.m.) railroad noise level was 43 dBA for a calculated L_{dn} of 50 dBA, which is lower than the City’s 60 dBA CNEL/ L_{dn} exterior noise threshold.

Project Sound Sources

On-site Outdoor Mechanical Equipment

The completion of the project buildings will add a variety of noise-producing mechanical equipment that include those presented and discussed in the following paragraphs. Most of these noise-producing equipment or sound sources would be considered stationary or limited in mobility to a defined area.

Roof-Mounted Recreation Center HVAC

The proposed recreation center would be served by roof-mounted air-conditioning equipment that includes outdoor-exposed packaged air-handling units and air-cooled condensers (ACC) that provide the expected cooling demand (expressed as refrigeration “tonnage”) for a building. The following are descriptions of modeled sound sources, with Table 11 exhibiting modeled sound power level (PWL) data at octave-band center frequency (OBCF) resolution. Detailed information supporting these summary descriptions and quantities appear in Appendix D.

Table 11. Modeled Sound Power Levels (PWL) for Stationary Roof-Mounted Sources (HVAC)

Building	Sound Source	Overall L_{eq} (dBA)	A-Weighted dB at Octave Band Center Frequency (OBCF, Hz)								
			32.5	63	125	250	500	1000	2000	4000	8000
Recreation Center	Air Handling	80	61	61	73	74	75	72	65	59	54
	Air Conditioning	85	58	58	71	74	81	77	76	75	69

The recreation center was modeled as a 7,600 square foot space. For the analysis of noise from roof-mounted recreation center HVAC equipment operation, one 30-ton air-conditioning unit was modeled on the roof of the recreation center building. The roof-mounted HVAC reference sound level was calculated from a combination of inputs that include square footage values for the proposed recreation center building, project applicant response to data requests, and manufacturer sound power level data.

Ground Level Residential HVAC

The proposed single-family homes would be served by heating or air conditioning equipment. For the analysis of noise from HVAC equipment operation, a Carrier Model CA16NA 42-A HVAC unit was modeled at ground-level in the center of the proposed pad. Table 12 contains the Carrier Model CA16NA-42-A-HVAC sound power levels used in the model.

Table 12. Modeled Sound Power Levels (PWL) for Stationary Ground Level Sources (HVAC)

Sound Source	Overall L_{eq} (dBA)	A-Weighted dB at Octave Band Center Frequency (OBCF, Hz)								
		32.5	63	125	250	500	1000	2000	4000	8000
CA16NA 42-A-HVAC	76	53	53	53	62	66	74	68	62	56

Source: Carrier 2012.

Other Stationary Noise Sources

In addition to project buildings, several outdoor amenities and sports courts are proposed for the project. A pickleball court, a horseshoe pit, and a dog park are located on the western portion of the project site, directly adjacent to nearby noise-sensitive residential land uses. Other amenities include a pool and bocci ball courts adjacent to the recreational center. The pickleball courts, horseshoe pit, bocci ball courts, event lawn, and pool were modeled using the CadnaA “sports court” model object, which emulates the noise generated by the point-of-serve for a tennis game and assumes continuous operation over the entire one-hour period. Four sports court objects were used to represent the four proposed pickleball courts, with one sports court object each for the horseshoe pit, the bocci ball courts, event lawn, and the pool. Additional noise sources associated with speech were added for the dog park, sports courts, event lawn, and swimming pool. Table 13 contains information about the custom speech sources utilized in the modeling effort.

Table 13. Modeled Custom Speech Sources

Source	Custom Source Description	Sound Power Level (PWL, dBA)
Pickleball Courts; Horseshoe Pit	4 people (+6 dB) "very loud speaking" at 1m (78 dBA), half of the time (-3dB), +8 hemispherical PWL conversion	89
Dog Park, Bocci Ball Courts, Swimming Pool, Event Lawn	4 people (+6 dB) "raised normal speaking" at 1m (60 dBA), half of the time (-3 dB), +8 dB hemispherical PWL conversion	71

Source: Hayne 2006

It is assumed that the outdoor amenity operating hours would be closed from 9:00 p.m. to 7:00 a.m.

Prediction Methodology and Parameters

The aggregate noise emission from these outdoor-exposed sound sources has been predicted with the Datakustik CadnaA sound propagation program. CadnaA is a commercially available software program for the calculation, presentation, assessment, and prediction of environmental noise based on algorithms and reference data per International Organization of Standardization (ISO) Standard 9613-2, "Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation" (ISO 1996). The CadnaA computer software allows one to position sources of sound emission in a simulated three-dimensional (3-D) space having heights and footprints consistent with project architectural plans and elevations. In addition to the above-mentioned sound source inputs and building-block structures that define the three-dimensional sound propagation model space, the following assumptions and parameters are included in this CadnaA-supported stationary noise source assessment:

- Ground effect acoustical absorption coefficient equal to 0.7, which intends to represent an average or blending of ground covers that are characterized by a mix of soft, natural materials and hard, reflective pavements along with existing building surfaces across the project site and the surroundings;
- Reflection order of 1, which allows for a single reflection of sound paths on encountered structural surfaces such as the modeled building masses;
- Off-site residential structures and buildings have not been rendered in the model;
- Calm meteorological conditions (i.e., no wind) with 68 degrees Fahrenheit and 50% relative humidity; and
- All of the modeled noise sources are operating concurrently and continuously for a minimum period of 1 hour.

Prediction Results

An operational scenario of the proposed project was modeled that assumes all the HVAC equipment and sports courts are operating simultaneously for a minimum period of one hour. Figure 4 displays the predicted noise contours associated with aggregate sound propagation from operating HVAC and other stationary sound sources.



SOURCE: Microsoft 2024; Dudek 2024

DUDEK

Figure 4
Predicted Stationary Source Operation Noise from Proposed Project (at 5' above grade)

Figure 4 illustrates predicted aggregate SPL propagation solely from daytime operation of the proposed project sound sources as described above. The color-coded annular bands of SPL are calculated across a field parallel with and five (5) feet above local grade. Figure 5 illustrates predicted aggregate SPL propagation solely from nighttime operation of the proposed project sound sources as described above, with the exception of project amenities, which would be closed to residents during nighttime hours (9:00 p.m. to 7:00 a.m.). The color-coded annular bands of SPL are calculated across a field parallel with and five (5) feet above local grade.

Based on the noise level contours appearing in Figure 4 and Figure 5, the proposed project is predicted to be up to 59 dBA L_{eq} during daytime hours and up to 35 dBA L_{eq} at the single-family homes to the west of the project and is therefore expected to be lower than and thus comply with the City's 65 dBA L_{eq} daytime threshold and 55 dBA L_{eq} nighttime threshold for residential land uses. Further, the predicted 59 dBA L_{eq} daytime level and 35 dBA L_{eq} nighttime level would be lower than the City's threshold with an additional 5 dBA reduction when considering the impulsive nature of the pickleball activities (i.e. the predicted levels would be lower than, and thus comply, with a City threshold of 60 dBA L_{eq} daytime threshold and 50 dBA L_{eq} nighttime threshold for residential land uses).

Therefore, impacts associated with stationary operations noise would be **less than significant**.

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

Less Than Significant Impact. 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 is considered annoying. For context, heavier pieces of construction equipment, such as a roller that may be expected on the project site, have peak particle velocities of approximately 0.21 ips or less at a reference distance of 25 feet (FTA 2018).

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. By way of example, for a roller operating off-site during Paving activities (i.e., ~40 feet from the nearest occupied structure), the estimated vibration velocity would be 0.104 ips per the equation as follows (FTA 2018):

$$PPV_{rcvr} = PPV_{ref} * (25/D)^{1.5} = 0.104 = 0.21 * (25/40)^{1.5}$$

In the above equation, PPV_{rcvr} is the predicted vibration velocity at the receptor 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 receptor. Therefore, at this predicted PPV, the impact of vibration-induced annoyance to occupants of nearby existing homes would be less than significant.

Construction vibration, at sufficiently high levels, can also present a building damage risk. However, anticipated construction vibration associated with the proposed project would yield a maximum amplitude of 0.104 ips, which does not surpass the guidance limit of 0.3 ips PPV for preventing damage to residential structures (Caltrans 2020). Because the predicted vibration level at 40 feet is less than this guidance limit and because there are no residential structures directly adjacent to the project, the risk of vibration damage to nearby structures is considered less than significant.

Once operational, the proposed project would not be expected to feature major producers of ground-borne vibration. Anticipated mechanical systems like heating, ventilation, and air-conditioning 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) *For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?*

The closest airport to the proposed project site is the Agua Dulce Airpark approximately 6.7 miles northeast of the project boundary. Therefore, airport noise impacts would be **less than significant**.

6 Exterior and Interior Noise Assessment

6.1 Prediction Methodology

6.1.1 Estimating Roadway Traffic Noise

The exterior noise analysis made use of the FHWA's Highway Traffic Noise Prediction Model RD-77-108 to predict future traffic noise exposure levels at representative sensitive receptor positions associated with the project buildings. Utilizing the same modeling techniques and PM peak hour project trip traffic data (102 passenger equivalent vehicles on the local project roadways) as described in Section 5, the City's maximum allowable exterior noise level of 60 dBA CNEL (as described in Section 2.3.2) was calculated to be approximately 15 feet from the centerline of "A" Street.

6.1.2 Estimating Rail Noise

The exterior noise analysis made use of the FRA's CREATE Railroad noise model to predict noise exposure levels at representative sensitive receptor positions associated with the project buildings. Utilizing the same modeling inputs and techniques as described in Section 5 and Appendix C, the calculated $L_{dn}/CNEL$ at the exterior of the closest project building was calculated to be 50 dBA CNEL.

6.1.3 Estimating Interior Background Sound Level

A predictive interior background noise analysis of sample occupied rooms with facades directly exposed to noise emission from nearby flows of roadway traffic was conducted by way of arithmetically subtracting the composite sound transmission class (STC) rating of the façade's estimated net sound transmission losses (at a third-octave band center frequency [1/3-OBCF] resolution, between and including 125 Hz and 4 kHz) from the predicted exterior traffic noise level. The net sound transmission loss accounts for the material-specific sound insulation properties of the façade elements, and their proportions of the "panel" surface area through which exterior noise travels into the affected occupied interior space.

Note that in a manner consistent with industry guidance (Owens Corning 2004) and Table 10.5 in Noise Control in Buildings (Harris 1994), the following decibel adjustments were included in this arithmetic expression as shown below:

$$\text{CNEL (interior)} = \text{Exterior CNEL} - \text{net STC of façade assembly} + \text{incidence} + \text{source type} + \text{absorption}$$

where the “incidence” of incoming sound is assumed to be random and thus yields a value of 3 dB; the “source type” is roadway traffic having less than 10% of its volume from trucks that yields a value of 4 dB; and acoustical “absorption” from interior room furnishings and surfaces that are (for purposes of this assessment) assumed to be “standard” (Owens Corning 2004) and yield a value calculated from the following equation:

$$10 \cdot \text{LOG}(S / (0.8 \cdot A))$$

with “S” being the surface area of the studied façade, and “A” being the floor area of the room (or portion thereof connected to the studied façade). The purposes of these decibel adjustments are to properly account for exterior and interior conditions and thus allow reasonable usage of net STC as the sound insulating barrier.

The STC rating of a single homogeneous construction element or assembly such as a wall, window, or door is derived from sound transmission loss (TL) values at 1/3-OBCF resolution that fit a standardized “curve” (within allowable tolerances) per American Society of Testing and Materials (ASTM) E 413 for the rating value. These TL values are typically the results of laboratory tests of the material or assembly. Because exterior facades of an occupied building often include a combination of windows and doors that represent penetrations to an otherwise uniform solid wall (that typically comprises an assembly of material layers and spacings between the exterior surface exposed to the outdoors and the interior surface of the occupied space), a composite STC rating must be calculated to represent the overall exterior-to-interior sound insulating performance of the combination. The calculation considers the areas and individual TL values of each façade component (wall, windows, doors, and unobstructed openings), which results in a set of composite TL values from which an STC rating can be derived. This calculation of a net STC rating for the façade makes it possible for a combination of components, some of which (e.g., windows) may individually appear inadequate to provide the needed noise reduction, to “on average” yield a satisfactory result since it relies on the contribution of the wall assembly and its typically high STC rating.

For purposes of this assessment, street-facing building shells for these rooms feature the following characteristics:

- 11/16” overall thickness insulated glass (IG) assembly of 4mm glass, airspace, and 4mm glass; with overall height and width dimensions that reflect what appears in the project plans. According to manufacturer data, a fiberglass-framed assembly for fixed windows would be expected to yield an STC rating of 29 (Pella 2022). With 1/3-OBCF TL detail unavailable for the Pella “Impervia” product, TL data for a comparable glazing system (5/8” overall = 1/8” glass, airspace, 1/8” glass) yielding STC 31 (Viracon 2019) was reduced by 2 dB in each one-third octave band.
- Exterior walls (i.e., an exterior-facing assembly having mass and solidity comparable to two layers of 5/8” gypsum wallboard attached to 2” by 4” wood studs featuring 24” on-center spacing, fiberglass batt fill in the stud cavities, and at least one layer of 5/8” interior-facing gypsum wallboard). This is likely a conservative input parameter, as the exterior wall types appearing in the project plans have a minimum stud/cavity depth of 4” and can feature additional layers of exterior or interior solid material.

6.2 Noise Analysis Results

6.2.1 Onsite Exterior Transportation Noise Analysis

As described in Section 6.1.1, predicted project-only vehicle trip noise levels for the project site were calculated to be approximately 60 dBA CNEL at 15 feet from the centerline of “A” Street. As traffic disseminates throughout the neighborhood, the distance to 60 dBA CNEL from the “A” Street centerline would decrease (i.e. the branching local roadways would carry less traffic than the worst-case scenario, where all project traffic enters at the northern gate where “A” Street begins). According to project plans, there are no outdoor use areas within 15 feet of the “A” Street centerline.

Additionally, the predicted rail noise level, as shown in Section 5, is approximately 50 dBA CNEL, which is lower than the City’s 60 dBA CNEL threshold. Therefore, future transportation noise at onsite exterior residential uses would be considered a less than significant impact.

6.2.2 Interior Analysis

For inhabited spaces (i.e., living rooms and bedrooms), the interior background sound level attributed to the intrusion of exterior noise dominated by roadway traffic must meet 45 dBA CNEL. Noise from heating, ventilating, and air-conditioning (HVAC) systems are not part of this assessment.

As described in Section 6.1.1, the City’s 60 dBA CNEL threshold is predicted at approximately 15 feet from the centerline of “A” Street, which runs through the center of the project. Therefore, noise-sensitive receptors along “A” Street would be subjected to the highest traffic noise levels from project-only traffic due to the northern gate carrying the entirety of the project trip traffic. According to project plans, there are no project facades within 15 feet of the “A” Street centerline.

Although noise levels at project facades are predicted to be below the 60 dBA CNEL City planning standard, a predictive analysis was performed for a number of sample facades using the methodology described in Section 6.1.2, the results of which are presented in Table 14.

Table 14. Predicted Interior Noise Levels due to Exterior Traffic Noise Intrusion

Sample Inhabited Room	Maximum Allowable Project Facade Exterior Noise Level, dBA CNEL	Interior Background Level, dBA CNEL
		Closed Windows, with 11/16" IG glazing
Plan 1 – Bedroom 2	60	36
Plan 2 – Living Room		35
Plan 3 – Primary Bedroom		36
Plan 4 – Den		36
Plan 5 – Primary Bedroom		35
Plan 6 – Living Room		35

The predicted values in Table 14 are less than the 45 dBA CNEL standard required by the City, and thus suggests typical glazing options for such occupied rooms would comply with this acoustical requirement. The predictions for the 11/16" IG case are below 45 dBA and the differences between the interior background sound levels and the 45 dBA criterion are greater than 5 dB, which is more than a typical safety margin of 5 dB applied to an STC rating in order to estimate its "field" STC (FSTC) that accounts for the anticipated difference between laboratory testing conditions and actual built conditions. Note that the predicted levels shown in Table 14 and recommendation for the 11/16" glazing option are preliminary as detailed individual room data, including window specifications and dimensions, were not included in project planning documents.

Set in properly designed and well-sealed framing systems, with appropriate seals and thresholds that are code-compliant and minimize acoustical leaks, the sound insulating performance of such glazing system options is dependent on the glass lite thickness, glass lite quantities, and any separating air gaps. Glazing coloring or solar control features should not influence these factors, unless they are part of any thin-film lamination or material layer(s) as part of the assembly. So long as the selected glazing option yields adequate STC or comparably demonstrates sound transmission loss performance, as shown by the Appendix E sample analyses, such non-acoustical glazing properties should be acceptable but related analyses would be beyond the scope of this assessment.

7 Summary of Findings

This noise report was conducted for the proposed project. The results indicate that potential impacts during construction would **be less than significant with mitigation**. Offsite exterior noise impacts due to operation of the proposed project (including traffic noise) would be **less than significant**. Onsite exterior noise impacts due to traffic noise would be **less than significant**.

8 References Cited

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Appendix A

Baseline Noise Measurement Field Data

Field Noise Measurement Data

Record: 2013

Project Name	Belcaro
Observer(s)	
Date	2024-11-21

Meteorological Conditions

Temp (F)	71
Humidity % (R.H.)	15
Wind	Light
Wind Speed (MPH)	3
Wind Direction	East
Sky	Sunny

Instrument and Calibrator Information

Instrument Name List	(ENC) Rion NL-52
Instrument Name	(ENC) Rion NL-52
Instrument Name Lookup Key	(ENC) Rion NL-52
Manufacturer	Rion
Model	NL-52
Serial Number	553896
Calibrator Name	(ENC) LD CAL150

Calibrator Name	(ENC) LD CAL150
Calibrator Name Lookup Key	(ENC) LD CAL150
Calibrator Manufacturer	Larson Davis
Calibrator Model	LD CAL150
Calibrator Serial #	5152
Pre-Test (dBA SPL)	94
Windscreen	Yes
Weighting?	A-WTD
Slow/Fast?	Slow

Monitoring

Record #	1
Site ID	ST7
Site Location Lat/Long	34.421098, -118.410829
Begin (Time)	10:39:00
End (Time)	10:54:00
Leq	41.9
Lmax	55
Lmin	35.6
Other Lx?	L90, L50, L10
L90	36.7
L50	38.9
L10	44.9

Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Birds, Distant Dog Barking, Distant Traffic, Rustling Leaves
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing north

Site Photos

Photo



Comments / Description

Facing south

Site Photos

Photo



Comments / Description

Facing east

Monitoring

Record #	2
Site ID	LT2
Site Location Lat/Long	34.421078, -118.410851
Begin (Time)	10:40:00
Other Lx (Specify Metric)	L
Primary Noise Source	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

Site Photos

Photo



Comments / Description

Facing east

Site Photos

Photo



Comments / Description

Facing north

Monitoring

Record #	3
Site ID	ST1
Site Location Lat/Long	34.416865, -118.405570
Begin (Time)	11:10:00
End (Time)	11:25:00
Leq	53.4
Lmax	73.1

Lmin	31.4
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Birds, Distant Gardener / Landscape Noise, Rustling Leaves
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing south

Site Photos

Photo



Comments / Description

Facing east

Site Photos

Photo



Comments / Description

Facing west

Monitoring

Record #	4
Site ID	LT1
Site Location Lat/Long	34.416886, -118.405456
Begin (Time)	11:11:00
Other Lx (Specify Metric)	L
Primary Noise Source	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

Site Photos

Photo



Comments / Description

Facing south

Site Photos

Photo



Comments / Description

Facing east

Monitoring

Record #	5
Site ID	ST2
Site Location Lat/Long	34.417565, -118.412535
Begin (Time)	11:34:00
End (Time)	11:49:00
Leq	55.7
Lmax	76.4

Lmin	29.8
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Birds, Distant Conversations / Yelling, Rustling Leaves
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing south east

Site Photos

Photo



Comments / Description

Facing northwest

Site Photos

Photo



Comments / Description

Facing north

Monitoring

Record #	6
Site ID	ST5
Site Location Lat/Long	34.411014, -118.404805
Begin (Time)	11:57:00
End (Time)	12:12:00
Leq	48.7
Lmax	66
Lmin	35
Other Lx (Specify Metric)	L
Primary Noise Source	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

Site Photos

Photo



Comments / Description

Facing southeast

Site Photos

Photo



Comments / Description

Facing northeast

Monitoring

Record #	7
Site ID	ST6
Site Location Lat/Long	34.411809, -118.415329
Begin (Time)	12:28:00
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Birds, Distant Conversations / Yelling, Distant Dog Barking, Rustling Leaves
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing east

Site Photos

Photo



Comments / Description

Facing north

Monitoring

Record #	8
Site ID	ST3
Site Location Lat/Long	34.424249, -118.417029
Begin (Time)	12:36:00
End (Time)	12:51:00
Leq	52.9
Lmax	73.4

Lmin	43.6
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Birds, Distant Dog Barking, Distant Gardener / Landscape Noise, Rustling Leaves
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing northeast

Site Photos

Photo



Comments / Description

Facing northwest

Site Photos

Photo



Comments / Description

Facing southwest

Monitoring

Record #	9
Site ID	ST4
Site Location Lat/Long	34.420111, -118.423546
Begin (Time)	12:54:00
End (Time)	13:09:00
Leq	71
Lmax	94
Lmin	49.8
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Distant Traffic, Rustling Leaves
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing northwest

Site Photos

Photo



Comments / Description

Facing southeast

Site Photos

Photo



Comments / Description

Facing southwest

Monitoring

Record #	10
Site ID	ST8
Site Location Lat/Long	34.428687, -118.411458
Begin (Time)	13:17:00
End (Time)	13:32:00
Leq	55.8
Lmax	73
Lmin	46.4
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic

Other Noise Sources (Background)	<i>Birds, Rustling Leaves</i>
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Site Photos

Photo



Comments / Description

Facing west

Site Photos

Photo



Comments / Description

Facing south

Site Photos

Photo



Comments / Description

Facing east

Long-Term Measurement 1 Data Summary

Hour	Leq	Lmax	Lmin	L(10)	L(50)	L(90)
10:53	52.4	82.1	35.0	45.7	41.1	38.7
11:53	49.9	74.8	33.8	43.8	38.7	36.4
12:53	47.2	70.5	34.3	44.4	40.4	38.2
13:53	43.6	57.4	34.9	44.7	40.5	38.2
14:53	49.6	73.1	33.8	44.9	39.6	37.0
15:53	45.5	71.0	37.9	45.1	42.9	41.5
16:53	50.2	74.4	42.1	48.8	46.2	45.0
17:53	49.9	60.0	42.2	50.1	48.4	47.2
18:53	52.6	73.7	45.3	53.2	50.9	49.4
19:53	52.3	71.4	46.0	52.8	50.8	49.4
20:53	51.8	70.4	46.7	52.8	51.0	49.6
21:53	52.5	73.0	45.8	53.2	50.7	49.1
22:53	52.6	73.3	44.7	53.7	50.7	48.5
23:53	49.9	74.8	39.9	50.3	47.7	45.8
00:53	47.3	61.8	41.1	48.8	46.5	44.5
01:53	61.4	88.6	39.1	51.6	48.3	45.5
02:53	50.0	62.7	42.5	51.4	49.0	47.2
03:53	52.4	62.3	46.9	53.3	51.8	50.6
04:53	52.0	73.6	46.3	52.5	51.0	49.9
05:53	55.0	76.6	48.7	55.2	53.4	52.1
06:53	55.8	78.6	47.7	55.4	52.9	51.5
07:53	50.1	72.8	40.2	49.4	47.3	46.0
08:53	44.5	69.7	36.3	45.3	41.2	39.1
09:53	44.9	68.3	35.3	44.1	40.9	39.2
24-hour						
24-hour	53	89	34	50	47	45
Leq day	49					
Leq eve	52					
Leq night	55					
CNEL	61					
Leq day						
Leq day	50	82	34	48	45	43
Leq night	55	89	39	52	50	48
LDN	61					

Long-Term Measurement 2 Data Summary

Hour	Leq	Lmax	Lmin	L(10)	L(50)	L(90)
11:08	56.4	84.0	31.3	46.1	38.7	35.6
12:08	50.0	75.5	29.6	44.4	37.7	34.6
13:08	45.0	69.9	31.2	42.7	36.8	34.4
14:08	45.7	67.1	31.3	44.9	38.7	35.6
15:08	47.3	70.4	29.1	42.5	36.9	33.6
16:08	47.4	69.7	36.1	46.5	42.4	41.0
17:08	46.9	71.9	37.4	45.8	42.8	41.3
18:08	47.6	67.0	39.2	47.5	43.7	42.3
19:08	50.5	78.4	39.8	47.3	44.4	43.0
20:08	44.3	65.2	39.4	44.5	42.5	41.4
21:08	44.7	63.2	39.4	45.1	43.0	41.8
22:08	43.0	59.7	38.1	43.8	42.1	40.8
23:08	44.0	61.9	36.8	44.6	41.9	40.6
00:08	40.9	61.5	34.6	41.3	39.2	37.9
01:08	39.5	61.3	33.0	40.3	38.2	36.6
02:08	43.2	67.8	33.5	41.9	39.5	37.9
03:08	40.9	55.3	36.4	41.9	40.3	39.1
04:08	45.2	66.9	39.2	44.8	43.0	41.9
05:08	44.6	66.8	39.2	44.8	43.3	42.4
06:08	48.4	70.3	41.3	48.3	45.6	44.4
07:08	48.9	69.9	39.8	48.3	45.1	43.8
08:08	48.7	76.6	33.8	46.4	41.8	40.3
09:08	43.4	65.8	31.0	41.3	37.9	36.0
10:08	46.9	68.1	31.3	44.2	37.7	35.2
24-hour						
Leq day	48	84	29	45	41	39
Leq eve	49					
Leq night	47					
CNEL	44					
CNEL	52					
Leq day						
Leq day	49	56	29	45	41	39
Leq night	44	48	33	44	41	40
LDN	52					

Appendix B

Construction Noise Modeling Input and Output

noise level limit for construction phase received at residentially-zoned land use, per FTA guidance = 80
 allowable hours over which Leq is to be averaged = 8

Source, receptor, and barrier all share same reference grade elevation; unless otherwise noted)
 = Barrier of input height inserted between source and receptor

Project Phase Description	Client Equipment Description, Data Source and/or Notes	Comparable FHWA RCNM Construction Equipment Type	Quantity	AUF % (from FHWA RCNM)	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq	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 (w/out barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)		
Initial Phase - Grading, Offsite Infrastructure, Onsite Utilities, Paving																										
Site Preparation	Rubber Tired Dozers	Dozer	0	40	70.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Tractors/Loaders/Backhoes	Backhoe	0	40	66.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Crawler Tractors	Tractor	1	40	72.6	8	480	69	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Excavators	Excavator	0	40	69.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Site Preparation Phase								69																		
Grading	Excavators	Excavator	0	40	69.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Graders	Grader	1	40	73.6	8	480	70	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Rubber Tired Dozers	Dozer	0	40	70.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Scrapers	Scraper	0	40	72.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Tractors/Loaders/Backhoes	Backhoe	0	40	66.6	8	480	0	5	5	0	125	5	130	125.1	7.1	130.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Grading Phase								70																		
Utilities/Trenching	Trenchers	Slurry Trenching Machine	0	50	55.7	8	480	0	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Tractors/Loaders/Backhoes	Backhoe	0	40	53.7	8	480	0	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Scrapers	Scraper	1	40	59.7	8	480	56	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Plate Compactors	Compactor (ground)	0	20	55.7	8	480	0	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Air Compressors	Compressor (air)	0	40	53.7	8	480	0	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Pumps	Pumps	0	50	52.7	8	480	0	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Rough Terrain Forklifts	Man Lift	0	20	50.7	8	480	0	5	5	0	460	5	465	460.0	7.1	465.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Utilities/Trenching Phase								56																		
Paving	Pavers	Paver	0	50	84.9	8	480	0	5	5	0	15	5	20	15.8	7.1	20.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Paving Equipment	Paver	0	50	84.9	6	360	0	5	5	0	15	5	20	15.8	7.1	20.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Rollers	Roller	1	20	87.9	6	360	80	5	5	0	15	5	20	15.8	7.1	20.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Grinder	Drum Mixer	0	50	87.9	6	360	0	5	5	0	15	5	20	15.8	7.1	20.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Dump Truck	Dump Truck	0	40	83.9	6	360	0	5	5	0	15	5	20	15.8	7.1	20.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Tractors/Loaders/Backhoes	Backhoe	0	40	85.9	8	480	0	5	5	0	15	5	20	15.8	7.1	20.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Paving Phase								80																		
Home Construction - Phases 1 & 2																										
Building Construction	Cranes	Crane	1	16	65.0	7	420	56	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Forklifts	Man Lift	0	20	59.0	8	480	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Generator Sets	Generator	0	50	56.0	8	480	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Tractor/Loaders/Backhoes	Backhoe	0	40	62.0	7	420	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Welders	Welder / Torch	0	40	57.0	8	480	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Building Construction Phase								56																		
Architectural Coating	Air Compressor	Compressor (air)	1	40	62.0	6	360	57	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Architectural Coating Phase								57																		
Home Construction - Phase 3																										
Building Construction	Cranes	Crane	1	16	65.0	7	420	56	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Forklifts	Man Lift	0	20	59.0	8	480	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Generator Sets	Generator	0	50	56.0	8	480	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Tractor/Loaders/Backhoes	Backhoe	0	40	62.0	7	420	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
	Welders	Welder / Torch	0	40	57.0	8	480	0	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Building Construction Phase								56																		
Architectural Coating	Air Compressor	Compressor (air)	1	40	62.0	6	360	57	5	5	0	195	5	200	195.1	7.1	200.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1		
Total Aggregate Noise Exposure from Architectural Coating Phase								57																		

Appendix C

Traffic Noise Modeling Input and Output

Appendix D

Project Sound Source Calculation Data

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

Building Minimum Ventilation

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):

Tag	Building	GSF	Avail. SF	Height (ft)	Avg. minutes to change air*	Volume (ft3)	CFM	comparable facility m ² 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:																					
1	Rec Center	7600	7220	21	6	151620	25270	671 Gym	2.5	625	12	plug	61	73	74	75	72	65	59	54	80
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 Loren Cook's "Engineering Cookbook", 1999 edition, p. 42

unweighted 87 86 83 78 72 64 58 55 90

ACCs (air-cooled chillers on rooftops):

Building Interior Comfort

with or without sound insulation? (enter Y/N):	tons	LWA	unweighted PWL (dB) per OCSF (Hz) at full load (100%)								data for models "without sound insulation" or no "sound blankets"								data for models "with sound insulation" or "sound blankets"									
			63	125	250	500	1000	2000	4000	8000	LWA	63	125	250	500	1000	2000	4000	8000	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	68	66.2	66.2	63.8	64.1	64.6	59.9	57.7	53.6	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	72	63.4	63.4	63.3	63.3	70.4	64.5	59.3	55.5	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	72	67.7	67.7	66.8	68.1	69.9	62.8	60.3	55.2	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	73	67.5	67.5	67.8	70.1	70.6	63.1	58.5	53.3	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	70	61.7	61.7	65.6	68.1	65.8	59.8	58.4	56.1	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	88	92	91	88	87	83	78	73	68	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	89	92	91	90	88	84	79	74	69	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	90	93	93	91	89	85	79	74	69	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	91	94	93	94	89	86	81	76	71	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	92	95	95	94	89	87	81	76	71	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	92	95	95	95	89	87	81	76	71	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	93	94	95	92	91	89	83	81	81	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	95	93	96	92	90	84	84	82	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	100	98	98	98	95	96	90	90	86	94	94	88	91	90	91	84	82	75

actual percent of GSF occupied: 95

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)	unweighted PWL (dB) per OCSF (Hz) at full load (100%)
1	Rec Center	7600	7220	Auditorium	245	29.5	1	30	85
*based upon "b" value per Loren Cook's "Engineering Cookbook", 1999 edition, pp. 59-60									
a weighting adj 26 13 9 3 0 -1 -1 1 58 71 74 81 77 76 75 69 85									

Appendix E

Interior Intrusion Worksheets

Interior Space Studied: Plan 1 - Bedroom 2		Exterior-to-Interior Scenario: Closed Window(s) and Door		Calculation per Owens Corning NCDG (pg. 16): 60 = exterior noise level (dBA Leq) 33 = approximate net STC of assembly 3 = incidence adj. ("G+3") per OC NCDG Table 3 4 = source adj. ("F") per OC NCDG Table 4 2 = absorption adj. per OC NCDG Table 5 36.2 = interior noise level (dBA Leq)																																																																																																																																																																										
Room dimensions: length width 10.9 12.2		Room absorption conditions: (hard, standard, soft, very soft?) 0.5																																																																																																																																																																												
Calculation of net STC:																																																																																																																																																																														
<table border="1"> <thead> <tr> <th>material or element #1</th> <th>qty</th> <th>width</th> <th>height</th> </tr> </thead> <tbody> <tr> <td>material or element #2</td> <td>2</td> <td>3</td> <td>6</td> </tr> <tr> <td>material or element #3</td> <td></td> <td></td> <td></td> </tr> <tr> <td>material or element #4</td> <td></td> <td></td> <td></td> </tr> <tr> <td>total surface</td> <td></td> <td>12.2</td> <td>9</td> </tr> </tbody> </table>		material or element #1	qty	width	height	material or element #2	2	3	6	material or element #3				material or element #4				total surface		12.2	9	<table border="1"> <thead> <tr> <th>square feet</th> <th>description</th> </tr> </thead> <tbody> <tr> <td>73.8</td> <td>exterior wall assembly</td> </tr> <tr> <td>36</td> <td>vinyl window (dual pane)</td> </tr> <tr> <td>0</td> <td>patio door</td> </tr> <tr> <td>0</td> <td>opening</td> </tr> <tr> <td>109.8</td> <td>arbitrary total surface area</td> </tr> </tbody> </table>		square feet	description	73.8	exterior wall assembly	36	vinyl window (dual pane)	0	patio door	0	opening	109.8	arbitrary total surface area																																																																																																																																											
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vinyl window (dual pane) material #2 τ	0.01259	0.01585	0.01995	0.03981	0.01995	0.00501	0.00251	0.00079	0.00063	0.00063	0.0004	0.00025	0.0002	0.00016	0.00013	0.00025																																																																																																																																																														
patio door material #3 τ	0.01259	0.01585	0.01995	0.03981	0.01995	0.00501	0.00251	0.00079	0.00063	0.00063	0.0004	0.00025	0.0002	0.00016	0.00013	0.00025																																																																																																																																																														
opening material #4 τ	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																																																																																														
composite TL	17	16	21	19	22	28	31	36	36	37	39	40	40	40	43	41																																																																																																																																																														
prospective STC curve	17	20	23	26	29	32	33	34	35	36	37	37	37	37	37	37																																																																																																																																																														
differentials	0	-4	-2	-7	-7	-4	-2	2	1	1	2	3	3	3	6	4																																																																																																																																																														
To User: per ASTM E413, if individual differential < -8 dB or sum of differentials < -32 dB, select a lower STC enter desired STC value: 33 sum of negative differentials: -28																																																																																																																																																																														

Interior Space Studied: Plan 2 - Living Room		Exterior-to-Interior Scenario: Closed Window(s) and Door		Calculation per Owens Corning NCDG (pg. 16): 60 = exterior noise level (dBA Leq) 32 = approximate net STC of assembly 3 = incidence adj. ("G+3") per OC NCDG Table 3 4 = source adj. ("F") per OC NCDG Table 4 0 = absorption adj. per OC NCDG Table 5 35.2 = interior noise level (dBA Leq)																																																																																																																																																									
Room dimensions: length width 17 23.5		Room absorption conditions: (hard, standard, soft, very soft?) 0.5																																																																																																																																																											
Calculation of net STC:																																																																																																																																																													
<table border="1"> <thead> <tr> <th>material or element #</th> <th>qty</th> <th>width</th> <th>height</th> </tr> </thead> <tbody> <tr> <td>material or element #1</td> <td></td> <td></td> <td></td> </tr> <tr> <td>material or element #2</td> <td>3</td> <td>3</td> <td>6</td> </tr> <tr> <td>material or element #3</td> <td>1</td> <td>6</td> <td>8</td> </tr> <tr> <td>material or element #4</td> <td></td> <td></td> <td></td> </tr> <tr> <td>total surface</td> <td></td> <td>23.5</td> <td>9</td> </tr> </tbody> </table>		material or element #	qty	width	height	material or element #1				material or element #2	3	3	6	material or element #3	1	6	8	material or element #4				total surface		23.5	9	<table border="1"> <thead> <tr> <th>square feet</th> <th>description</th> </tr> </thead> <tbody> <tr> <td>109.5</td> <td>exterior wall assembly</td> </tr> <tr> <td>54</td> <td>vinyl window (dual pane)</td> </tr> <tr> <td>48</td> <td>patio door</td> </tr> <tr> <td>0</td> <td>opening</td> </tr> <tr> <td>211.5</td> <td>arbitrary total surface area</td> </tr> </tbody> </table>		square feet	description	109.5	exterior wall assembly	54	vinyl window (dual pane)	48	patio door	0	opening	211.5	arbitrary total surface area																																																																																																																						
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To User: per ASTM E413, if individual differential < -8 dB or sum of differentials < -32 dB, select a lower STC enter desired STC value: 32 sum of negative differentials: -29																																																																																																																																																													

Interior Space Studied: Plan 3 - Primary Bedroom		Exterior-to-Interior Scenario: Closed Window(s) and Door		Calculation per Owens Corning NCDG (pg. 16): 60 = exterior noise level (dBA Leq) 32 = approximate net STC of assembly 3 = incidence adj. ("G+3") per OC NCDG Table 3 4 = source adj. ("F") per OC NCDG Table 4 1 = absorption adj. per OC NCDG Table 5 36.4 = interior noise level (dBA Leq)																	
Room dimensions: length width 13 13.5		Room absorption conditions: (hard, standard, soft, very soft?) 0.5																			
Calculation of net STC:																					
		qty	width	height	square feet	description															
material or element #1					67.5	exterior wall assembly															
material or element #2		3	3	6	54	vinyl window (dual pane)															
material or element #3					0	patio door															
material or element #4					0	opening															
total surface			13.5	9	121.5	arbitrary total surface area															
				One-third (1/3) Octave Band Center Frequency (OBCF, Hz)																	
				125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000																	
TL Data Source NRC-CNRC IC-IR-761 (p. 25: G16_WS90(406)_MFB90_2G16) 2 x 5/8" GWB, 2"x4" wood, 24" o.c., fiber batt fill, 1 x 5/8" GWB				exterior wall assembly material #1 τ																	
				available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)																	
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				available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)																	
				patio door material #3 τ																	
				opening material #4 τ																	
To User: per ASTM E413, if individual differential < -8 dB or sum of differentials < -32 dB, select a lower STC enter desired STC value 32 sum of negative differentials -28				composite TL prospective STC curve differentials																	

Interior Space Studied: Plan 4 - Den		Exterior-to-Interior Scenario: Closed Window(s) and Door		Calculation per Owens Corning NCDG (pg. 16): 60 = exterior noise level (dBA Leq) 32 = approximate net STC of assembly 3 = incidence adj. ("G+3") per OC NCDG Table 3 4 = source adj. ("F") per OC NCDG Table 4 1 = absorption adj. per OC NCDG Table 5 36.0 = interior noise level (dBA Leq)	
Room dimensions: length width 14.3 14.8		Room absorption conditions: (hard, standard, soft, very soft?) 0.5			
Calculation of net STC:					
		qty width height	square feet	description	
material or element #1			79.2	exterior wall assembly	
material or element #2		3 3 6	54	vinyl window (dual pane)	
material or element #3			0	patio door	
material or element #4			0	opening	
total surface		14.8 9	133.2	arbitrary total surface area	
One-third (1/3) Octave Band Center Frequency (OBCF, Hz)					
TL Data Source NRC-CNRC IC-IR-761 (p. 25: G16_WS90(406)_MFB90_2G16) 2 x 5/8" GWB, 2"x4" wood, 24" o.c., fiber batt fill, 1 x 5/8" GWB		exterior wall assembly material #1 τ	125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 16 15 25 40 39 37 41 46 45 48 49 49 43 41 47 52		
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		vinyl window (dual pane) material #2 τ	19 18 17 14 17 23 26 31 32 32 34 36 37 38 39 36 0.01259 0.01585 0.01995 0.03981 0.01995 0.00501 0.00251 0.00079 0.00063 0.00063 0.0004 0.00025 0.0002 0.00016 0.00013 0.00025		
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		patio door material #3 τ	19 18 17 14 17 23 26 31 32 32 34 36 37 38 39 36 0.01259 0.01585 0.01995 0.03981 0.01995 0.00501 0.00251 0.00079 0.00063 0.00063 0.0004 0.00025 0.0002 0.00016 0.00013 0.00025		
		opening material #4 τ	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
To User: per ASTM E413, if individual differential < -8 dB or sum of differentials < -32 dB, select a lower STC enter desired STC value 32 sum of negative differentials -26		composite TL prospective STC curve differentials	17 16 20 18 21 27 30 35 36 36 38 40 40 40 42 40 16 19 22 25 28 31 32 33 34 35 36 36 36 36 36 36 1 -3 -2 -7 -7 -4 -2 2 2 1 2 4 4 4 6 4		

Interior Space Studied: Plan 5 - Primary Bedroom		Exterior-to-Interior Scenario: Closed Window(s) and Door		Calculation per Owens Corning NCDG (pg. 16): 60 = exterior noise level (dBA Leq) 33 = approximate net STC of assembly 3 = incidence adj. ("G+3") per OC NCDG Table 3 4 = source adj. ("F") per OC NCDG Table 4 1 = absorption adj. per OC NCDG Table 5 34.6 = interior noise level (dBA Leq)													
Room dimensions: length width 15.8 16		Room absorption conditions: (hard, standard, soft, very soft?) 0.5															
Calculation of net STC:																	
		qty width height	square feet	description													
material or element #1			90	exterior wall assembly													
material or element #2		3 3 6	54	vinyl window (dual pane)													
material or element #3			0	patio door													
material or element #4			0	opening													
total surface		16 9	144	arbitrary total surface area													
One-third (1/3) Octave Band Center Frequency (OBCF, Hz)																	
TL Data Source NRC-CNRC IC-IR-761 (p. 25: G16_WS90(406)_MFB90_2G16) 2 x 5/8" GWB, 2"x4" wood, 24" o.c., fiber batt fill, 1 x 5/8" GWB		125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		16	15	25	40	39	37	41	46	45	48	49	49	43	41	47	52
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		0.02512	0.03162	0.00316	0.0001	0.00013	0.0002	7.9E-05	2.5E-05	3.2E-05	1.6E-05	1.3E-05	1.3E-05	5E-05	7.9E-05	2E-05	6.3E-06
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		19	18	17	14	17	23	26	31	32	32	34	36	37	38	39	36
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		0.01259	0.01585	0.01995	0.03981	0.01995	0.00501	0.00251	0.00079	0.00063	0.00063	0.0004	0.00025	0.0002	0.00016	0.00013	0.00025
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		19	18	17	14	17	23	26	31	32	32	34	36	37	38	39	36
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		0.01259	0.01585	0.01995	0.03981	0.01995	0.00501	0.00251	0.00079	0.00063	0.00063	0.0004	0.00025	0.0002	0.00016	0.00013	0.00025
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)																	
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		17	16	20	18	21	27	30	35	36	36	38	40	40	40	42	40
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		17	20	23	26	29	32	33	34	35	36	37	37	37	37	37	37
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		0	-4	-3	-8	-8	-5	-3	1	1	0	1	3	3	3	5	3
To User: per ASTM E413, if individual differential < -8 dB or sum of differentials < -32 dB, select a lower STC enter desired STC value 33 sum of negative differentials -30																	

Interior Space Studied: Plan 6 - Den		Exterior-to-Interior Scenario: Closed Window(s) and Door		Calculation per Owens Corning NCDG (pg. 16): 60 = exterior noise level (dBA Leq) 34 = approximate net STC of assembly 3 = incidence adj. ("G+3") per OC NCDG Table 3 4 = source adj. ("F") per OC NCDG Table 4 2 = absorption adj. per OC NCDG Table 5 35.1 = interior noise level (dBA Leq)	
Room dimensions: length width 11 17.3		Room absorption conditions: (hard, standard, soft, very soft?) 0.5			
Calculation of net STC:					
		qty width height	square feet	description	
material or element #1			119.7	exterior wall assembly	
material or element #2		3 2 6	36	vinyl window (dual pane)	
material or element #3			0	patio door	
material or element #4			0	opening	
total surface		17.3 9	155.7	arbitrary total surface area	
One-third (1/3) Octave Band Center Frequency (OBCF, Hz)					
TL Data Source NRC-CNRC IC-IR-761 (p. 25: G16_WS90(406)_MFB90_2G16) 2 x 5/8" GWB, 2"x4" wood, 24" o.c., fiber batt fill, 1 x 5/8" GWB		125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000			
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		exterior wall assembly material #1 τ			
		16 15 25 40 39 37 41 46 45 48 49 49 43 41 47 52			
		0.02512 0.03162 0.00316 0.0001 0.00013 0.0002 7.9E-05 2.5E-05 3.2E-05 1.6E-05 1.3E-05 1.3E-05 5E-05 7.9E-05 2E-05 6.3E-06			
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		vinyl window (dual pane) material #2 τ			
		19 18 17 14 17 23 26 31 32 32 34 36 37 38 39 36			
		0.01259 0.01585 0.01995 0.03981 0.01995 0.00501 0.00251 0.00079 0.00063 0.00063 0.0004 0.00025 0.0002 0.00016 0.00013 0.00025			
available TL data for comparable assembly: Champion 3/4" overall - 3/32" glass + 9/16" airspace + 3/32" glass (horizontal sliding window, STC 29 per WEAL TL08-405)		patio door material #3 τ			
		19 18 17 14 17 23 26 31 32 32 34 36 37 38 39 36			
		0.01259 0.01585 0.01995 0.03981 0.01995 0.00501 0.00251 0.00079 0.00063 0.00063 0.0004 0.00025 0.0002 0.00016 0.00013 0.00025			
		opening material #4 τ			
		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
To User: per ASTM E413, if individual differential < -8 dB or sum of differentials < -32 dB, select a lower STC enter desired STC value		composite TL			
34		prospective STC curve			
sum of negative differentials -29		differentials			
		-1 -5 -2 -7 -7 -4 -2 2 2 1 2 4 3 2 6 4			