11 EL CAMINO REAL
NOISE AND VIBRATION ASSESSMENT

San Carlos, California

August 14, 2023

Prepared for:

Carolyn Mogollon
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San Jose, CA 95126

Prepared by:

Heather Bruce
Michael S. Thill

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
429 East Cotati Avenue
Cotati, CA 94931
(707) 794-0400

Project: 23-053

INTRODUCTION

The 11 El Camino Real project would demolish the existing one-story, approximately 28,000 square foot commercial building, parking lot, and landscaping and construct a new six-story apartment building with up to 242 residential units above one level of below grade parking and one level of podium parking. The building would include a leasing office, lobby, work-from-home space, fitness studio, clubroom, a WiFi lounge, and other amenity spaces for residents. A total of approximately 22,880 square feet of shared open space would be provided in the form of two rooftop decks on the fifth and sixth floors, and two courtyards on the second floor. In addition, a fenced dog area would be provided in the southeast corner of the site for use by future residents. Approximately 17,300 square feet of additional private open space would also be provided in the form of private decks for each residential unit.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory background, and describes the existing ambient noise environment at the project site; 2) the Plan Consistency Analysis Section discusses the compatibility of the project with noise and vibration levels experienced at the site utilizing applicable regulatory background; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is the intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which

the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn} or *DNL*) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn} of 60-70 dBA. Between a L_{dn} of 70-80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception of vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess

the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Railroad and light rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People’s response to ground vibration from rail vehicles has been correlated best with the average, root mean square (RMS) velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1 x 10-6 in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation “VdB” is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe – Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, April 2020.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, September 2018.

Regulatory Background – Noise

Federal Agencies, the State of California, San Mateo County, and the City of San Carlos have established noise criteria that are applicable in this assessment. Federal Agencies, the State of California, and the City of San Carlos have also established vibration criteria that are applicable in this assessment. The State of California Environmental Quality Act (CEQA) Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

Federal Government

Federal Transit Administration. The Federal Transit Administration (FTA) has identified construction noise thresholds in the *Transit Noise and Vibration Impact Assessment Manual*,[1] which limit daytime construction noise to 80 dBA L_{eq} at residential land uses and to 90 dBA L_{eq} at commercial and industrial land uses.

State of California

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels; or

(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, if the project would expose people residing or working in the project area to excessive noise levels.

San Mateo County

Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport, July 2012. Noise compatibility policies established in this document were designed to protect the public health, safety, and welfare by minimizing the exposure of residents and occupants of future noise-sensitive development to excessive noise and to protect the public interest in providing for the orderly development of SFO by ensuring that new development in the Airport environs complies with all requirements necessary to ensure compatibility with aircraft noise in the area. The intent is to avoid the introduction of new incompatible land uses into the Airport's "noise impact area" so that the Airport will continue to be in compliance with the State

[1] Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.

Noise Standards for airports (California Code of Regulations, Title 21, Sections 5012 and 5014).[2] The following noise compatibility policies (NP) shall apply to the ALUCP and are applicable to this project:

NP-1: Noise Compatibility Zones. For the purposes of this ALUCP, the projected 2020 CNEL noise contour map from the Draft Environmental Assessment for the Proposed Runway Safety Area Program shall define the boundaries within which noise compatibility policies described in this Section shall apply.[3] Exhibit IV-5 depicts the noise compatibility zones. The zones are defined by the CNEL 65, 70 and 75 dB contours.

NP-2: Airport Noise/Land Use Compatibility Criteria. The compatibility of proposed land uses located in the Airport noise compatibility zones shall be determined according to the noise/land use compatibility criteria shown in Table IV-1. The criteria indicate the maximum acceptable airport noise levels, described in terms of Community Noise Equivalent Level (CNEL), for the indicated land uses. The compatibility criteria indicate whether a proposed land use is "compatible," "conditionally compatible," or "not compatible" within each zone, designated by the identified CNEL ranges.

- "Compatible" means that the proposed land use is compatible with the CNEL level indicated in the table and may be permitted without any special requirements related to the attenuation of aircraft noise.

- "Conditionally compatible" means that the proposed land use is compatible if the conditions described in Table IV-1 are met.

- "Not compatible" means that the proposed land use is incompatible with aircraft noise at the indicated CNEL level.

NP-3: Grant of Avigation Easement. Any action that would either permit or result in the development or construction of a land use considered to be conditionally compatible with aircraft noise of CNEL 65 dB or greater shall be subject to this easement requirement. The determination of conditional compatibility shall be based on the criteria presented in Table IV-1 "Noise/Land Use Compatibility Criteria."

The San Mateo County Airport Land Use Commission (the C/CAG Board) deems it necessary to: (1) ensure the unimpeded use of airspace in the vicinity of SFO; (2) to ensure that new noise-sensitive land uses within the CNEL 65 dB contour are made compatible with aircraft noise, in accordance with California Code of Regulations, Title 21, Section 5014; and (3) to provide notice to owners of real property near the Airport of the proximity to SFO and of the potential impacts that could occur on the property from airport/aircraft operations. Thus, C/CAG shall condition its approval of proposed development upon the owner of the subject property granting an avigation easement to the City and County of San Francisco, as the proprietor of SFO. The local government

[2] In 2002, the San Mateo County Board of Supervisors declared that the Airport had eliminated its "noise impact area," as defined under state law -- California Code of Regulations, Title 21, Sections 5012 and 5014.
[3] URS Corporation and BridgeNet International. Draft Environmental Assessment, Proposed Runway Safety Area Program, San Francisco International Airport, June 2011.

with the ultimate permitting and approval authority over the proposed development shall ensure that this condition is implemented prior to final approval of the proposed development. If the approval action for the proposed development includes construction of a building(s) and/or other structures, the local permitting authority shall require the grant of an avigation easement to the City and County of San Francisco prior to issuance of a building permit(s) for the proposed building or structure. If the proposed development is not built, then, upon notice by the local permitting authority, SFO shall record a notice of termination of the avigation easement.

The avigation easement to be used in fulfilling this condition is presented in Appendix G[4].

NP-4: Residential Uses Within CNEL 70 dB Contour. As described in Table IV-1, residential uses are not compatible in areas exposed to noise above CNEL 70 dB and typically should not be allowed in these high noise areas.

> *NP-4.1: Situations Where Residential Use Is Conditionally Compatible.* Residential uses are considered conditionally compatible in areas exposed to noise above CNEL 70 dB only if the proposed use is on a lot of record zoned exclusively for residential use as of the effective date of the ALUCP. In such a case, the residential use must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources. The property owner also shall grant an avigation easement to the City and County of San Francisco in accordance with Policy NP-3 prior to issuance of a building permit for the proposed building or structure.

[4] Ricondo & Associates. Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport Volume 2: Appendices, July 2012.

Table IV-1 Noise/Land Use Compatibility Criteria

	COMMUNITY NOISE EQUIVALENT LEVEL (CNEL)			
LAND USE	**BELOW 65 dB**	**65-70 dB**	**70-75 dB**	**75 dB AND OVER**
Residential				
Residential, single family detached	Y	C	N *(a)*	N
Residential, multi-family and single family attached	Y	C	N *(a)*	N
Transient lodgings	Y	C	C	N
Public/Institutional				
Public and Private Schools	Y	C	N	N
Hospitals and nursing homes	Y	C	N	N
Places of public assembly, including places of worship	Y	C	N	N
Auditoriums, and concert halls	Y	C	C	N
Libraries	Y	C	C	N
Outdoor music shells, amphitheaters	Y	N	N	N
Recreational				
Outdoor sports arenas and spectator sports	Y	Y	Y	N
Nature exhibits and zoos	Y	Y	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N
Golf courses, riding stables, and water recreation	Y	Y	Y	Y
Commercial				
Offices, business and professional, general retail	Y	Y	Y	Y
Wholesale; retail building materials, hardware, farm equipment	Y	Y	Y	Y
Industrial and Production				
Manufacturing	Y	Y	Y	Y
Utilities	Y	Y	Y	Y
Agriculture and forestry	Y	Y *(b)*	Y *(c)*	Y *(c)*
Mining and fishing, resource production and extraction	Y	Y	Y	Y

Notes:

CNEL = Community Noise Equivalent Level, in A-weighted decibels.

Y (Yes) = Land use and related structures compatible without restrictions.

C (conditionally compatible) = Land use and related structures are permitted, provided that sound insulation is provided to reduce interior noise levels from exterior sources to CNEL 45 dB or lower and that an avigation easement is granted to the City and County of San Francisco as operator of SFO. See Policy NP-3.

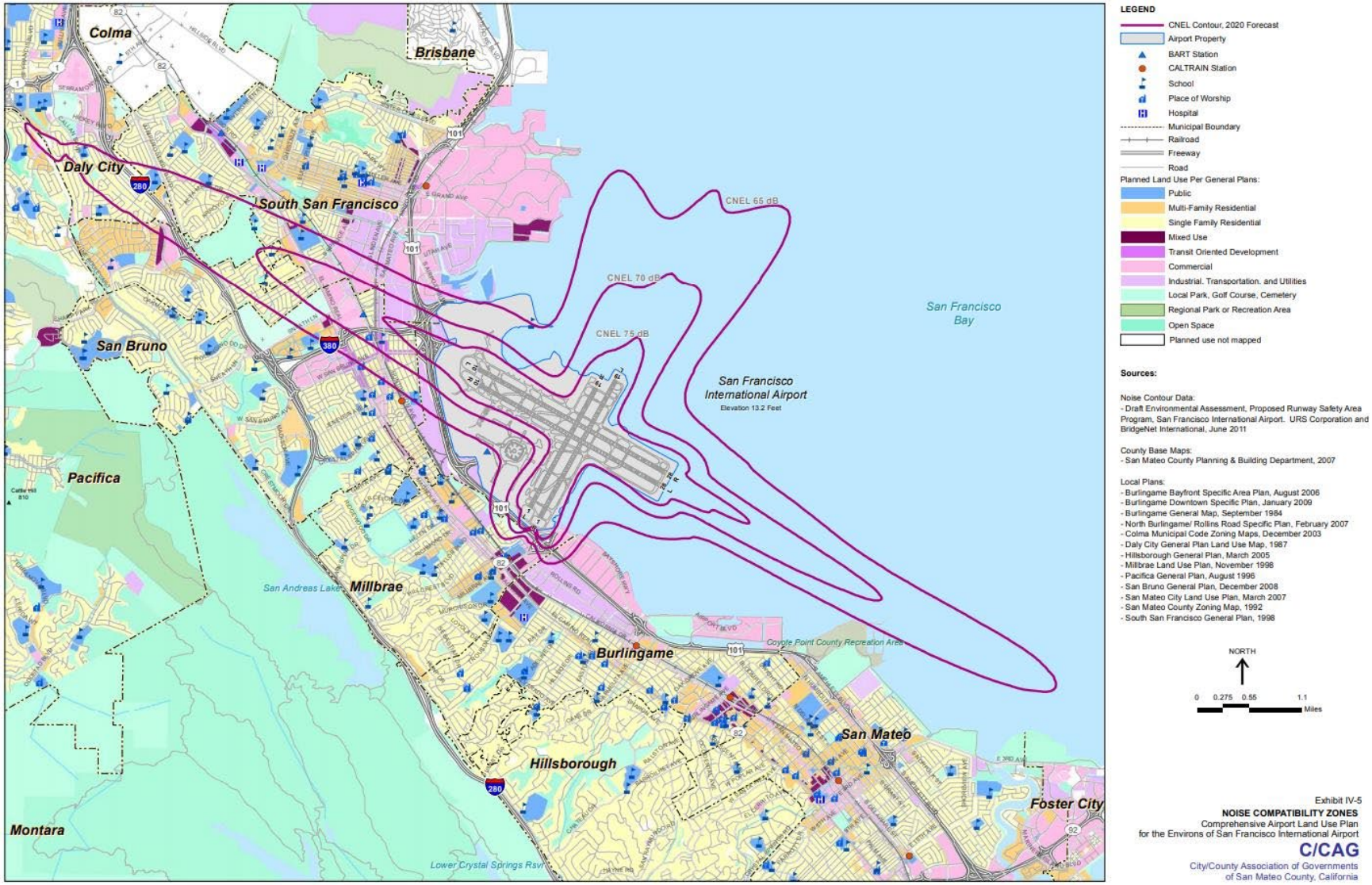
N (No) = Land use and related structures are not compatible..

(a) Use is conditionally compatible only on an existing lot of record zoned only for residential use as of the effective date of the ALUCP. Use must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources. The property owners shall grant an avigation easement to the City and County of San Francisco prior to issuance of a building permit for the proposed building or structure. If the proposed development is not built, then, upon notice by the local permitting authority, SFO shall record a notice of termination of the avigation easement.

(b) Residential buildings must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or less from exterior sources.

(c) Accessory dwelling units are not compatible.

SOURCES: Jacobs Consultancy Team 2010. Based on State of California General Plan Guidelines for noise elements of general plans; California Code of Regulations, Title 21, Division 2.5, Chapter 6, Section 5006; and 14 CFR Part 150, Appendix A, Table 1.
PREPARED BY; Ricondo & Associates, Inc., June 2012.


Colma
Brisbane
Daly City
South San Francisco
San Bruno
Pacifica
Millbrae
Burlingame
San Mateo
Hillsborough
Foster City
Montara
San Francisco Bay
San Francisco International Airport
Elevation 13.2 Feet
CNEL 65 dB
CNEL 70 dB
CNEL 75 dB
San Andreas Lake
Lower Crystal Springs Rsvr
Coyote Point County Recreation Area
LEGEND
CNEL Contour, 2020 Forecast
Airport Property
BART Station
CALTRAIN Station
School
Place of Worship
Hospital
Municipal Boundary
Railroad
Freeway
Road
Planned Land Use Per General Plans:
Public
Multi-Family Residential
Single Family Residential
Mixed Use
Transit Oriented Development
Commercial
Industrial. Transportation. and Utilities
Local Park, Golf Course, Cemetery
Regional Park or Recreation Area
Open Space
Planned use not mapped
Sources:
Noise Contour Data:
- Draft Environmental Assessment, Proposed Runway Safety Area Program, San Francisco International Airport. URS Corporation and BridgeNet International, June 2011
County Base Maps:
- San Mateo County Planning & Building Department, 2007
Local Plans:
- Burlingame Bayfront Specific Area Plan, August 2006
- Burlingame Downtown Specific Plan, January 2009
- Burlingame General Map, September 1984
- North Burlingame/ Rollins Road Specific Plan, February 2007
- Colma Municipal Code Zoning Maps, December 2003
- Daly City General Plan Land Use Map, 1987
- Hillsborough General Plan, March 2005
- Millbrae Land Use Plan, November 1998
- Pacifica General Plan, August 1996
- San Bruno General Plan, December 2008
- San Mateo City Land Use Plan, March 2007
- San Mateo County Zoning Map, 1992
- South San Francisco General Plan, 1998
NORTH
0 0.275 0.55 1.1
Miles
Exhibit IV-5
NOISE COMPATIBILITY ZONES
Comprehensive Airport Land Use Plan
for the Environs of San Francisco International Airport
C/CAG
City/County Association of Governments
of San Mateo County, California

City of San Carlos

San Carlos 2030 General Plan. The City of San Carlos adopted the 2030 General Plan in October 2009. The Noise Element of the General Plan[5] provides goals, policies, and actions to maintain a community with a noise environment that supports a high quality of life. The goals, policies, and actions that apply to the proposed project are as follows:

Goal NOI-1: Encourage compatible noise environments for new development and control sources of excessive noise citywide.

Policy NOI-1.1. Use the Noise and Land Compatibility Standards shown in Figure 9-1, the noise level performance standards in Table 9-1 and the projected future noise contours for the General Plan shown in Figure 9-3 and detailed in Table 9-2, as a guide for future planning and development decisions.

Policy NOI-1.2. Minimize noise impacts on noise-sensitive land uses. Noise-sensitive land uses include residential uses, retirement homes, hotel/motels, schools, libraries, community centers, places of public assembly, daycare facilities, churches, and hospitals.

Policy NOI-1.3. Limit noise impacts on noise-sensitive uses to noise level standards as indicated in Table 9-1.

Policy NOI-1.4. Require a detailed acoustic report in all cases where noise-sensitive land uses are proposed in areas exposed to exterior noise levels of 60 CNEL L_{dn} or greater. If recommended in the report, mitigation measures shall be required as conditions of project approval.

Policy NOI-1.5. New development of noise-sensitive land uses proposed in noise-impacted areas shall incorporate effective mitigation measures into the project design to reduce exterior and interior noise levels to the following acceptable levels.

a. For new single-family residential development, maintain a standard of 60 L_{dn} (day/night average noise level) for exterior noise in private use areas.

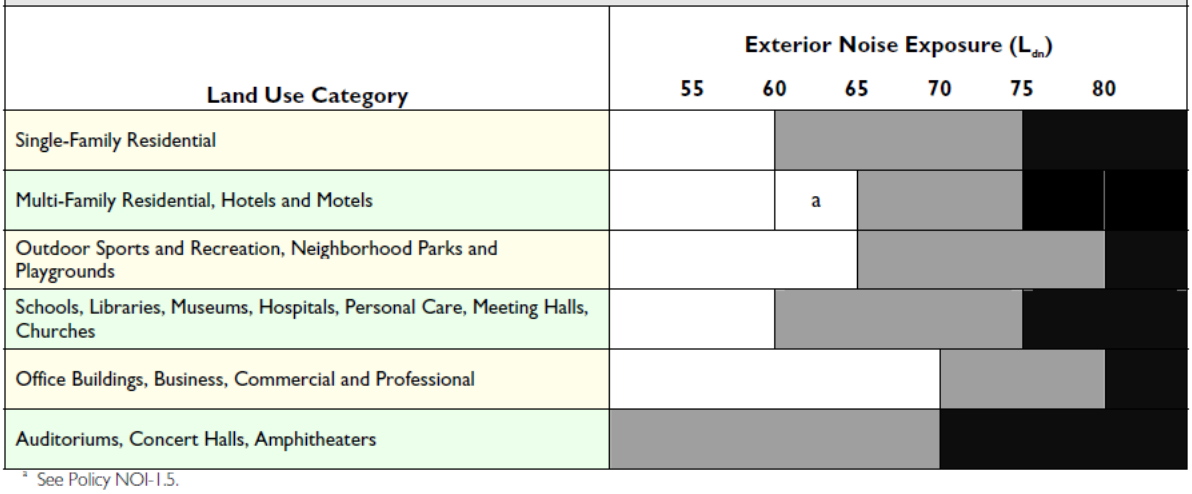
b. For new multi-family residential development maintain a standard of 65 L_{dn} in community outdoor recreation areas. Noise standards are not applied to private decks and balconies and shall be considered on a case-by-case basis in the downtown core.

c. Interior noise levels shall not exceed 45 L_{dn} in all new residential units (single- and multi-family). Development sites exposed to noise levels exceeding 60 L_{dn} shall be analyzed following protocols in Appendix Chapter 12, Section 1208, A, Sound Transmission Control, 2001 Building Code Chapter 12, Appendix 1207.11.2 of the 2007 California Building Coe (or the latest version).

[5] City of San Carlos, *San Carlos 2030 General Plan*, Noise Element, Adopted October 12, 2009.

d. Where new residential units (single- and multi-family) would be exposed to intermittent noise levels generated during train operations, maximum railroad noise levels inside homes shall not exceed 50 dBA in bedrooms or 55 dBA in other occupied spaces. These single event limits are only applicable where there are normally four or more train operations per day.

FIGURE 9-1 LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENT



[a] See Policy NOI-1.5.

NORMALLY ACCEPTABLE. Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special insulation requirements.

CONDITIONALLY ACCEPTABLE. Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

UNACCEPTABLE. New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

TABLE 9-1 NON-TRANSPORTATION NOISE STANDARDS

Land Use Receiving the Noise	Hourly Noise-Level Descriptor	Exterior Noise-Level Standard In Any Hour (dBA)		Interior Noise-Level Standard In Any Hour (dBA)	
		Daytime (7am-10pm)	Nighttime (10pm-7am)	Daytime (7am-10pm)	Nighttime (10pm-7am)
Residential	L_{eq}	55	45	40	30
	L_{max}	70	60	55	45
Medical, convalescent	L_{eq}	55	45	45	35
	L_{max}	70	60	55	45
Theater, auditorium	L_{eq}	--	--	35	35
	L_{max}	--	--	50	50
Church, meeting hall	L_{eq}	55	--	40	40
	L_{max}	--	--	55	55
School, library, museum	L_{eq}	55	--	40	--
	L_{max}	--	--	55	--

Notes:
1. The Residential standards apply to all residentially zoned properties.
2. Each of the noise levels specified above shall be lowered by 5 dBA for tonal noises characterized by a whine, screech, or hum, noises consisting primarily of speech or music, or recurring impulsive noises.
3. In situations where the existing noise level exceeds the noise levels indicated in the above table, any new noise source must include mitigation that reduces the noise level of the noise source to the existing level.
4. The exterior noise standards are measured at any point on the receiving property where there is, or could be in the future, frequent human use and quiet would be beneficial.
5. These standards do not apply to temporary sources such as construction activities.

Policy NOI-1.6. Where noise mitigation measures are required to achieve the noise level standards, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered after practical design-related noise mitigation measures have been integrated into the project.

Policy NOI-1.7. The City shall seek to reduce impacts from groundborne vibration associated with rail operations by requiring that vibration-sensitive buildings (e.g. residences) are sited at least 100 feet from the centerline of the railroad tracks whenever feasible. The development of vibration-sensitive buildings within 100 feet from the centerline of the railroad tracks would require a study demonstrating that groundborne vibration issues associated with rail operations have been adequately addressed (i.e., through building siting, foundation design and construction techniques).

Policy NOI-1.8. During all phases of construction activity, reasonable noise reduction measures shall be utilized to minimize the exposure of neighboring properties to excessive noise levels.

a. Construction activities shall comply with the City's noise ordinance.

Policy NOI-1.9. Minimize potential transportation-related noise through the use of setbacks, street circulation design, coordination of routing and other traffic control measures and the construction of noise barriers and consider use of "quiet" pavement surfaces when resurfacing roadways.

Policy NOI-1.10. Ensure that mixed-use development projects are designed to minimize noise impacts on residential units.

Policy NOI-1.11. Ensure that proposed noise sensitive land uses include appropriate mitigation to reduce noise impacts from aircraft operations at San Carlos Airport. Work with the San Carlos Airport Pilots Association and San Mateo County to continue to refine and implement the Airport's noise abatement procedures.

Policy NOI-1.12. Ensure consistency with the noise compatibility policies and criteria contained in the San Carlos Airport Land Use Plan.

Policy NOI-1.13. Require a noise analysis for new residential uses located within the 55 CNEL impact area of the San Carlos Airport. If recommended in the report, mitigation measures shall be required as conditions of project approval.

Policy NOI-1.14. The Federal Transit Administration vibration impact criteria and assessment methods shall be used to evaluate the compatibility of train vibration with proposed land uses adjoining the UPRR (Caltrain) corridor. Site specific vibration studies shall be completed for vibration-sensitive uses proposed within 100 feet of active railroad tracks.

Action NOI-1.1. Establish a noise abatement protocol for existing sensitive land uses located in areas anticipated to experience significant noise increases with the implementation of the General Plan. Cumulative traffic noise impacts on existing noise-sensitive uses could be reduced through the inclusion of exterior and/or interior sound-reduction measures, such as setbacks, noise barriers, forced-air mechanical ventilation and sound-rated window construction. The City should research sources of funding for these actions.

Action NOI-1.2. Revise the City's Noise Ordinance to be consistent with this Element.

Action NOI-1.3. Require residents of new mixed-use developments to be informed of potential noise from refuse collection and other activities typically associated with commercial activity.

Action NOI-1.4. Require the evaluation of mitigation measures for projects that would cause the following criteria to be exceeded or would cause a significant adverse community response:

a. Cause the L_{dn} at noise-sensitive uses to increase by 3 dBA or more and exceed the "normally acceptable" level.

b. Cause the L_{dn} at noise-sensitive uses to increase by 5 dBA or more and remain "normally acceptable."

c. Cause noise levels to exceed the limits in Table 9-1.

Action NOI-1.5. Enforce Section 27007 of the California Motor Vehicle Code that prohibits amplified sound that can be heard 50 or more feet from a vehicle.

Action NOI-1.6. Enforce Section 27150 of the California Motor Vehicle Code that addresses excessive exhaust noise.

Action NOI-1.7. Update and review procedures for dealing with noise complaints in the community.

Action NOI-1.8. Evaluate the necessity of requesting Caltrain to establish a Quiet Zone designation for San Carlos.

Comprehensive Airport Land Use Compatibility Pan (ALUCP) For the Environs of San Carlos Airport - Noise Compatibility Criteria and Policies for San Carlos Airport

Noise Policy 1 Nosie Impact Area. The threshold for evaluation is the project CNEL 60 dB contour depicted on Exhibit 4-2. This contour defines the noise impact area of the Airport. All land uses located outside this contour are consistent with the noise compatibility and policies of the ALUCP.

Noise Policy 2 - Airport Noise/Land Use Compatibility Criteria. The noise compatibility policies set forth in this section shall be used in conjunction with the 20-year future noise exposure contours depicted on Exhibit 4-2 and noise/land use compatibility criteria presented in Table 4-3.

a) The compatibility criteria in this section indicate the maximum acceptable airport-related noise levels, which are measured in terms of CNEL, for a range of land uses.

b) Noise compatibility policies only apply to the identified noise contours. Within the four noise exposure ranges, each land use type is shown as "compatible", "conditionally compatible", or "incompatible". The meaning of these terms is provided in Table 4-3.

c) Land uses not specifically listed in Table 4-3 shall be evaluated using the criteria for similar listed uses.

Noise Policy 3 - Residential Land Uses. Residential land uses are considered conditionally compatible in areas exposed to noise levels between CNEL 60-64 dB only if the proposed use is on a lot of record zoned exclusively for residential use as of the effective date of this ALUCP. In such a case, the residential land use must be sound-insulated to achieve an indoor noise level of CNEL 45 dB or lower.

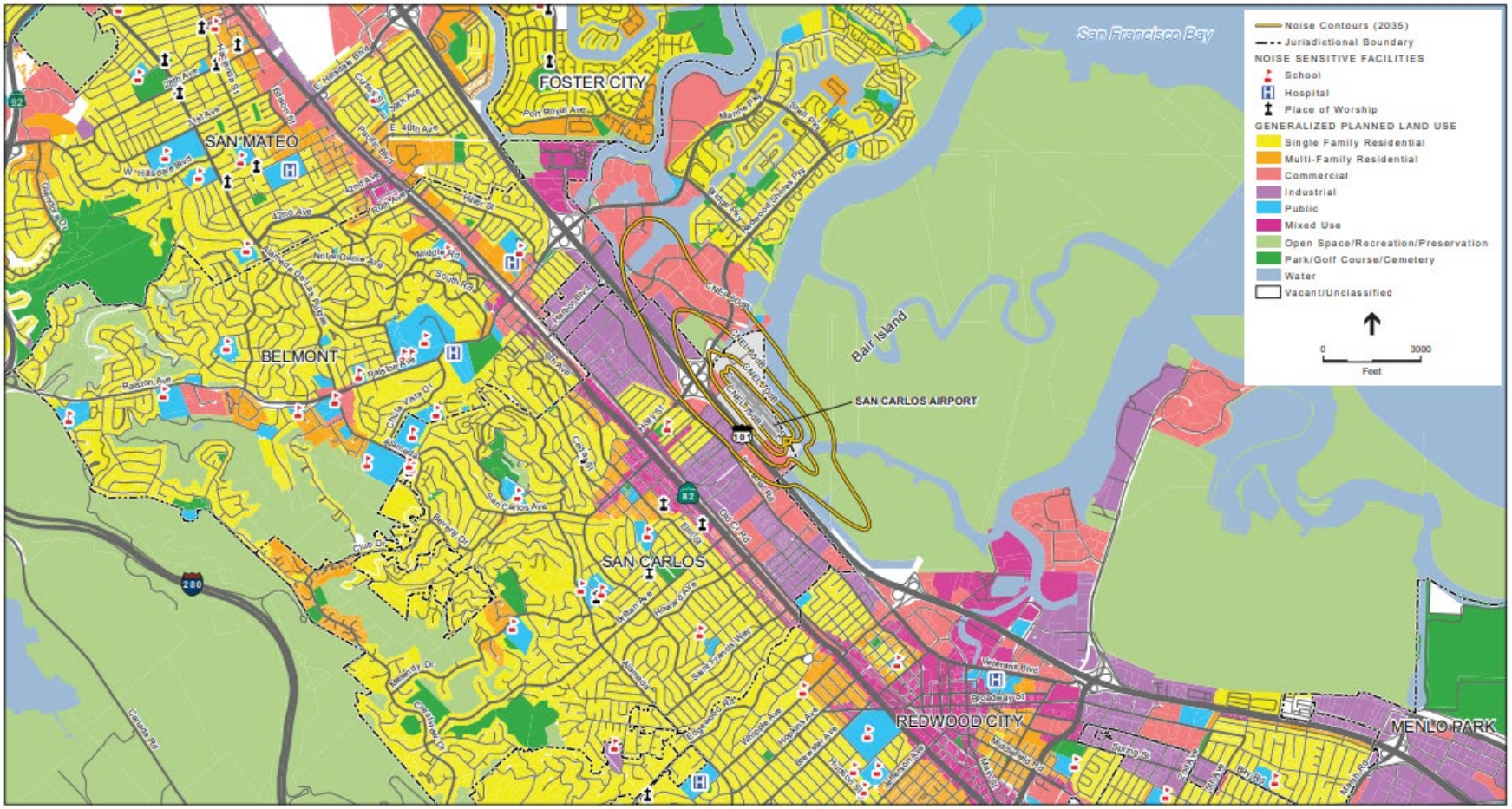
TABLE 4-3
NOISE COMPATIBILITY CRITERIA

Land Use Category	Community Noise Equivalent Level (dBA)			
	<60	60-64	65-69	70-75
Residential and Lodging				
Residential Single-family (detached, semi-detached, attached row)	Y	C(2)	N	N
Multi-family residential	Y	C(2)	N	N
Mobile home parks or courts	Y	N	N	N
Retirement homes; intermediate care facilities	Y	C(2)	N	N
Hotels; motels; other transient lodging	Y	Y	C(1)	N
Public/Institutional				
Children's schools (K-12) and child care facilities	Y	C(2)	C(2)	N
Adult schools; colleges; universities (excluding laboratories, gymnasiums, and outdoor athletic facilities)	Y	Y	C(1)	N
Outdoor amphitheaters and stadiums	Y	N	N	N
Auditoriums; concert halls; indoor arenas	Y	Y	C(1)	N
Hospitals; nursing homes; other health care services	Y	C(2)	N	N
Religious facilities; cemetery chapels; mortuaries; libraries; museums	Y	C(2)	N	N
Prisons; reformatories	Y	Y	C(3)	N
Public safety facilities (e.g., police, fire stations)	Y	Y	C(3)	C(3)
Cemeteries	Y	Y	Y	N
Recreational				
Children-oriented neighborhood parks; playgrounds	Y	Y	N	N
Community parks; regional parks; golf courses; tennis courts; athletic fields; outdoor spectator sports; fairgrounds; water recreation facilities	Y	Y	N	N
Recreation buildings; gymnasiums; club houses; athletic clubs; dance studios	Y	Y	C(3)	C(3)
Campgrounds; recreational vehicle/motor home parks	Y	C(4)	N	N
Commercial				
Office buildings; office areas of industrial facilities; medical clinics; laboratories; radio, television, and recording studios	Y	Y	C(3)	N
Retail sales; eating/drinking establishments; movie theaters; personal services	Y	Y	C(3)	N
Wholesale sales; warehouses; mini/other indoor storage	Y	Y	Y	C(3)
Auto and marine sales and repair services; car washes; gas stations	Y	Y	Y	C(3)
Animal shelters/kennels	Y	C(4)	C(4)	N
Industrial				
Light industrial/manufacturing; miscellaneous manufacturing; research and development facilities	Y	Y	Y	C(3)
Printing, publishing, and allied industries	Y	Y	Y	Y
Processing of food, wood and paper products; warehouses; wholesale storage	Y	Y	Y	Y

TABLE 4-3
NOISE COMPATIBILITY CRITERIA

Land Use Category	Community Noise Equivalent Level (dBA)			
	<60	60-64	65-69	70-75
Refining, manufacturing and storage of chemicals, petroleum and related products; manufacturing and assembly of electronic components	Y	Y	Y	Y
Salvage yards; natural resource extraction and processing; public works yards; solid waste facilities; outdoor storage; automobile dismantling	Y	Y	Y	Y
Utilities, road, rail rights-of-way; communication and other utilities; automobile parking	Y	Y	Y	Y
Agriculture and Animal-Related				
Nature preserves; wildlife preserves	Y	Y	Y	Y
Agriculture-related activities (except livestock); greenhouses; fishing	Y	C(1)	C(5)	C(5)
Horse stables; livestock breeding or farming	Y	Y	C(5)	C(5)
Zoos	Y	C(4)	N	N
Interactive Nature Exhibits	Y	C(4)	N	N

Notes:
Y – Land use and related structures are compatible without restrictions.
C(1) – Land use and related structures are conditionally compatible. Building structure must be capable of attenuating exterior noise levels to an interior noise level of CNEL 45 dB or lower.
C(2) - Land use and related structures are conditionally compatible. Building structure must be capable of attenuating exterior noise levels to an interior noise level of CNEL 45 dB or lower. Requires that an avigation easement be granted to San Mateo County as the operator of San Carlos Airport.
C(3) - Land use and related structures are conditionally compatible. Building structure must be capable of attenuating exterior noise levels to an interior noise level of CNEL 50 dB or lower.
C(4) – Land Use is conditionally compatible. Caution should be exercised with regard to noise-sensitive outdoor uses as these uses are likely to be disrupted by aircraft noise events.
C(5) – Land Use is conditionally compatible. Caution should be exercised with regard to noise-sensitive outdoor uses as these uses are likely to be disrupted by aircraft noise events. Accessory dwelling units are not compatible.
N – Land use and related structures are not compatible under any circumstances.
Source: ESA Airports, September 2014.



SOURCE: Belmont, 1982; San Mateo County, 1986; Foster City, 1993; Menlo Park, 1994; San Carlos, 2009; City of San Mateo, 2010; Redwood City, 2010; ESRI, 2014; ESA Airports, 2015

San Carlos Airport ALUCP . 130753

Exhibit 4-2
Future Conditions (2035) Aircraft Noise Contours

San Carlos Municipal Code. Chapter 9.30, Noise Control, of the City's Municipal Code seeks to protect the peace, health and safety of its citizens from unnecessary and unreasonable noises produced by any machine, person or device.

9.30.030 Basic noise regulation. Except as otherwise permitted under this chapter, no person shall cause and no property owner shall permit, as to property owned by him, a noise produced by any person, amplified sound or device, or any combination thereof in excess of the noise limits established in Table 18.21.050-A to emanate from any property, public or private, as measured at the receiving property line. (Ord. 1439 § 4 (Exh. B (part)), 2011: Ord. 1086 § 1 (part), 1991)

9.30.070 Exempt activities. The following noise-generating activities are exempt from the provisions of this chapter:

A. Transportation facilities, such as freeways, airports, buses, and railroads;

B. Construction activities; such activities, however, shall be limited to the hours of eight a.m. to six p.m. Monday through Friday, and nine a.m. to five p.m. on Saturdays and Sundays. No construction noise-related activities on the following holidays: New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, 4th of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day. All gasoline-powered construction equipment shall be equipped with an operating muffler or baffling system as originally provided by the manufacturer, and no modification to these systems is permitted (the Building Official shall have the authority to grant exceptions to construction noise-related activities);

C. Home workshops and gas-powered gardening equipment; such activities, however, shall be limited to the hours of eight a.m. to sunset Monday through Friday, and ten a.m. to sunset on Saturday, Sunday and holidays stated in subsection B of this section;

D. Public works and public utilities activities; such activities, however, shall be limited to the hours set forth under subsection B of this section, except for emergency situations (the Public Works Director shall have the authority to grant exceptions to public works and public utilities construction noise-related activities);

E. Emergency vehicles;

F. Solid waste pickup; such activities, however, shall be limited to the hours of collection set forth under the applicable franchise agreement for solid waste pickup, recyclable materials pickup and/or organic materials pickup as may be restricted for residential, commercial and City facilities. (Ord. 1439 § 4 (Exh. B (part)), 2011: Ord. 1086 § 1 (part), 1991)

Chapter 18.21 provides performance standards for noise and vibration. The following sections apply to this report:

18.21.050 Noise.

A. Noise Limits. No use or activity shall create noise levels that exceed the following standards. The maximum allowable noise levels specified in Table 18.21.050-A, Noise Limits, do not apply to noise generated by automobile traffic or other mobile noise sources in the public right-of-way.

1. Adjustments to Noise Limits. The maximum allowable noise levels of Table 18.21.050-A, Noise Limits, shall be adjusted according to the following provisions. No more than one increase in the maximum permissible noise level shall be applied to the noise generated on each property.

    a. Ambient Noise. If the ambient noise level at a noise-sensitive use is ten dBA or more below the standard, the allowable noise standard shall be decreased by five decibels.

    b. Duration. The maximum allowable noise level (L_{50}) shall be increased as follows to account for the effects of duration:

        i. Noise that is produced for no more than a cumulative period of fifteen minutes in any hour may exceed the noise limit by five decibels; and

        ii. Noise that is produced for no more than a cumulative period of five minutes in any hour may exceed the noise limits by ten decibels;

        iii. Noise that is produced for no more than a cumulative period of one minute in any hour may exceed the noise limits by fifteen decibels.

    c. Character of Sound. If a noise contains a steady audible tone or is a repetitive noise (such as hammering or riveting) or contains music or speech conveying informational content, the maximum allowable noise levels shall be reduced by five decibels.

    d. Prohibited Noise. Noise for a cumulative period of thirty minutes or more in any hour which exceeds the noise standard for the receiving land use.

TABLE 18.21.050-A: NOISE LIMITS

Land Use Receiving the Noise	Noise-Level Descriptor	Exterior Noise Level Standard in Any Hour (dBA)		Interior Noise-Level Standard in Any Hour (dBA)	
		Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)	Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)
Residential	L_{50}	55	45	40	30
	L_{max}	70	60	55	45
Medical, convalescent	L_{50}	55	45	45	35
	L_{max}	70	60	55	45
Theater, auditorium	L_{50}	-	-	35	35
	L_{max}	-	-	50	50
Church, meeting hall	L_{50}	55	-	40	40
	L_{max}	-	-	55	55
School, library, museum	L_{50}	55	-	40	-
	L_{max}	-	-	55	-

Notes: 1. New residential development in noise impacted areas area subject to the following noise levels:

a. For new single-unit residential development, maintain a standard of 60 L_{dn} for exterior noise in private use areas.

b. For new multi-unit residential development, maintain a standard of 65 L_{dn} in community outdoor recreation areas. Noise standards are not applied to private decks and balconies and shall be considered on a case-by-case basis in the MU-DC District.

c. Where new residential units (single and multifamily) would be exposed to intermittent noise levels generated during train operations, maximum railroad noise levels inside homes shall not exceed forty-five dBA in bedrooms or fifty-five dBA in other occupied spaces. These single-event limits are only applicable where there are normally four or more train operations per day.

TABLE 18.21.050-B: NOISE EXPOSURE
—LAND USE REQUIREMENTS AND LIMITATIONS

Land Use	Day/Night Average Sound Level (Ldn)	Requirements and Limitations
Residential (1) and Other Noise-Sensitive Uses (e.g., Schools, Hospitals, and Churches)	Less than 60	Satisfactory
	60 to 75	Acoustic study and noise attenuation measures required
	Over 75	Acoustic study and noise attenuation measures required
Auditoriums, Concert Halls, Amphitheaters	Less than 70	Acoustic study and noise attenuation measures required
	Over 70	Not allowed
Commercial and Industrial	Less than 70	Satisfactory
	70 to 80	Acoustic study and noise attenuation measures required
	Over 80	Airport-related development only; noise attenuation measures required
Outdoor Sports and Recreation, Parks	Less than 65	Satisfactory
	65 to 80	Acoustic study and noise attenuation measures required; avoid uses involving concentrations of people or animals
	Over 80	Limited to open space; avoid uses involving concentrations of people or animals

Notes: 1. New residential development in noise impacted areas area subject to the following noise levels:

a. For new single-unit residential development, maintain a standard of 60 L_{dn} for exterior noise in private use areas.

b. For new multi-unit residential development, maintain a standard of 65 L_{dn} in community outdoor recreation areas. Noise standards are not applied to private decks and balconies and shall be considered on a case-by-case basis in the MU-DC District.

c. Where new residential units (single and multifamily) would be exposed to intermittent noise levels generated during train operations, maximum railroad noise levels inside homes shall not exceed forty-five dBA in bedrooms or fifty-five dBA in other occupied spaces. These single-event limits are only applicable where there are normally four or more train operations per day.

B. Noise Exposure – Land Use Requirements and Limitations. Table 18.21.050-B, Noise Exposure—Land Requirements and Limitations, describes the requirements and limitations of various land uses within the listed day/night average sound level (L_{dn}) ranges.

C. Acoustic Study. The Director may require an acoustic study for any proposed project that could cause any of the following:

1. Locate new residential uses within the fifty-five CNEL impact area of the San Carlos Airport;

2. Cause noise levels to exceed the limits in Table 18.21.050-A;

3. Create a noise exposure that would require an acoustic study and noise attenuation measures listed in Table 18.21.050-B, Noise Exposure – Land Use Requirements and Limitations; or

4. Cause the L_{dn} at noise-sensitive uses to increase three dBA or more.

D. Establishing Ambient Noise. When the Director has determined that there could be cause to make adjustments to the standards, an acoustical study shall be performed to establish ambient noise levels. In order to determine if adjustments to the standards should be made either upwards or downwards, a minimum twenty-four-hour-duration noise measurement shall be conducted. The noise measurements shall collect data utilizing noise metrics that are consistent with the noise limits presented in Table 18.21.050-A, e.g., L_{max} (zero minutes), L_{02} (one minute), L_{08} (five minutes), L_{25} (fifteen minutes) and L_{50} (thirty minutes). An arithmetic average of these ambient noise levels during the three quietest hours shall be made to demonstrate that the ambient noise levels are regularly ten or more decibels below the respective noise standards. Similarly, an arithmetic average of ambient noise levels during the three loudest hours should be made to demonstrate that ambient noise levels regularly exceed the noise standards.

E. Noise Attenuation Measures. Any project subject to the acoustic study requirements of subsection C of this section may be required as a condition of approval to incorporate noise attenuation measures deemed necessary to ensure that noise standards are not exceeded.

1. New noise-sensitive uses (e.g., schools, hospitals, churches, and residences) shall incorporate noise attenuation measures to achieve and maintain an interior noise level of forty-five dBA.

2. Noise attenuation measures identified in an acoustic study shall be incorporated into the project to reduce noise impacts to satisfactory levels.

3. Emphasis shall be placed upon site planning and project design measures. The use of noise barriers shall be considered and may be required only after all feasible design-related noise measures have been incorporated into the project. (Ord. 1438 § 4 (Exh. A (part)), 2011)

Regulatory Background – Vibration

Federal Government

Federal Transit Administration. The FTA has identified vibration impact criteria for sensitive buildings, residences, and institutional land uses near rail transit and railroads. These criteria are shown in Table 5. The thresholds for residences are 72 VdB for frequent events (more than 70 events of the same source per day), 75 VdB for occasional events (30 to 70 vibration events of the same source per day), and 80 VdB for infrequent events (less than 30 vibration events of the same source per day).

TABLE 5 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 µinch/sec, RMS)		
	Frequent Events[1]	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:

1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

State of California

California Department of Transportation. To avoid damage to buildings, Caltrans recommends that construction vibration levels are limited to 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, to 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and to 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened (see Table 3).

City of San Carlos

San Carlos Municipal Code. Chapter 18.21 of the City's Municipal Code includes the following regarding vibration:

18.21.060 Vibration. No vibration shall be produced that is transmitted through the ground and is discernible without the aid of instruments by a reasonable person at the lot lines of the site. Vibrations from temporary construction, demolition, and vehicles that enter and leave the subject parcel (e.g., construction equipment, trains, trucks, etc.) are exempt from this standard. (Ord. 1438 § 4 (Exh. A (part)), 2011)

Existing Noise Environment

The project site is located between El Camino Real and the UPRR (Caltrain) tracks, south of F Street, in the City of San Carlos. Currently, the site is occupied by an approximately 28,000 square foot one-story commercial building (CVS drug store). Adjoining the site to the northwest are existing residential and office uses, and adjoining the site to the southeast is an existing commercial shopping center. Southwest of the site, opposite El Camino Real, are two existing hotels, an orthodontist's office, and a retail store. Existing commercial uses are located northeast of the project site, opposite the UPRR (Caltrain) tracks. The nearest residences are located approximately 75 feet northwest of the project site along F Street, as measured from the nearest property lines.

The noise environment at the site and in the surrounding areas results primarily from traffic along El Camino Real and train activity along the UPRR (Caltrain) tracks. Aircraft associated with San Carlos Airport and San Francisco International Airport also contribute to the noise environment.

A noise monitoring survey, which included two long-term (LT-1 and LT-2) and two short-term (ST-1 through ST-2) noise measurements, was performed at the site beginning on Tuesday April 18, 2023 and concluding on Thursday April 20, 2023. All measurement locations are shown in Figure 1.

Long-term noise measurement LT-1 was installed in a tree approximately 50 feet northeast of the El Camino Real centerline on the project site. This long-term measurement was positioned far enough away from the train tracks to capture the existing noise environment along El Camino Real. Hourly average noise levels at LT-1 typically ranged from 70 to 76 dBA L_{eq} during daytime hours (between 7:00 a.m. and 10:00 p.m.) and from 58 to 70 dBA L_{eq} during nighttime hours (between 10:00 p.m. and 7:00 a.m.). The day-night average noise level (L_{dn}) measured on Wednesday April 19, 2023 was 75 dBA L_{dn}. The daily trends in noise levels at LT-1 are shown in Figures A1 through A3 in the Appendix of this report.

LT-2 was made approximately 14 feet southeast of the F Street centerline and approximately 56 feet southwest of the edge of the nearest UPRR (Caltrain) tracks, which is the dominant noise source at LT-2. Hourly average noise levels at LT-2 typically ranged from 50 to 67 dBA L_{eq} during the day and from 46 to 62 dBA L_{eq} at night. The day-night average noise level was 64 dBA L_{dn} on Wednesday, April 19, 2023. The daily trends in noise levels at LT-2 are shown in Figures A4 through A6 in the Appendix of this report.

Each short-term noise measurement was made on Tuesday April 18, 2023, in 10-minute intervals between 8:00 a.m. and 9:40 a.m. Table 6 summarizes the measurements at each short-term location.

ST-1 was made within the project site along F Street, approximately 146 feet from the centerline of El Camino Real and approximately 55 feet from the edge of the nearest UPRR (Caltrain) tracks. This measurement represents the existing noise environment at the nearest residential uses to the northwest (Belmont Apartments). During the first measurement at ST-1, two Caltrain pass-bys occurred. The train passbys produced noise ranging from 54 to 82 dBA. The 10-minute average noise level during the first measurement at ST-1 was 63 dBA. During the second 10-minute measurement at ST-1, 245 passenger cars, three heavy trucks, two buses, and one motorcycle drove along El Camino Real, generating noise levels at ST-1 ranging from 52 to 70 dBA. No trains passed during the second measurement. Additional noise sources contributing to the noise measurement included jet flyovers (52 dBA). The 10-minute average noise level during the second measurement at ST-1 was 60 dBA.

ST-2 was made at the setback of proposed project's building façade, approximately 70 feet from the centerline of El Camino Real. During this 10-minute measurement, 297 passenger cars, four heavy trucks, and three buses drove along El Camino Real, generating noise levels at ST-2 ranging from 60 to 72 dBA. Additional noise sources contributing to the noise measurement included jet flyovers (53 dBA). The 10-minute average noise level at ST-2 was 68 dBA.

TABLE 6 Summary of Short-Term Noise Measurement Data (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$
ST-1: 4/18/2023, 8:00-8:10 a.m.[a]	82	77	71	64	62	63
ST-1: 4/18/2023, 8:10-8:20 a.m.	70	66	63	58	51	60
ST-2: 4/18/2023, 9:30-9:40 a.m.	76	74	71	67	60	68

[a] This measurement included two Caltrain pass-bys

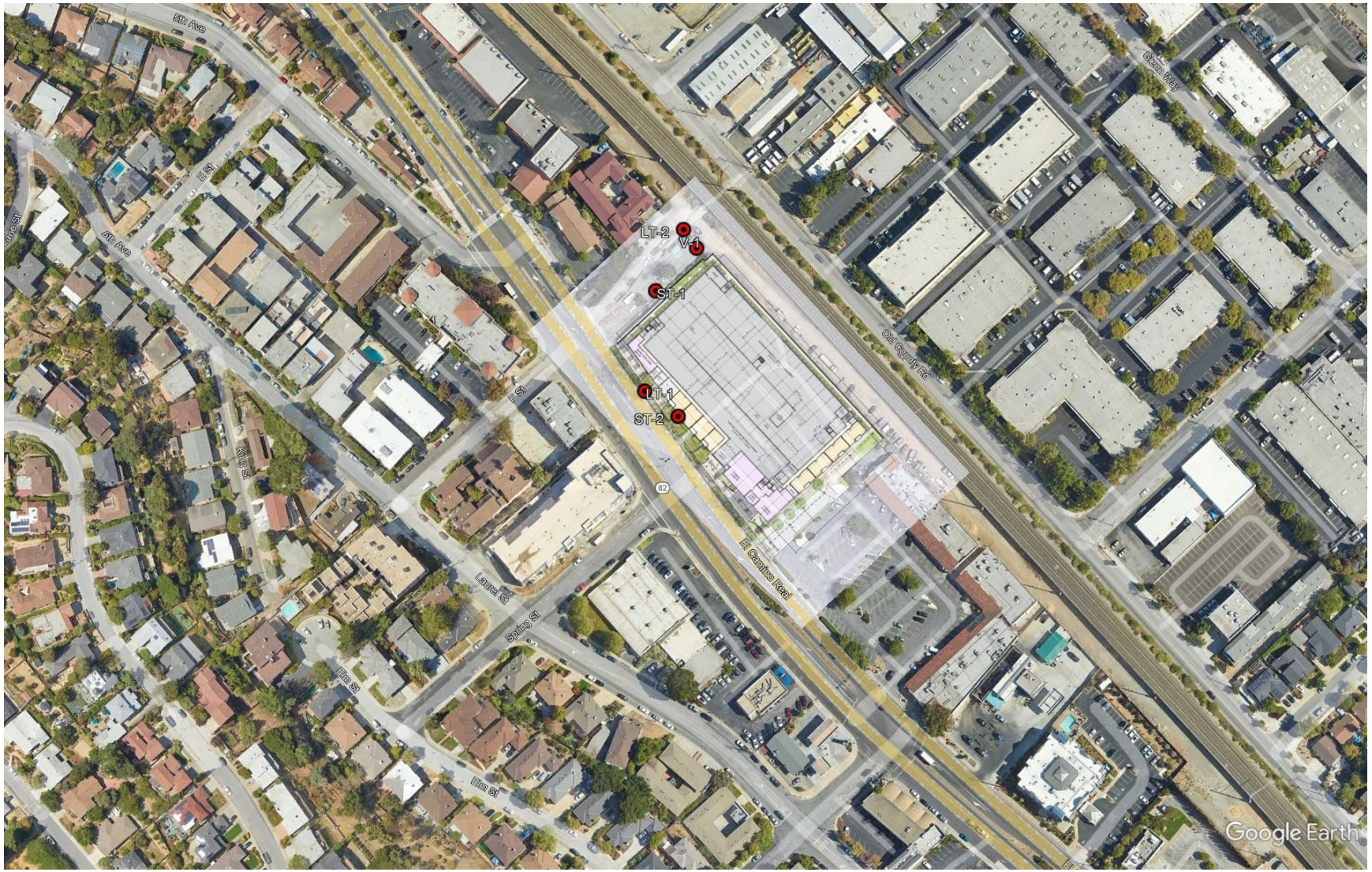
Existing Vibration Environment

Vibration measurements were made near the northwestern corner of the project site. As shown in Figure 1, V-1 was made approximately 60 feet from the edge of the nearest set of UPRR (Caltrain) tracks. At this location, the vibration sensor was approximately 15 feet below the grade of the elevated tracks.

Twelve observed and recorded vibration measurements of individual train activity were conducted on Tuesday, April 18, 2023, between 7:50 a.m. and 9:20 a.m. The instrumentation used to conduct the measurements included a Roland model R-05 solid state recorder and seismic grade, low noise accelerometers firmly fixed to the ground. This system was capable of accurately measuring very low vibration levels. Vibration levels were measured at ground level at a setback distance of approximately 60 feet from the edge of the nearest UPRR (Caltrain) tracks.

AT V-1, vibration levels ranged from 60 to 70 VdB, and the average was 67 VdB. Table 7 summarizes each of the twelve measurements made at V-1. Vibration levels were measured in the vertical axis because ground vibration is typically the most dominant on this axis. Vibration levels measured at V-1 during each of the train pass-by events can be seen in Figure A7 of Appendix A.

FIGURE 1 Aerial Image of the Project Site and Surrounding Area with Long- and Short-Term Measurement Locations Identified



Source: Google Earth, 2023.

TABLE 7 Summary of Train Pass-by Vibration Measurements Made at V-1

Date, Time	Train Information						Distance from V-1	Vibration Level at V-1
	Type of Train	No. of Engines	No. of Cars	Track	Direction of Travel	Speed		
4/18/2023, 7:57 a.m.	Caltrain	1	4	Near	SB	40 mph	60	69 VdB
4/18/2023, 8:05 a.m.	Caltrain	1	4	Far	NB	50 mph	80	63 VdB
4/18/2023, 8:05 a.m.	Caltrain	1	4	Near	SB	50 mph	60	70 VdB
4/18/2023, 8:10 a.m.	Caltrain	1	4	Far	NB	50 mph	80	64 VdB
4/18/2023, 8:10 a.m.	Caltrain	1	4	Near	SB	40 mph	60	69 VdB
4/18/2023, 8:18 a.m.	Caltrain	1	4	Far	NB	40 mph	80	60 VdB
4/18/2023, 8:56 a.m.	Caltrain	1	4	Near	SB	30 mph	60	63 VdB
4/18/2023, 9:03 a.m.	Caltrain	1	4	Far	NB	50 mph	80	64 VdB
4/18/2023, 9:05 a.m.	Caltrain	1	4	Near	SB	50 mph	60	70 VdB
4/18/2023, 9:09 a.m.	Caltrain	1	4	Near	SB	40 mph	60	68 VdB
4/18/2023, 9:10 a.m.	Caltrain	1	4	Far	NB	55 mph	80	66 VdB
4/18/2023, 9:18 a.m.	Caltrain	1	4	Far	NB	40 mph	80	62 VdB

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The City of San Carlos's General Plan sets forth policies with the goal of minimizing the impact of noise on people through noise reduction and suppression techniques and through appropriate land use policies in the City of San Carlos. Noise level thresholds established in Figure 9-1 of the City's General Plan that apply to this project include the following:

- The City's acceptable exterior noise level standard is 65 dBA L_{dn} or less for proposed multi-family residential uses. This standard applies to community outdoor recreation areas and not to private decks and balconies.

- The City's conditionally acceptable exterior noise level standard is 65 to 75 dBA L_{dn} for proposed multi-family residential uses.

- The City specifies interior noise levels shall not exceed 45 dBA L_{dn} in all new residential units. Development sites exposed to noise levels exceeding 60 dBA L_{dn} shall be analyzed.

The future noise environment at the project site would continue to be dominated by trains traveling along the UPRR (Caltrain) tracks and local traffic along El Camino Real. A traffic study completed for the proposed project included peak hour turn movements for several segments in the project vicinity. Under the Future with project scenario (Year 2030), traffic volumes along El Camino Real would increase above existing ambient conditions by up to 1 dBA L_{dn}.

Future Exterior Noise Environment

The project's site plan shows two interior courtyards in the center of the proposed building. In addition, there is a fenced dog park in the southeast corner of the project site, adjacent to the UPRR (Caltrain). There will also be two rooftop decks on the fifth and sixth floors. Roof Deck 1 is located at the southwestern corner of the project building adjacent to El Camino Real. Roof Deck 2 is located at the northeastern corner of the project building adjacent to the UPRR (Caltrain). Most residential units will have a private deck. Note, the exterior thresholds established by the City are applied to outdoor common use areas only and not private decks/balconies, such as those for each residential unit.

The North Courtyard on level 2 will be completely surrounded by the proposed building and would be shielded from El Camino Real and the UPRR (Caltrain) tracks. The center of the courtyard would be approximately 165 feet from the centerline of El Camino Real and 155 feet from the nearest UPRR (Caltrain) tracks. Future exterior noise levels at the center of the North Courtyard would be below 60 dBA L_{dn}.

The South Courtyard on level 2 will be surrounded by the proposed building to the northeast, north, south and mostly shielded by the project building to the southwest. Therefore, this outdoor use area would be mostly shielded from El Camino Real and completely shielded from the UPRR

(Caltrain) tracks. The center of the courtyard would be approximately 160 feet from the centerline of El Camino Real and 180 feet from the nearest UPRR(Caltrain) tracks. Future exterior noise levels at the center of the South Courtyard would be below 60 dBA L_{dn}.

The level 5 Roof Deck 1 would have direct line-of-sight to El Camino Real (setback of approximately 80 feet from the centerline). Due to the elevation of this deck being 85 feet above the ground, the elevation would provide partial shielding at the center of the deck. Future exterior noise levels at the center of the level 5 Roof Deck 1 would be 65 dBA L_{dn}.

The level 6 Roof Deck 2 would have direct line-of-sight to the train tracks (setback of approximately 60 feet from the edge of the nearest track). Due to the elevation of this deck being 92 feet above the ground, the elevation would provide partial shielding at the center of the deck. Future exterior noise levels at the center of the level 6 Roof Deck 2 would be below 60 dBA L_{dn}.

The ground floor Dog Park would have direct line-of-sight to the train tracks (setback of approximately 50 feet from the edge of the nearest track) and El Camino Real (setback of approximately 260 feet from the centerline). Future exterior noise levels at the center of the Dog Park would be 66 dBA L_{dn}.

The future exterior noise levels at the centers of the North and South Courtyards as well as the Level 5 and Level 6 Roof Top Decks would be 65 dBA L_{dn} or less and would be considered normally acceptable. The future exterior noise level at the center of the Dog Park would be between 65 and 75 dBA L_{dn}, and would be conditionally acceptable.

Future Interior Noise Environment

The northeast building façade faces the UPRR (Caltrain) tracks, would be set back approximately 60 feet from the edge of the nearest track. At this distance, day-night average noise levels would be 65 dBA L_{dn} at the building façade.

The southwest building façade faces El Camino Real, would be set back approximately 65 feet from the centerline of the roadway. At this distance, day-night average noise levels would be 75 dBA L_{dn} at the building facade.

The day-night average noise levels would range from 65 to 75 dBA L_{dn} at the building façades.

Standard residential construction provides approximately 15 dBA of exterior-to-interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA L_{dn}, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA L_{dn}, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated

exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.
The following noise insulation features shall be incorporated into the proposed project to reduce interior noise levels to 45 dBA L_{dn} or less at residential interiors:

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards.

- Preliminary calculations indicate that residential units located along the building façades would require windows and doors with a minimum rating of 34 to 36 STC with adequate forced-air mechanical ventilation to meet the interior noise threshold of 45 dBA L_{dn}. Higher sound rated windows and doors could be required to meet interior noise level goals as identified by the applicant.

The City of San Carlos General Plan also states that new residential units affected by noise from railroad operations shall be designed to limit typical maximum instantaneous noise levels to 50 dBA in bedrooms and 55 dBA in other rooms. Noise measurements along the rail line (LT-2) indicate that the maximum exterior noise levels would be expected to range from 85 to 91 dBA at the closest building facades. This means that approximately 35 to 41 dBA of outdoor-to-indoor noise reduction would be required at bedrooms and 30 to 36 dBA of outdoor-to indoor-reduction for other rooms. There are no at grade rail crossings in the vicinity of the site, so this analysis assumes that train horns are not the primary noise source. The noise of the train engine and cars is at a lower amplitude and lower in frequency. Normally, to achieve 35 to 41 dBA of noise reduction from railroad train noise, exterior walls must incorporate special noise control treatments such as staggered studs or resilient channels, stucco or an alternative heavy cement board siding, and high-performance-sound rated windows and doors. The facades of the buildings further from and facing away from the railroad tracks would require standard or slightly better than standard building elements. Detailed architectural plans were not available at the time of this analysis. For typical California construction, we expect the exterior wall to be an internally insulated single wood stud assembly with one layer of gypsum board at the interior face and stucco on the exterior.

The following noise insulation features could be incorporated into the proposed project to reduce the maximum railroad interior noise levels to 50 dBA in bedrooms or 55 dBA in other occupied spaces.

- Exterior walls facing the rail tracks should implement staggered-stud construction methods or resilient channel systems to improve the transmission loss of the partition.

- Preliminary calculations indicate that residential units located along the building façades would require windows and doors with a minimum rating of 28 to 44 STC with adequate forced-air mechanical ventilation to meet the maximum railroad interior noise levels of 50 dBA in bedrooms and 55 dBA in other occupied spaces.

Salter conducted an Environmental Noise Study[6] which details the required window and door STC values along each façade on each floor. In their analysis, the assumption was made that the Applicant will be invoking the density bonus and will design the project to meet a maximum railroad interior noise level of 55 dBA in bedrooms.

Conditions of Approval

Interior Noise Standard for Residential Development. The project applicant shall prepare final design plans that incorporate building design and acoustical treatments to ensure compliance with State Building Codes and City noise standards. A project-specific acoustical analysis shall be prepared to ensure that the design incorporates controls to reduce interior noise levels to 45 dBA L_{dn} or lower within the residential units. The project applicant shall conform with any special building construction techniques requested by the City's Building Department, which may include sound-rated windows and doors, sound-rated wall constructions, and acoustical caulking.

Train Vibration and Land Use Compatibility

The FTA vibration impact assessment criteria (summarized in Table 5) were used to evaluate vibration levels produced by trains passing the project area under future conditions. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria in Table 5 provide thresholds based on the number of train pass-bys in a given day: frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

Future Vibration Environment

As shown in Table 7, twelve trains were measured in 1.5 hours. According to the existing Caltrain schedule,[7] about 61 trains currently pass through San Carlos in a 24-hour period, which would fall within the occasional events FTA vibration impact category. Assuming more than 70 pass-by events under future conditions, which would represent worst-case conditions, maximum vibration levels of 72 VdB under frequent events for residences would be the threshold for the proposed project.

Train pass-bys along the near and far tracks resulted in measured vibration levels of 60 to 70 VdB at 60 to 80 feet. Therefore, the proposed building would be compatible with the future worst-case vibration environment at the project site.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise and vibration resulting from the project:

[6] Salter, "11 El Camino Real Environmental Noise Study Salter Project 21-0184," May 25, 2023.
[7] https://www.caltrain.com/station/sancarlos?active_tab=route_explorer_tab&origin=7013

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels;

(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, if the project would expose people residing or working in the project area to excessive noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

The construction schedule assumed that the earliest possible start date would be early May 2024, and the development would be built over a period of about two years and 4 months, with construction expected to conclude by mid-September 2026. Construction phases would include demolition, site preparation, grading/excavation, trenching/foundation, building construction, architectural coating, and paving. During each phase of construction, there would be a different mix of equipment operating, and noise levels would vary by phase and vary within phases, based on the amount of equipment in operation and the location at which the equipment is operating.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Chapter 9.30.070 of the City's Municipal Code limits construction activities to between 8:00 a.m. and 6:00 p.m. on weekdays and to between 9:00 a.m. and 5:00 p.m. on weekends. Construction activities are prohibited on the following holidays: New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, 4th of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day. Additionally, the Municipal Code requires all gasoline-powered construction equipment to be equipped with an operating muffler or baffling system as originally provided by the manufacturer, and no modification to these systems is permitted.

As part of the Applicant's Density Bonus Law incentive request[8], the project would be exempt from the City's Municipal code construction hour limits. Construction activities would be between 7:00 a.m. and 6:00 p.m. on weekdays and between 9:00 a.m. and 5:00 p.m. on weekends, with no

[8] Blackwell, David H. Allen Matkins Leck Gamble Mallory & Natsis LLP Attorneys at Law. PLN2023-0004: 11 El Camino Real-Development Application. May 26, 2023.

construction on the following holidays: New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, 4th of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

While the City of San Carlos does not establish noise level thresholds for construction activities, this analysis uses the noise limits established by the Federal Transit Administration (FTA) to identify the potential for impacts due to substantial temporary construction noise. The FTA identifies construction noise limits in the *Transit Noise and Vibration Impact Assessment Manual*. During daytime hours, an exterior threshold of 80 dBA L_{eq} shall be enforced at residential land uses and 85 dBA L_{eq} shall be enforced at commercial land uses.

Construction activities for individual projects are typically carried out in phases. During each phase of construction, there would be a different mix of equipment operating, and noise levels would vary by phase and vary within phases, based on the amount of equipment in operation and the location at which the equipment is operating. The typical range of maximum instantaneous noise levels for the proposed project would be 70 to 90 dBA L_{max} at a distance of 50 feet (see Table 8) from the equipment. Table 9 shows the hourly average noise level ranges, by construction phase, typical for various types of projects. Hourly average noise levels generated by construction are about 72 to 88 dBA L_{eq} for residential buildings, measured at a distance of 50 feet from the center of a busy construction site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

Equipment expected to be used in each construction phase are summarized in Table 10, along with the quantity of each type of equipment and the reference noise level at 50 feet, assuming the operation of the two loudest pieces of construction equipment for each construction phase.

Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels for each phase of construction, assuming the two loudest pieces of equipment would operate simultaneously, as recommended by the FTA for construction noise evaluations. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). The usage factors represent the percentage of time that the equipment would be operating at full power. Table 10 also summarizes the construction noise levels for the two loudest pieces of equipment propagated to the surrounding receiving land uses.

To assess construction noise impacts at the receiving property lines of existing noise-sensitive receptors, the worst-case hourly average noise level, which are calculated from combining all equipment per phase, was propagated from the geometrical center of the project site to the property lines of the receptors. These noise level estimates are shown in Table 11. Noise levels in Table 11 do not assume reductions due to intervening buildings or existing barriers.

TABLE 8 Construction Equipment, 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes: [1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3]Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 9 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I – All pertinent equipment present at site.
II – Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 10 Estimated Construction Noise Levels for the Proposed Project at a Distance of 50 feet

Phase of Construction	Construction Equipment (Quantity)	Estimated Construction Noise Level at 50 feet, dBA L_{eq}
Demolition	Concrete/Industrial Saw (1)[a] Excavator (2) Tractor/Loader/Backhoe (1)[a] Water Truck (1)	85
Site Preparation	Grader (1)[a] Driller Displacement Column Rig (1) Tractor/Loader/Backhoe (2)[a] Water Truck (1)	84
Grading/Excavation	Excavator (1) Grader (1)[a] Tractor/Loader/Backhoe (1)[a] Water Truck (1)	84
Trenching/Foundation	Tractor/Loader/Backhoe (1)[a] Excavator (2) [a] Water Truck (1)	82
Building – Exterior	Crane (1)[a] Forklift (1) Generator Set (2)[a]	79
Building – Interior/ Architectural Coating	Aerial Lift (1)[a] Compressor (2)[a]	75
Paving	Paver (1)[a] Roller (2) Tractor/Loader/Backhoe (2)[a]	81

[a] Denotes two loudest pieces of construction equipment per phase.

TABLE 11 Estimated Construction Noise Levels at Nearby Land Uses

Phase of Construction	Calculated Hourly Average Noise Levels, dBA L_{eq}			
	SE Commercial (180ft[a])	SW Hotel/Medical Office (230ft[a])	NW Residential/Office (230ft[a])	NE Commercial (265ft[a])
Demolition	75[b]	73[b]	72[b]	71[b]
Site Preparation	75[b]	73[b]	72[b]	71[b]
Grading/ Excavation	73[b]	71[b]	70[b]	70[b]
Trenching/Foundation	72[b]	70[b]	69[b]	68[b]
Building – Exterior	70[b]	68[b]	68[b]	67[b]
Building – Interior/ Architectural Coating	66[b]	64[b]	63[b]	63[b]
Paving	71[b]	69[b]	68[b]	68[b]

[a] The distances shown in the table were measured from the center of the project site to the receiving property lines.
[b] These noise levels represent all equipment per phase operating simultaneously and propagated to the surrounding property lines.

As shown in Table 11, construction noise levels would intermittently range from 63 to 72 dBA L_{eq} at existing residential uses and from 63 to 75 dBA L_{eq} at existing hotel and commercial uses when activities are focused near the center of the project site. These construction noise levels would not exceed the exterior threshold of 80 dBA L_{eq} at the nearest existing residential land uses in the project site vicinity or the 85 dBA L_{eq} threshold at the hotel and commercial land uses surrounding the project site when activities occur near the center of the project site. When occurring 50 feet from the adjoining property lines, construction noise levels would range from 75 to 85 dBA L_{eq}.

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life.

Policy NOI-1.8 requires all phases of construction activity to utilize reasonable noise reduction measures to minimize the exposure of neighboring properties to excessive noise levels and comply with the City's noise ordinance. The project is exempt from the City's Municipal code construction hour limits, but all gasoline-powered construction equipment shall be equipped with an operating muffler or baffling system as originally provided by the manufacturer, and no modification to these systems is permitted. In accordance with Policy NOI-1.8, reasonable noise reduction measures shall be incorporated into all projects within the Plan Area. Such measures shall include, but not be limited to, the following to reduce construction noise levels as low as practical:

- Limit construction activity to between 7:00 a.m. and 6:00 p.m. on weekdays and between 9:00 a.m. and 5:00 p.m. on weekends, with no construction on the following holidays: New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, 4th of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

- Utilize "quiet" models of air compressors and other stationary noise sources where such technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;

- Locate staging areas and construction material areas as far away as possible from adjacent land uses;
- Prohibit all unnecessary idling of internal combustion engines;

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem are implemented.

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction.

With the implementation of these measures to control noise during construction activities, in accordance with Policy NOI-1.8 of the General Plan, the temporary construction noise impact would be reduced to a less-than-significant level.

Mitigation Measure 1a: No further mitigation required.

Impact 1b: Permanent Noise Level Increase/Exceed Applicable Standards. The proposed project would not result in a substantial permanent noise level increase. Further, the proposed project would not generate noise levels exceeding the City's established thresholds at noise-sensitive receptors in the project vicinity. **This is a less-than-significant impact.**

According to Action NOI-1.4 of the City's General Plan, a significant impact would occur if the proposed project caused the L_{dn} at noise-sensitive uses to increase by 3 dBA or more and exceed the "normally acceptable" level; caused the L_{dn} at noise-sensitive uses to increase by 5 dBA or more and remain "normally acceptable;" or caused noise levels to exceed the limits in Table 9-1 of the General Plan. According to Figure 9-1 of the City's General Plan, the "normally acceptable" threshold for single-family receptors is 60 dBA L_{dn} and for multi-family receptors is 65 dBA L_{dn}.

Table 9-1 of General Plan and the Municipal Code provides exterior and interior daytime and nighttime L_{eq}/L_{50} and L_{max} thresholds for non-transportation sources. Table 9-1 and the Municipal Code include thresholds for the following type of receptors: residential, medical, convalescent, theater, auditorium, church, meeting hall, school, library, and museum uses only. The site is surrounded by existing commercial, hotels, and residential uses. The threshold for residential land use is for daytime is 55 dBA L_{eq}/L_{50} with a L_{max} of 70 dBA and for nighttime is 45 dBA L_{eq}/L_{50} with a L_{max} of 60 dBA

TABLE 12 Summary of Ambient Noise Levels for Existing Receptors Surrounding the Project Site

Receptor	Range of Daytime Noise Levels (Average), dBA L_{eq}	Range of Nighttime Noise Levels (Average), dBA L_{eq}	L_{dn}, dBA
NW Residential / Office	59 to 67 (62)	46 to 62 (53)	64
SE Commercial	70 to 76 (74)	58 to 70 (64)	75
SW Hotel / Commercial / Medical Office	70 to 76 (74)	58 to 70 (64)	75
NE Commercial	59 to 67 (62)	46 to 62 (53)	64

Project Traffic Increase

The traffic study included peak hour am and pm traffic along several roadway segments in the project vicinity for existing and existing plus project traffic conditions. The existing plus project traffic conditions represent the near-term traffic conditions by adding project trips to existing

traffic volumes. By comparing the existing plus project volumes to the existing volumes, the project's contribution to the overall noise increase was calculated. Table 13 summarizes the estimated noise level increase attributed to the proposed project. As shown in Table 13, the project's traffic would not measurably increase traffic noise levels along any roadway segments in the project vicinity. This would be a less-than-significant impact.

TABLE 13 Estimated Noise Level Increases of Existing Plus Project Traffic Volumes Compared to Existing Volumes at Receptors in the Project Vicinity

Roadway	Segment	Estimated Noise Level Increase, dBA L_{dn}
El Camino Real (SR 82)	Ralston Avenue to Harbor Boulevard (N)	0
	Harbor Boulevard (N) to Harbor Boulevard (S)	0
	Harbor Boulevard (S) to 5th Avenue	0
	5th Avenue to Spring Street	0
	Spring Street to Hull Drive	0
	Hull Drive to Holly Street	0
Ralston Avenue	East of El Camino Real (SR 82)	0
	West of El Camino Real (SR 82)	0
Harbor Boulevard (N)	East of El Camino Real (SR 82)	0
Harbor Boulevard (S)	West of El Camino Real (SR 82)	0
5th Avenue	East of El Camino Real (SR 82)	0
	West of El Camino Real (SR 82)	0
Spring Street	East of El Camino Real (SR 82)	0
	West of El Camino Real (SR 82)	0
Hull Drive	East of El Camino Real (SR 82)	0
	West of El Camino Real (SR 82)	0
Holly Street	East of El Camino Real (SR 82)	0
	West of El Camino Real (SR 82)	0

Mechanical Equipment

The project would include mechanical equipment for building heating, cooling, and ventilation (HVAC) as well as a diesel-powered fire pump and trash compactors. The project plans show garage exhaust fans and water heaters located in the lower-level garage, a 1st floor garage exhaust fan mechanical room and fire pump, with HVAC systems and exhaust fans on the roof. The trash compactors would be located within trash rooms in both the lower-level and 1st floor garage. Information regarding the type and size of the exhaust fans, water heater, fire pump and HVAC equipment units were provided by the applicant. The garage exhaust fan room, mechanical room, and trash compactors would be well insulated by the building and would not generate noise levels audible or measurable at the property lines.

The fire pump would be located within a mechanical room along the western building façade adjacent to El Camino Real. The fire pump has a 64 kW Tier 4 John Deere 4045 Series Power Tech M engine. The manufacturer specifications provided by the applicant do not specify noise levels. Based on our experience, similar fire pumps produce a maximum average noise level of 73 dBA at 7 meters (23 feet). While fire pumps operating under emergency conditions would be exempt from City noise limits, monthly testing of emergency fire pumps, which typically occur for a period of one hour between 7:00 a.m. and 10:00 p.m., would be required to fall within the existing ambient conditions. Additionally, the building façade would provide a minimum attenuation of 20 dBA at all surrounding receptors.

The garage exhaust fans would be located within mechanical rooms in the interior of the building. Greenheck QEI-49 mixed flow belt drive has been selected for the proposed project. According to the manufacturer specifications provided by the applicant, the garage exhaust fan would produce a maximum average noise level of 71 dBA at 3 feet. The building façade would provide a minimum attenuation of 20 dBA at all surrounding receptors.

Table 14 summarizes the hourly average noise levels and the combined day-night average noise level for all noise-generating mechanical equipment located on the ground level of the proposed project site as propagated to the surrounding receptors.

Operational noise levels due to the fire pump and garage exhaust fans would not exceed the City's standards and daytime or nighttime average ambient noise levels at any of the surrounding receptors. For all existing receptors, the noise level increase due to fire pump and garage exhaust fans noise would not be measurable or detectable (0 dBA L_{dn} increase).

TABLE 14 Estimated Operational Noise Levels for Ground-Level Mechanical Equipment Sources

Receptor	Distance from Center of Emergency Fire Pump Room, feet	L_{eq} from Emergency Fire Pump Noise, dBA	Distance from Center of the Garage Exhaust Fan Room, feet	L_{eq} from Garage Exhaust Fans, dBA	Combined L_{dn}, dBA	Noise Level Increase, dBA L_{dn}
SW Hotel/ Medical Office	118	39[a]	230	< 25[a]	26[a,b]	0
NW Residential/ Office	160	36[a]	400	< 25[a]	23[a,b]	0
SE Commercial	320	30[a]	80	< 25[a]	29[a,b]	0
SW Commercial	235	33[a]	190	< 25[a]	24[a,b]	0
NE Commercial	320	30[a]	270	< 25[a]	23[a,b]	0

[a] Conservative 20 dBA attenuation assumed for building façade.
[b] L_{dn} assumes the emergency fire pump operating for 1 hour between 7am-10pm.

The HVAC systems would be located on the roof. Information regarding the type and size of the HVAC equipment units was provided by the applicant. Carrier 25SCA5 Comfort Series Single-State Heath Pump with Puron Refrigeration have been selected for the proposed project. According to the manufacturer specifications provided by the applicant, the HVAC systems would produce a maximum average noise level of 68 dBA at 3 feet. The plans show HVAC systems in clusters of 12, 34, 42, and 56. Estimated noise levels at each receptor are calculated from the nearest mechanical equipment cluster, assuming a worst-case scenario where all units are running simultaneously during daytime hours and 25% of units running during the night.

The corridor and trash exhaust fans would be located on the roof. Greenheck universal single width fans (USF-16, USF-13) and Supply Air Fan (SAF-115-10), have been selected for the proposed project. According to the manufacturer specifications provided by the applicant, the corridor and trash exhaust fans would produce average noises levels between 50 to 56 dBA at 3 feet.

Table 15 summarizes the rooftop mechanical equipment noise levels propagated to the property lines of the surrounding land uses. Note, an additional attenuation of 10 dBA is assumed for all rooftop sources due to the elevation of the equipment above the ground. This is applied to the values in Table 15 for all ground-level receptors.

Operational noise levels due to rooftop equipment would not exceed the City's standards and daytime or nighttime average ambient noise levels at any of the surrounding receptors. For all existing receptors, the noise level increase due to HVAC and corridor and trash exhaust fan noise would not be measurable or detectable (0 dBA L_{dn} increase).

TABLE 15 Estimated Operational Noise Levels for Rooftop Mechanical Equipment Sources

Receptor	Distance from Center of the nearest HVAC system cluster, feet	L_{eq} from HVAC systems, dBA	Distance from nearest Corridor & Trash Exhaust Fan, feet	L_{eq} from Corridor & Trash Exhaust Fan, dBA	Combined L_{eq}, dBA	Combined L_{dn}, dBA	Noise Level Increase, dBA L_{dn}
SW Hotel/ Medical Office	75	50[ab] (daytime) 41[ab] (nighttime)	150	<35[a]	50[ab] (daytime) 42[ab] (nighttime)	52[ab]	0
NW Residential/ Office	90	46[ac] (daytime) 40[ac] (nighttime)	85	<35[a]	46[ac] (daytime) 40[ac] (nighttime)	49[ac]	0
SE Commercial	160	40[ad] (daytime) 34[ad] (nighttime)	65	<35[a]	40[ad] (daytime) 35[ad] (nighttime)	43[ad]	0
SW Commercial	190	40[ae] (daytime) 32[ae] (nighttime)	190	<35[a]	40[ae] (daytime) 33[ae] (nighttime)	42[ae]	0
NE Commercial	170	43[af] (daytime) 37[af] (nighttime)	185	<35[a]	43[af] (daytime) 38[af] (nighttime)	46[af]	0

[a] Conservative 10 dBA attenuation assumed for the elevation of the rooftop equipment.
[b] Assumes 98 units running during daytime hours and 25 units running during nighttime hours.
[c] Assumes 56 units running during daytime hours and 14 units running during nighttime hours.
[d] Assumes 46 units running during daytime hours and 12 units running during nighttime hours.
[e] Assumes 42 units running during daytime hours and 11 units running during nighttime hours.
[f] Assumes 112 units running during daytime hours and 28 units running during nighttime hours.

Total Combined Project-Generated Noise

Operational noise levels produced by the proposed project combined (i.e., traffic, mechanical equipment) would result in an increase of less than 3 dBA L_{dn} at all existing noise-sensitive receptors in the project vicinity. This would be a less-than-significant impact.

Mitigation Measure 1b: None required.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels resulting from activities at the project site would potentially exceed 0.3 in/sec PPV at the existing structures adjoining the project site. **This is a less than significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g., jackhammers, hoe rams) are used. Construction activities would include grading, foundation work, paving, and new building framing and finishing. According to the equipment list provided at the time of this study, impact or vibratory pile driving activities, which can cause excessive vibration, are not expected for the proposed project.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No known ancient buildings or buildings that are documented to be structurally weakened adjoin the project area. Therefore, conservatively, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 16 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet.

Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 16 also summarizes the distances to the 0.3 in/sec PPV threshold for all conventional buildings.

TABLE 16 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.3 in/sec PPV (feet)
Clam shovel drop		0.202	18
Hydromill (slurry wall)	in soil	0.008	1
	in rock	0.017	2
Vibratory Roller		0.210	19
Hoe Ram		0.089	9
Large bulldozer		0.089	9
Caisson drilling		0.089	9
Loaded trucks		0.076	8
Jackhammer		0.035	4
Small bulldozer		0.003	<1

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., February 2023.

Table 17 summarizes the vibration levels at each of the surrounding buildings in the project vicinity. Vibration levels are highest close to the source and then attenuate with increasing distance at the rate $\left({}^{D_{ref}}/_{D}\right)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet. While construction noise levels increase based on the cumulative equipment in use simultaneously, construction vibration levels would be dependent on the location of individual pieces of equipment. That is, equipment scattered throughout the site would not generate a collective vibration level, but a vibratory roller, for instance, operating near the project site boundary would generate the worst-case vibration levels for the receptor sharing that property line. Further, construction vibration impacts are assessed based on damage to buildings on receiving land uses, not receptors at the nearest property lines. Therefore, the distances used to propagate construction vibration levels (as shown in Table 17), which are different than the distances used to propagate construction noise levels (as shown in Table 11), were estimated under the assumption that each piece of equipment from Table 16 was operating along the nearest boundary of the busy construction site, which would represent the worst-case scenario.

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[9] The findings of this study have been applied to buildings affected by construction-generated vibrations.[10] As reported in USBM RI 8507[6] and reproduced by Dowding,[7] Figure 2 presents the damage probability, in terms of "threshold damage" (described above as cosmetic damage), "minor damage," and "major damage," at varying vibration levels. Threshold damage, or cosmetic damage, would entail hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage would include hairline cracking in masonry or the loosening of plaster, and major structural damage would include wide cracking or shifting of foundation or bearing walls.

[9] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.
[10] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

As shown in Figure 2, there would be no observations of “threshold damage,” “minor damage,” or “major damage” at buildings of normal conventional construction when vibration levels were 0.210 in/sec PPV or less.

Project-generated vibration levels are below the 0.3 in/sec PPV structural damage threshold, which implies that neither cosmetic, minor, or major damage would occur beyond 25 feet. At these locations and in other surrounding areas where vibration would not be expected to cause structural damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration. By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby residences, perceptible vibration can be kept to a minimum.

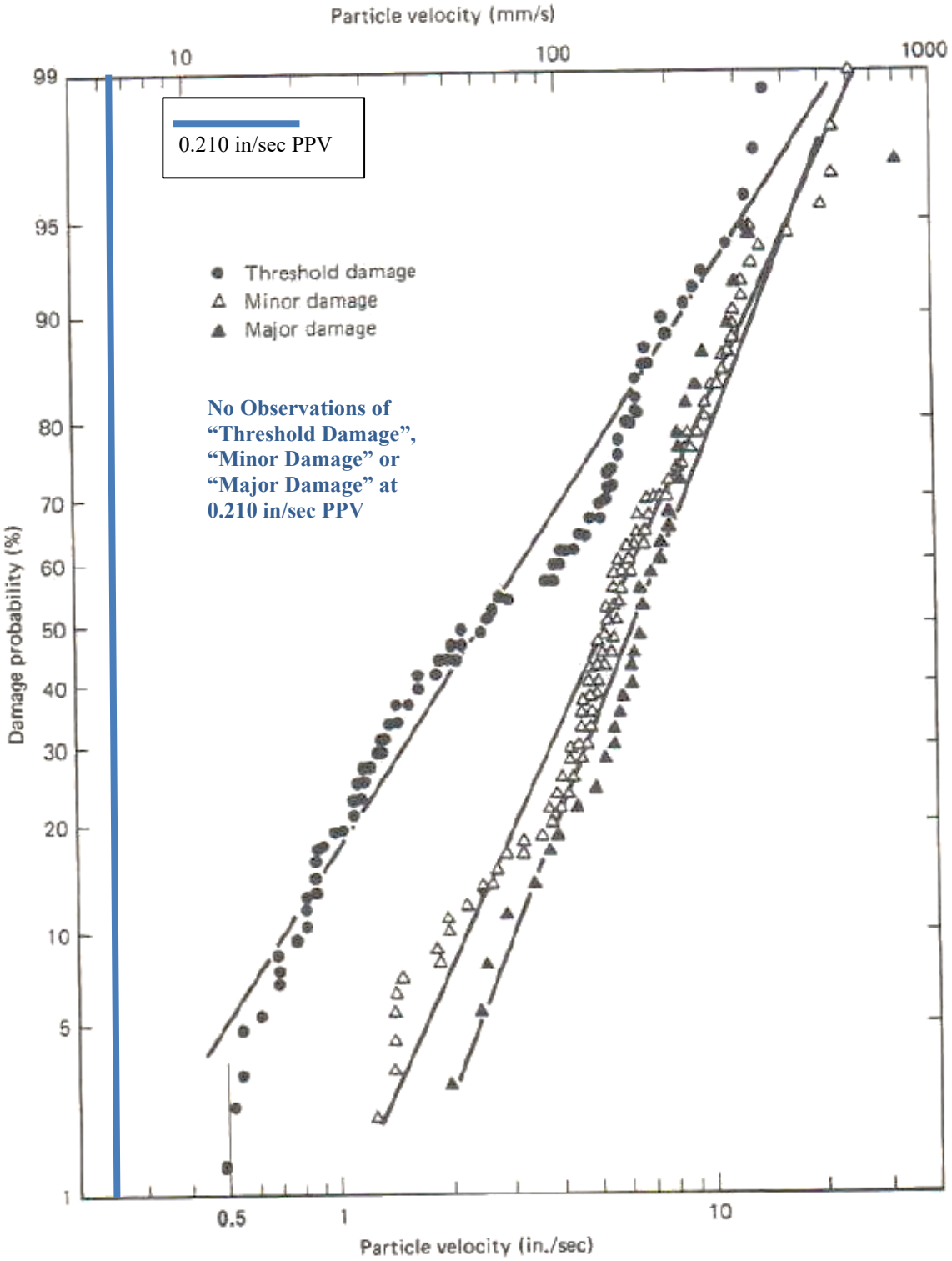
While construction activity may be perceptible, the proposed project is not expected to result in “architectural” damage to any surrounding structure. This is a less-than-significant impact.

TABLE 17 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Estimated Vibration Levels at Structures Surrounding the Project Site, in/sec PPV					
			SE Commercial (25 feet)	NW Residential (90 feet)	NW Office (100 feet)	SW Medical Office/Hotel (100 feet)	SW Commercial (150 feet)	NE Commercial (155 feet)
Clam shovel drop		0.202	0.202	0.049	0.044	0.044	0.028	0.027
Hydromill (slurry wall)	in soil	0.008	0.047	0.002	0.002	0.002	0.001	0.001
	in rock	0.017	0.100	0.004	0.004	0.004	0.002	0.002
Vibratory Roller		0.210	0.210	0.051	0.046	0.046	0.029	0.028
Hoe Ram		0.089	0.089	0.022	0.019	0.019	0.012	0.012
Large bulldozer		0.089	0.089	0.022	0.019	0.019	0.012	0.012
Caisson drilling		0.089	0.089	0.022	0.019	0.019	0.012	0.012
Loaded trucks		0.076	0.076	0.019	0.017	0.017	0.011	0.010
Jackhammer		0.035	0.035	0.009	0.008	0.008	0.00	0.005
Small bulldozer		0.003	0.003	0.001	0.001	0.001	0.0004	0.0004

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., May 2023.

FIGURE 2 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

Impact 3: **Excessive Aircraft Noise.** The project site is located about 9 miles from the San Francisco International Airport. Additionally, the project site lies outside the 60 dBA CNEL noise contour for the San Carlos Airport. The noise environment attributable to aircraft is considered normally acceptable. **This is a less-than-significant impact.**

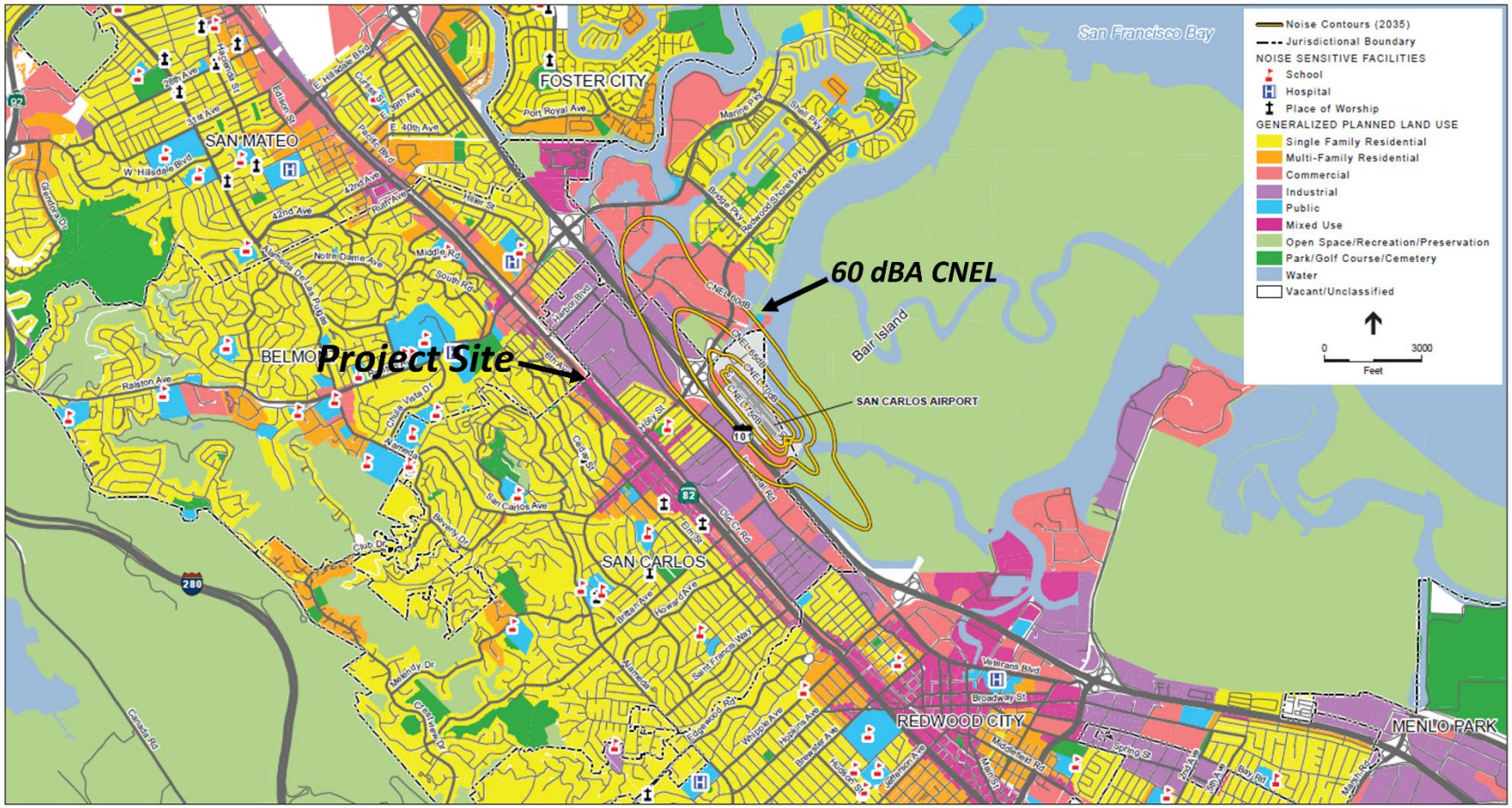
The San Francisco International Airport is a public-use airport located approximately 9 miles northwest of the project site. According to the *Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport*,[11] the project site lies well outside the 65 dBA CNEL/L_{dn} noise contour, and the required safe and compatible threshold for exterior noise levels would be at or below 65 dBA CNEL for aircrafts. As shown in Figure 3, the project site lies well outside the 60 dBA CNEL noise contour for the San Carlos Airport, which is less than a 1 mile east of the project site. Therefore, the proposed project would be compatible with the exterior noise standards for aircraft noise.

Assuming standard construction materials, future interior noise levels resulting from aircraft would be below 45 dBA CNEL. Therefore, future interior noise at the proposed building would be compatible with aircraft noise. This would be a less-than-significant impact.

Mitigation Measure 3: **None required.**

[11] Ricondo & Associates, Inc. with Jacobs Consultancy and Clarion Associates, *Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport*, November 2012.

FIGURE 3 **2035 Noise Contours for San Carlos Airport**



SOURCE: Belmont, 1982; San Mateo County, 1986; Foster City, 1993; Menlo Park, 1994; San Carlos, 2009; City of San Mateo, 2010; Redwood City, 2010; ESRI, 2014; ESA Airports, 2015

San Carlos Airport ALUCP . 130753

Exhibit 4-2

Future Conditions (2035) Aircraft Noise Contours

Cumulative Impacts

Cumulative noise impacts would include either cumulative traffic noise increases under future conditions or temporary construction noise from cumulative construction projects.

A significant cumulative traffic noise increase would occur if two criteria are met: 1) if the cumulative traffic noise level increase was 3 dBA L_{dn} or greater for future levels exceeding 60 dBA L_{dn} or was 5 dBA L_{dn} or greater for future levels at or below 60 dBA L_{dn}; and 2) if the project would make a "cumulatively considerable" contribution to the overall traffic noise increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA L_{dn} or more attributable solely to the proposed project.

The traffic study included peak hour turning movements cumulative (no project), cumulative plus project for each of the 7 intersections in the project site vicinity. These two traffic scenarios were compared to the existing traffic volumes to determine the noise level increase. There were no roadway segments with a 3 dBA L_{dn} or more increase. Therefore, the project would not result in a cumulatively considerable contribution to the overall noise increase. This would be a less-than-significant impact.

From the City of San Carlos website[12] as well as the City of Belmont's website,[13] the following planned or approved projects are located within 1,000 feet of the proposed project:

- **642 Quarry Road Life Science** – this project is located at 642 Quarry Road. This project site is approximately 860 feet north of the project site. This project involves construction of two six-story buildings for research and development lab and office use and an ten-story parking structure. This project is in the planning review phase. This project would not share receptors with direct line-of-sight to both construction sites. This would result in a less-than-significant cumulative construction impact.

No other projects are located within 1,000 feet of the proposed project site. Therefore, potential cumulative construction impacts would be less-than-significant.

[12] https://mydashgis.com/SanCarlosProjects/map
[13] https://www.belmont.gov/departments/community-development/maps

APPENDIX A

FIGURE A1 Daily Trend in Noise Levels at LT-1, Tuesday April 18, 2023

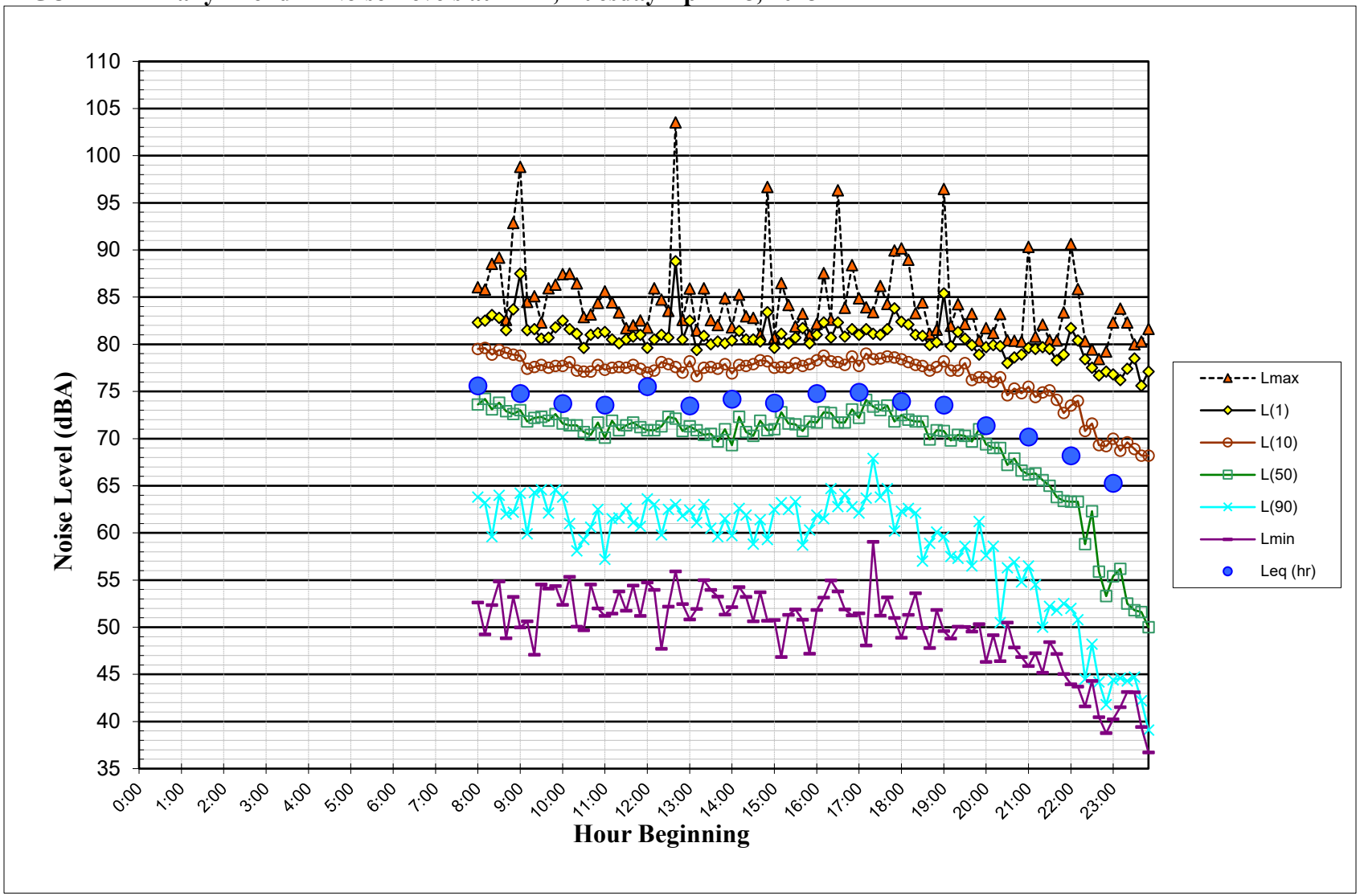


FIGURE A2 Daily Trend in Noise Levels at LT-1, Wednesday, April 19, 2023

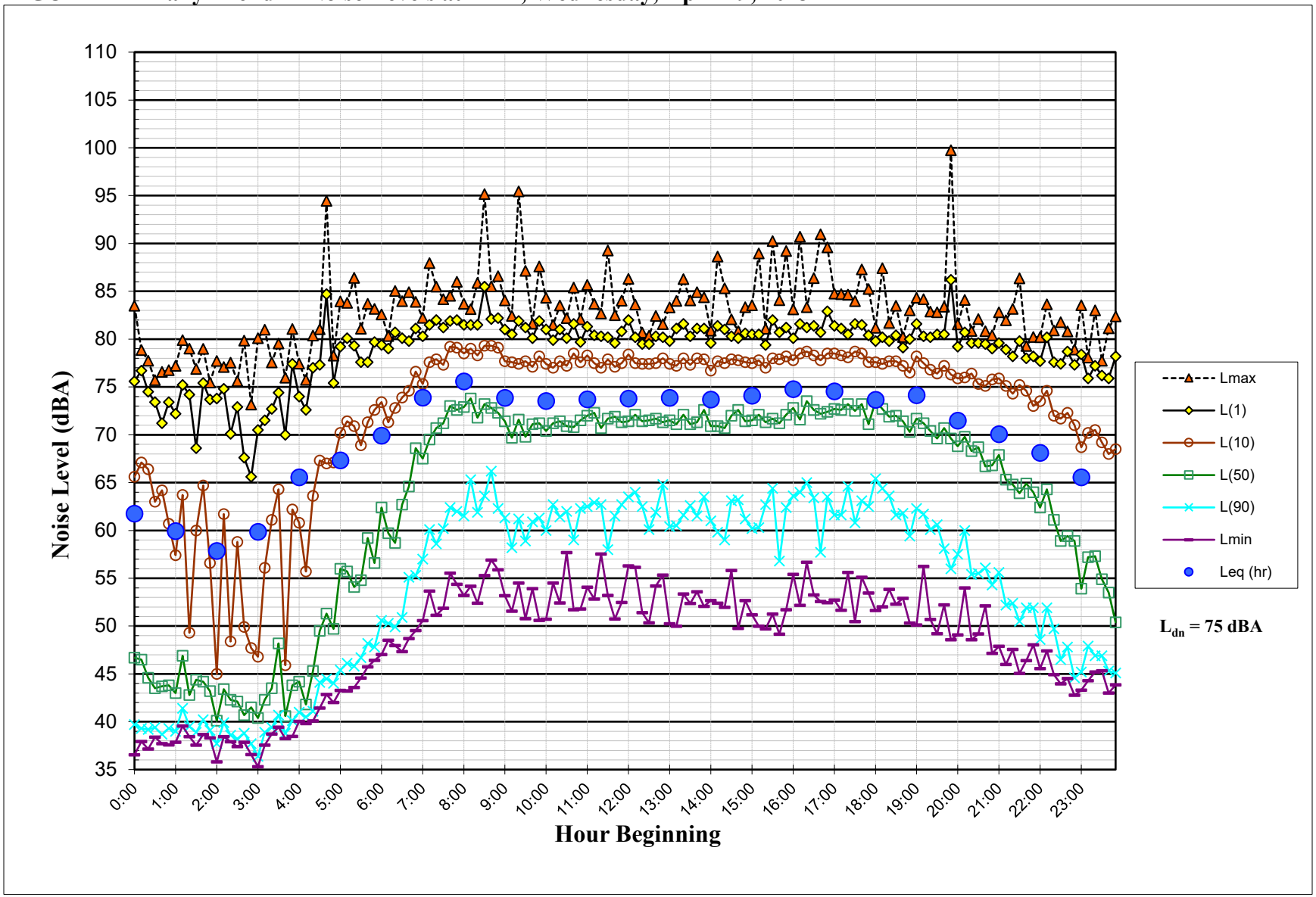


FIGURE A3 Daily Trend in Noise Levels at LT-1, Thursday, April 20, 2023

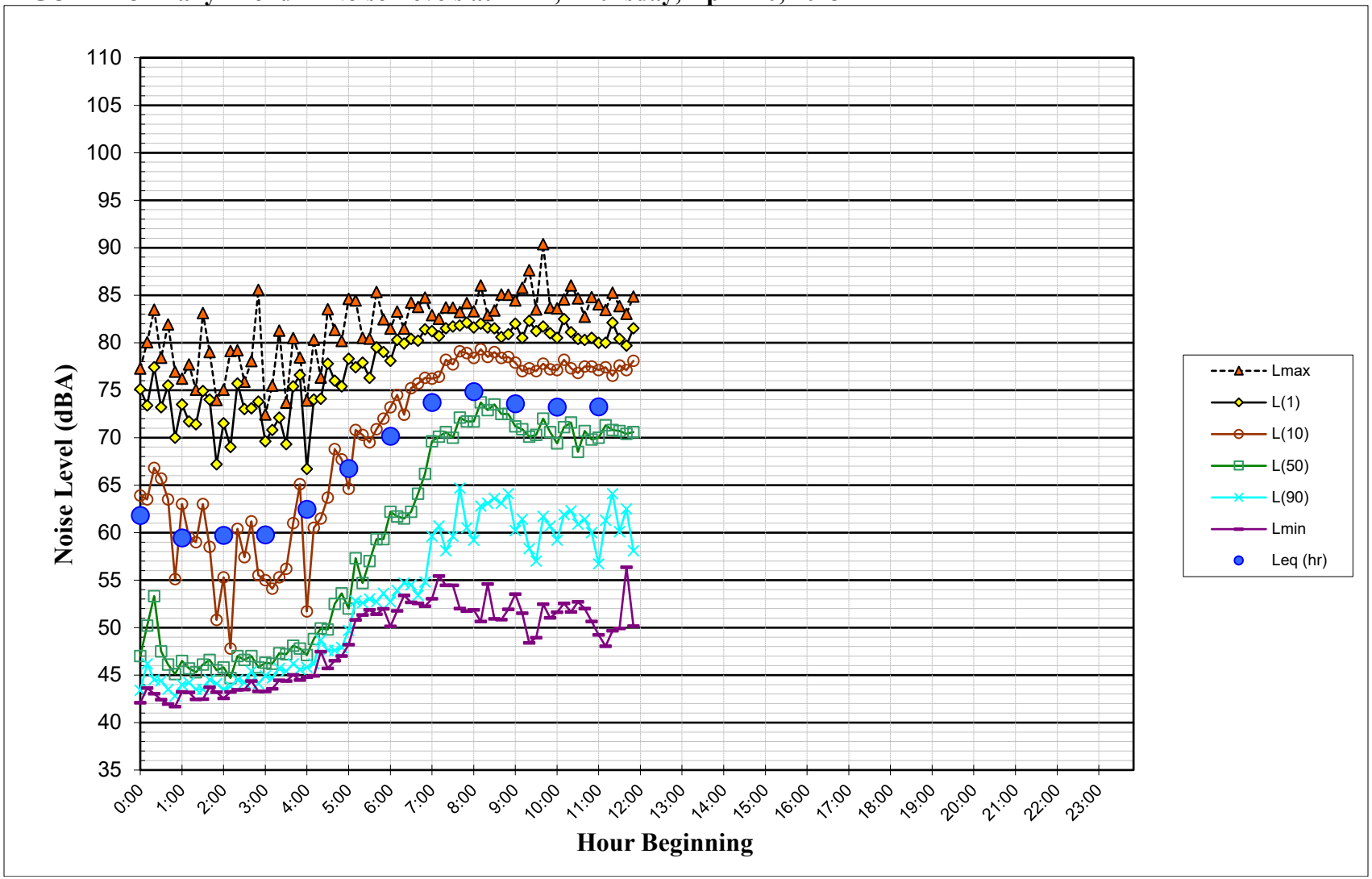


FIGURE A4 Daily Trend in Noise Levels at LT-2, Tuesday, April 18, 2023

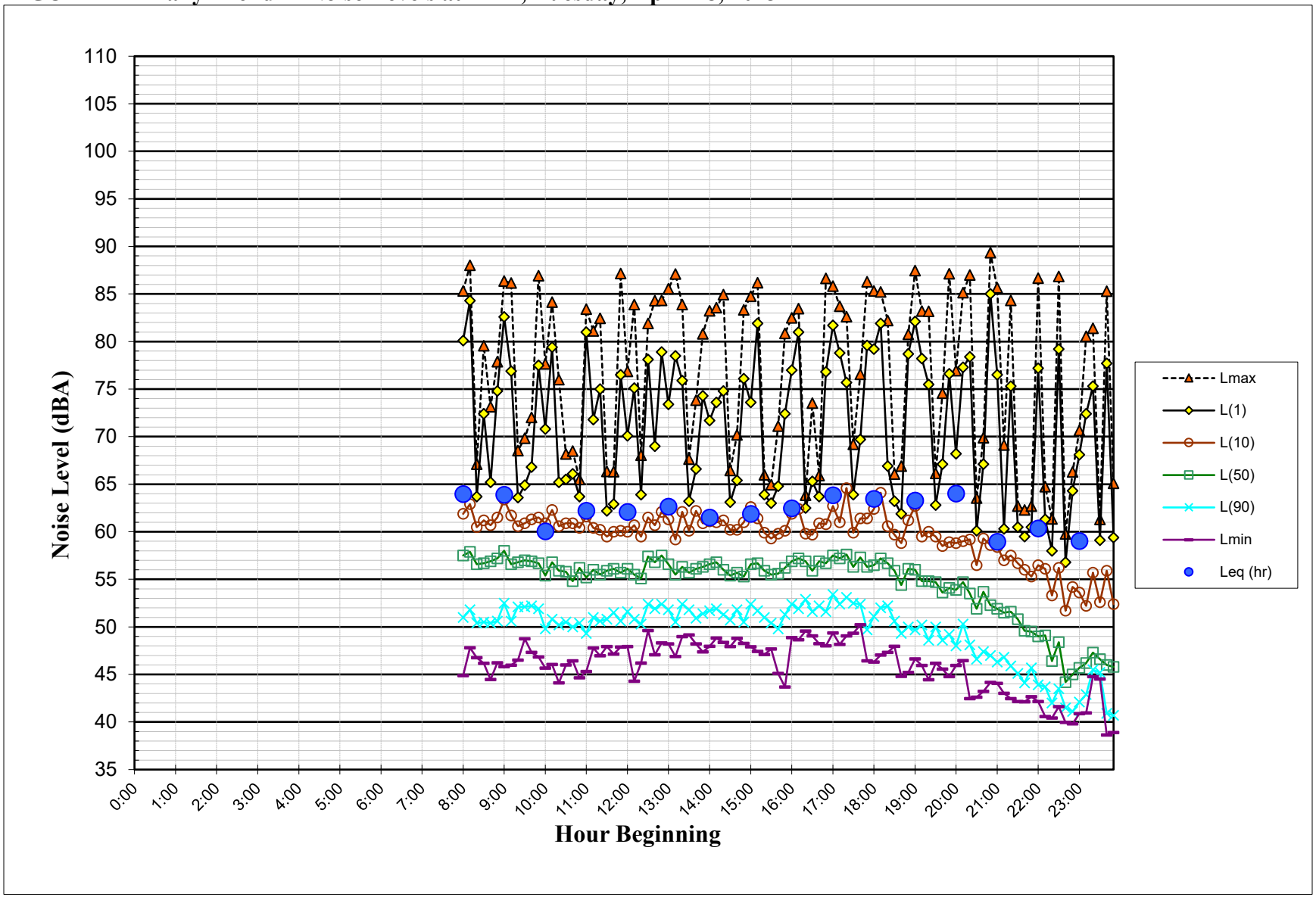


FIGURE A5 Daily Trend in Noise Levels at LT-2, Wednesday, April 19, 2023

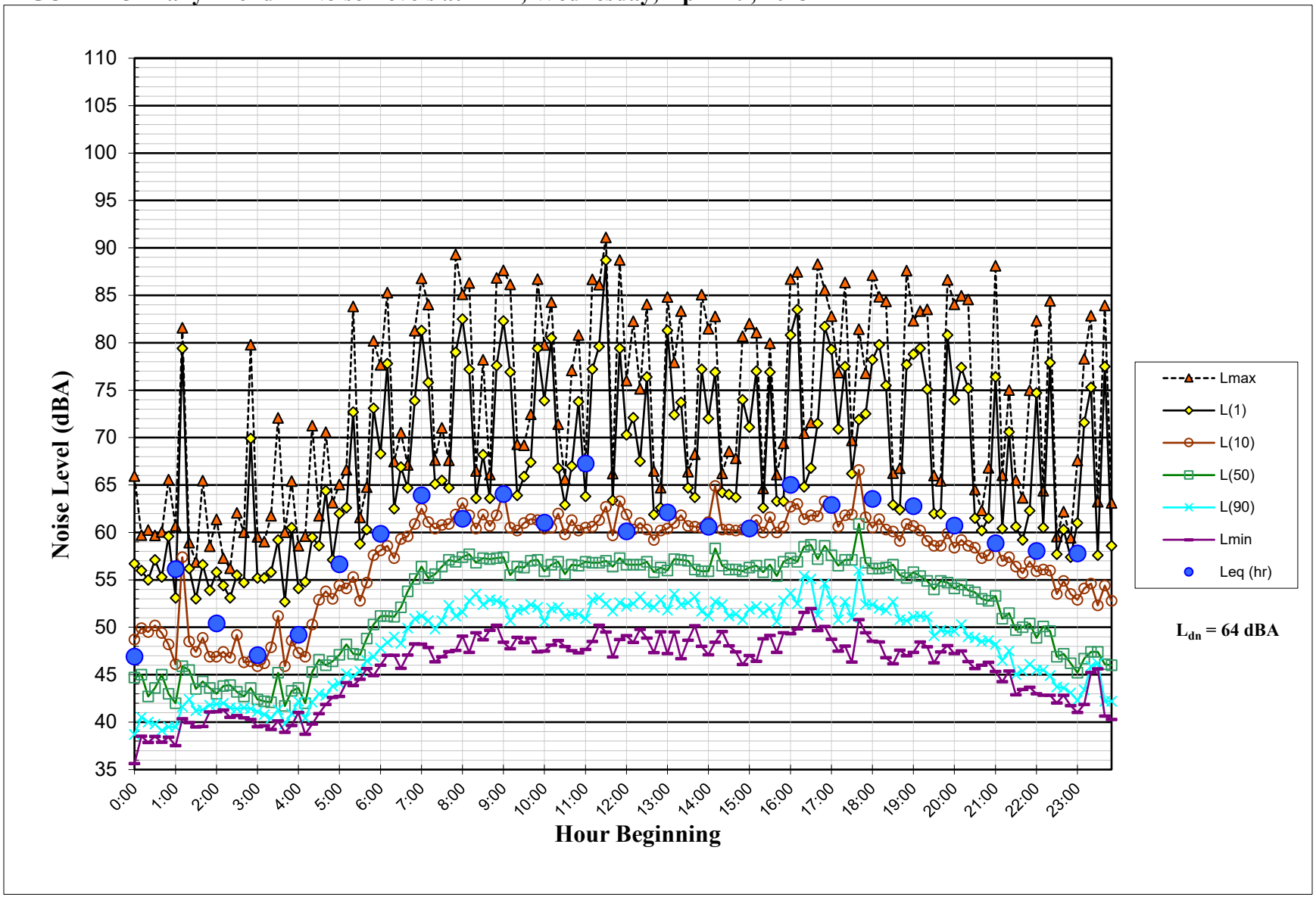


FIGURE A6 Daily Trend in Noise Levels at LT-2, Thursday, April 20, 2023

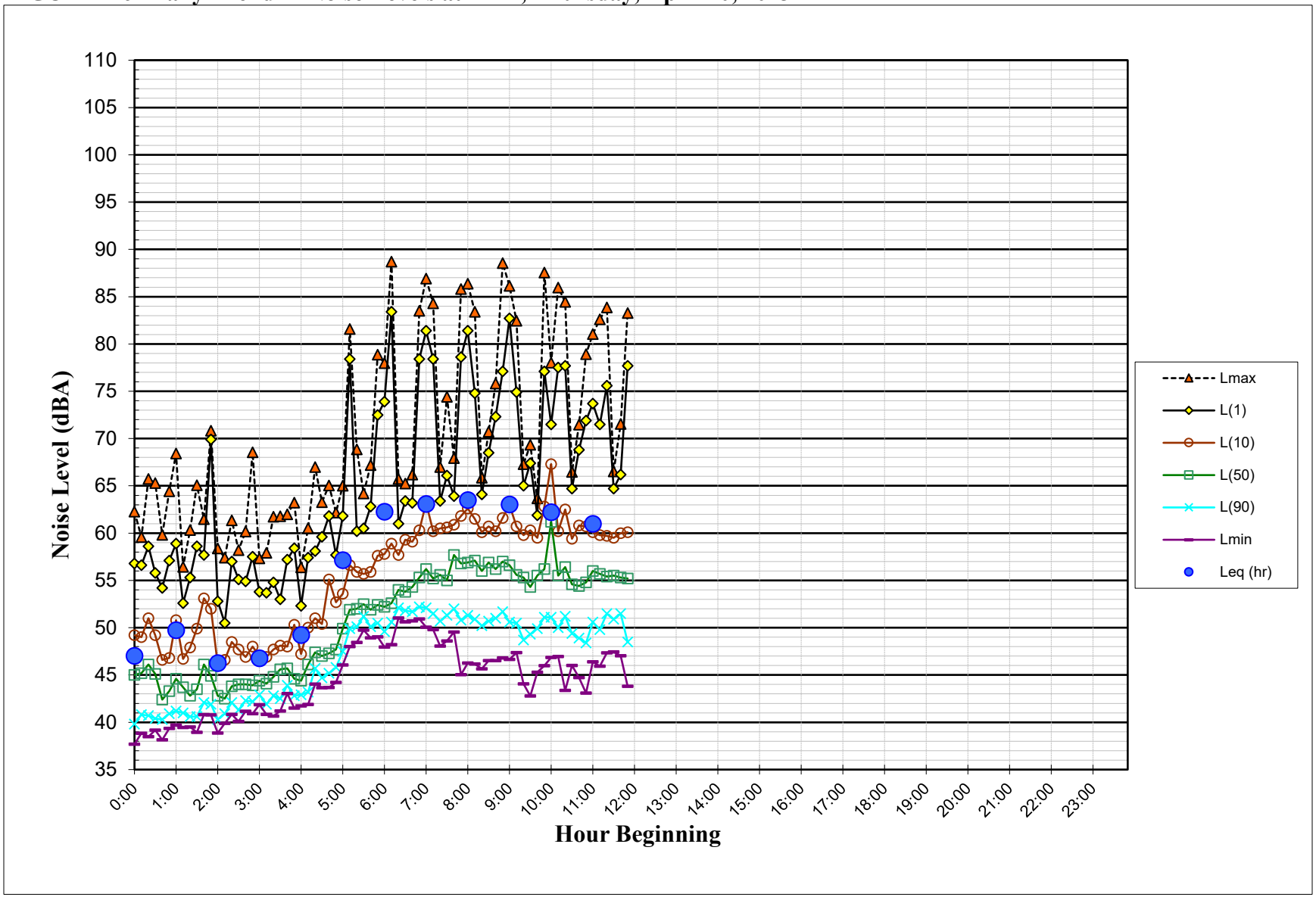
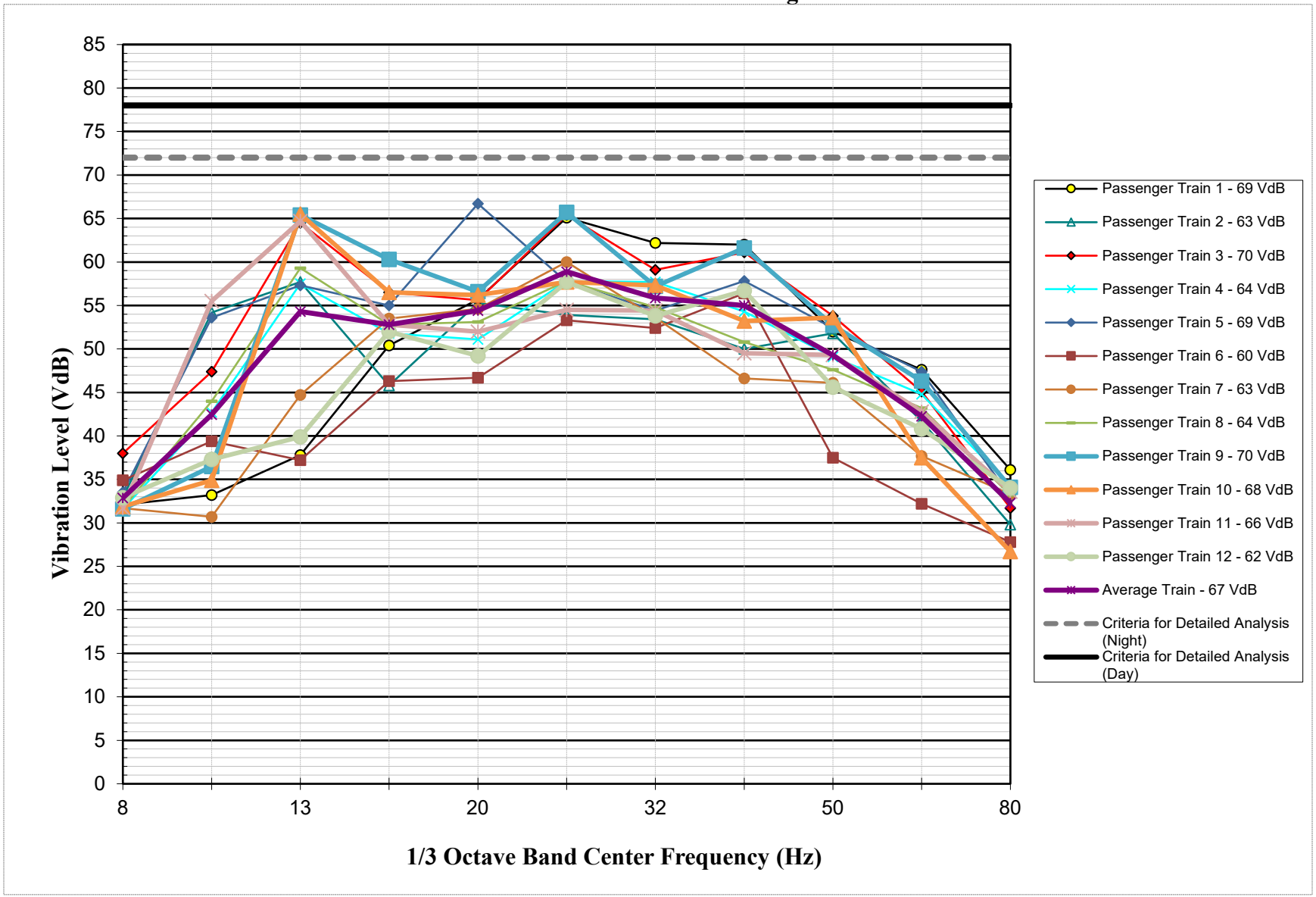


FIGURE A7 Caltrain Vibration Levels at a Distance of 60 feet from the Edge of the Nearest Tracks



APPENDIX B
Table B-1 Construction Noise Level Calculations

Phase	Total Days	Equipment	Quantity	Leq at 50ft			Two Loudest Pieces of Equipment	All Equipment	S Commerical/Strip mall		SW Hotel/orth odintist		N Nearest Residential Across F Street		NE commercial	
									Dist	Leq	Dist	Leq	Dist	Leq	Dist	Leq
Demo	28	Concrete/Industrial Saw	1	82.6	1.82E+08	181970085.9	85	86	180	75	230	72	250	72	265	71
		Excavator	2	76.7	46773514	93547028.26										
		Tractor/Loader/Backhoe	1	80	1E+08	100000000										
Site Prep	20	Grader	1	81	1.26E+08	125892541.2	84	86	180	75	230	73	250	72	265	71
		Tractor/Loader/Backhoe	2	80	1E+08	200000000										
		Auger drill rig	1	77.4	54954087	54954087.39										
Grading/Excavation	15	Excavator	1	76.7	46773514	46773514.13	84	84	180	73	230	71	250	70	265	70
		Grader	1	81	1.26E+08	125892541.2										
		Tractor/Loader/Backhoe	1	80	1E+08	100000000										
Trenching/Foundation	90	Tractor/Loader/Backhoe	1	80	1E+08	100000000	82	83	180	72	230	70	250	69	265	68
		Excavator	2	76.7	46773514	93547028.26										
Building - exterior	259	Crane	1	72.6	18197009	18197008.59	79	81	180	70	230	68	250	67	265	67
		Forklift	1	67.7	5888437	5888436.554										
		Generator Set	2	77.6	57543994	115087987.5										
Building - interior/archi	30	Air Compressor	2	73.7	23442288	46884576.31	75	77	180	66	230	64	250	63	265	63
		Aerial Lift	1	67.7	5888437	5888436.554										
Paving	9	Paver	1	74.2	26302680	26302679.92	81	82	180	71	230	69	250	68	265	68
		Roller	2	73	19952623	39905246.3										
		Tractor/Loader/Backhoe	1	80	1E+08	100000000										