

Appendix G
Noise Study



Acoustical & Audiovisual Consultants

ENVIRONMENTAL NOISE STUDY FOR:
MASTER PLAN AMENDMENT
ALDERSLY RETIREMENT COMMUNITY
326 MISSION AVENUE
SAN RAFAEL, CA 94941
RGD Project #: 20-057

PREPARED FOR:
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DATE:
6 November 2020

1 Introduction

The proposed project is a master plan for the renovation of existing buildings and construction of two new independent living buildings plus a new service building at the Aldersly Retirement Community in San Rafael, CA. The project will be constructed in four phases over several years.

This report addresses the potential noise impacts associated with the project with respect to the requirements of the State of California Building Code, City of San Rafael General Plan and Municipal Code. This report also analyzes the potential off-site noise impacts associated with the project as required by the California Environmental Quality Act (CEQA).

2 Summary of Findings

This chapter presents the project's site noise assessment with respect to the City of San Rafael General Plan and the CEQA requirements. The following summarizes the impact findings and mitigation measures identified in this report.

General Plan Compliance / Land Use Compatibility

- Exterior noise: the project's common outdoor areas meets the San Rafael General Plan's N-2 exterior noise standard.
- Interior noise: a design level noise study is required to identify any required noise control measures that will reduce interior noise levels to the City and State interior noise requirement (see **Required Noise Control Measure 1: Interior Sound Levels** on page 21).

CEQA Assessment

- Construction noise is considered a **less than significant impact with Mitigation Measure NO-1: Construction Noise** (page 34)
- Construction vibration is considered a **less than significant impact with Mitigation Measure NO-2: Construction Vibration Reduction Measures** (page 38).
- Project-generated traffic is considered a **less than significant impact** (page 40).
- Mechanical equipment noise is considered a **less than significant impact with Mitigation Measure NO-3: Mechanical Equipment Noise** (page 42).
- Airport noise exposure is considered **no impact** (page 42).



3 Fundamental Concepts of Environmental Noise

Noise can be defined as unwanted sound. It is commonly measured with an instrument called a sound level meter. The sound level meter captures the sound with a microphone and converts it into a number called a sound level. Sound levels are expressed in units of decibels.

To correlate the microphone signal to a level that corresponds to the way humans perceive noise, the A-weighting filter is used. A-weighting de-emphasizes low-frequency and very high-frequency sound in a manner similar to human hearing. The use of A-weighting is required by most local General Plans as well as federal and state noise regulations (e.g. Caltrans, EPA, OSHA and HUD). The abbreviation dBA is sometimes used when the A-weighted sound level is reported.

Because of the time-varying nature of environmental sound, there are many descriptors that are used to quantify the sound level. Although one individual descriptor alone does not fully describe a particular noise environment, taken together, they can more accurately represent the noise environment. The maximum instantaneous noise level (L_{max}) is often used to identify the loudness of a single event such as a car pass-by or airplane flyover.

To express the average noise level the L_{eq} (equivalent noise level) is used. The L_{eq} can be measured over any length of time but is typically reported for periods of 15 minutes to 1 hour. The background noise level (or residual noise level) is the sound level during the quietest moments. It is usually generated by steady sources such as distant freeway traffic. It can be quantified with a descriptor called the L_{90} which is the sound level exceeded 90 percent of the time.

There are other statistical descriptors that are used, often times as part of a local noise ordinance. These descriptors are used since local ordinances will have limits based on the number of minutes per hour that an intrusive sound may exceed a specified limit. For example, if a specified noise level cannot be exceeded more than 30 minutes in an hour that is referred to as the L_{50} . The L_{50} is also referred to as the median noise level.

To quantify the noise level over a 24-hour period, the Day/Night Average Sound Level (DNL or L_{dn}) or Community Noise Equivalent Level (CNEL) is used. These descriptors are averages like the L_{eq} except they include a 10 dB penalty during nighttime hours (and a 5 dB penalty during evening hours in the CNEL) to account for peoples increased sensitivity during these hours. The CNEL and DNL are typically within one decibel of each other.

In environmental noise, a change in noise level of 3 dB is considered a just noticeable difference. A 5 dB change is clearly noticeable, but not dramatic. A 10 dB change is perceived as a halving or doubling in loudness.

Examples of common noise sources and their corresponding noise levels are provided in the following table.



Sound Source	Sound Pressure Level (dBA)
Air raid siren at 50 ft (threshold of pain) ⁽¹⁾	120
Maximum levels in audience at rock concerts ⁽¹⁾	110
Train horn at 100 ft ⁽³⁾	103
On platform by passing subway train ⁽¹⁾	100
On sidewalk by passing heavy truck or bus ⁽¹⁾	90
Commuter train traveling at 79 mph at 100 ft ⁽³⁾	88
On sidewalk by passing automobiles ⁽¹⁾	70
Typical gas and electric powered leaf blower at 50 ft ⁽²⁾	68 - 71
Conversational speech ⁽⁴⁾	60
Typical urban area background/busy office ⁽¹⁾	60
Typical suburban area background ⁽¹⁾	50
Quiet suburban area at night ⁽¹⁾	40
Typical rural area at night ⁽¹⁾	30
Isolated broadcast studio ⁽¹⁾	20
Audiometric (hearing testing) booth ⁽¹⁾	10
Threshold of hearing ⁽¹⁾	0

¹Cowan, James P. *Handbook of Environmental Acoustics*. Van Nostrand Reinhold, 1994.

²California Environmental Protection Agency, Air Resources Board. Mobile Source Control Division (2000). A report to the California legislature on the potential health and environmental impacts of leaf blowers. Retrieved from <https://ww3.arb.ca.gov/msprog/leafblow/leafblow.htm>

³California High-Speed Rail Authority. (2018). *How do High-Speed Train Noise Levels Compare to Traditional Trains*. Retrieved from https://www.hsr.ca.gov/communication/info_center/factsheets.aspx

⁴Everest, Fredrick Alton, and Ken C. Pohlmann. *Master Handbook of Acoustics, 5th Ed*. McGraw-Hill, 2009.



Vibration is an oscillatory motion which can be described in terms of the displacement, velocity, or acceleration. Because the motion is oscillatory, there is no net movement. Displacement is the easiest descriptor to understand. For a vibrating floor, the displacement is simply the distance that a point on the floor moves away from its static position. The velocity represents the instantaneous speed of the floor movement.

The peak particle velocity (PPV) is the descriptor used in monitoring of construction vibration since it is related to the stresses that are experienced by buildings. The tables below show the guideline criteria for building damage and annoyance potential by Caltrans. The criteria are in terms of the peak particle velocity (PPV) expressed in inches per second.

Guideline Vibration Damage Potential Threshold Criteria (Caltrans Table 19¹)

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Guideline Vibration Annoyance Potential Threshold Criteria (Caltrans Table 20)

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

¹ Caltrans, *Transportation and Construction Vibration Guidance Manual*, September 2013.



4 Regulatory Framework

4.1 California Building Code

Section 1206.4 specifies allowable interior noise levels for new multi-family residential buildings. This section states that “*Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The metric shall be either the day-night average sound level (L_{dn}) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.*”

4.2 San Rafael General Plan 2020

The Noise Element of the City of San Rafael General Plan 2020 has goals, policies, and programs to protect the health and welfare of the community by promoting development which is compatible with established noise standards.

Goal 29: Acceptable Noise Levels

It is the goal of San Rafael to have acceptable noise levels.

N-1: Noise Impacts on New Development.

Protect people in new development from excessive noise by applying noise standards in land use decisions. Apply the Land Use Compatibility Standards (see Exhibit 31) to the siting of new uses in existing noise environments. These standards identify the acceptability of a project based on noise exposure. If a project exceeds the standards in Exhibit 31, an acoustical analysis shall be required to identify noise impacts and potential noise mitigations. Mitigation should include the research and use of state-of-the-art abating materials and technology.

N-1A: Acoustical Studies.

Require acoustical studies for all new residential projects within the projected L_{dn} 60 dB noise contours (see Figure 1) so that noise mitigation measures can be incorporated into project design. Acoustical studies shall identify noise sources and contain a discussion of the existing and future noise exposure and the mitigation measures that may be used to achieve the appropriate outdoor and indoor noise standards.

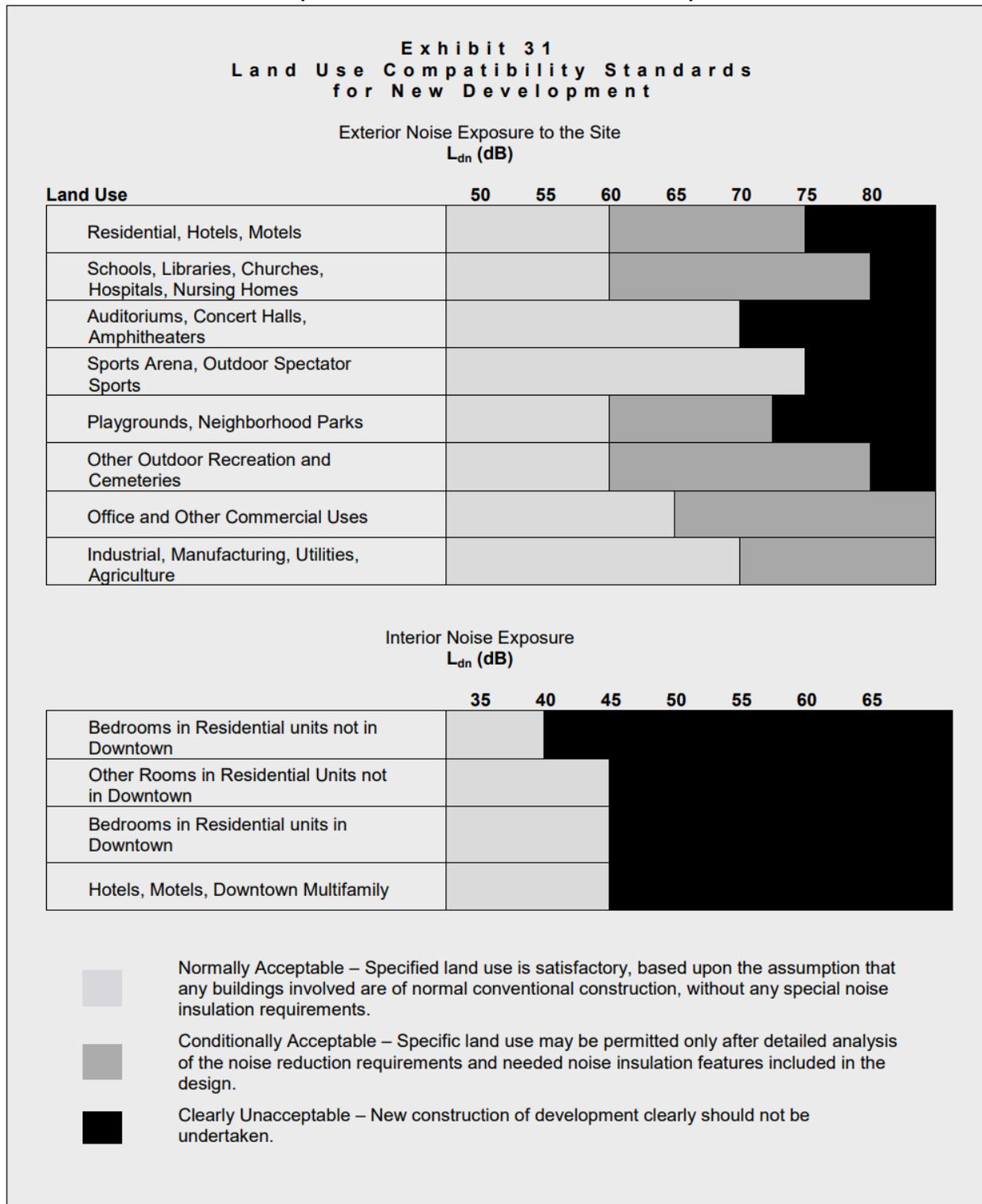
Responsibility: Community Development

Timeframe: Ongoing

Resources: Fees



**Figure 1: City of San Rafael General Plan Land Use Compatibility Standards
 (San Rafael General Plan Exhibit 31)**



N-2: Exterior Noise Standards for Residential Use Areas.

The exterior noise standard for backyards and/or common usable outdoor areas in new residential development is up to L_{dn} of 60 dB. In common usable outdoor areas in Downtown, mixed-use residential, and high-density residential districts, up to L_{dn} of 65 dB may be allowed if determined acceptable through development review.

N-3: Planning and Design of New Development.

Encourage new development to be planned and designed to minimize noise impacts from outside noise sources.

N-3A: Noise Mitigation. Require, where appropriate, the following mitigation measures to minimize noise impacts on proposed development projects:

1. **Site planning.** Proper site planning is the first mitigation measure that should be investigated to reduce noise impacts. By taking advantage of the natural shape and terrain of the site, it often is possible to arrange the buildings and other uses in a manner that will reduce and possibly eliminate noise impacts. Specific site planning techniques include:

- a. Increasing the distance between the noise source and the receiver;
- b. Placing non-noise sensitive land uses such as parking lots, maintenance facilities, and utility areas between the source and the receiver;
- c. Using non-noise sensitive structures such as garages to shield noise-sensitive areas; and
- d. Orienting buildings to shield outdoor spaces from a noise source.

2. **Architectural layout of buildings.** In many cases, noise reduction can be attained by careful layout of noise-sensitive spaces. Bedrooms, for example, should be placed away from freeways. Quiet outdoor spaces can be provided next to a noisy highway by creating a U-shaped development, which faces away from the highway.

3. **Noise Barriers.** Absorptive types of noise barriers or walls should be used to reduce noise levels from ground transportation noise sources and industrial sources. A barrier must interrupt the line of sight between the noise source and the receiver in order to reduce noise level both outdoors and indoors. A barrier should provide at least L_{dn} 5 dB of noise reduction to achieve a noticeable change in noise levels.

4. **Construction modifications.** If site planning, architectural layout, noise barriers, or a combination of these measures does not achieve the required noise reduction, then mitigation should be facilitated through construction modification to walls, roofs, ceilings, doors, windows.

5. **Alternatives to Sound Walls.** Encourage new development to identify alternatives to the use of sound walls to ease noise impacts.

Responsibility: Community Development
Timeframe: Ongoing
Resources: Fees



N-4: Noise from New Nonresidential Development.

Design nonresidential development to minimize noise impacts on neighboring uses.

a. Performance Standards for Uses Affecting Residential Districts. New nonresidential development shall not increase noise levels in a residential district by more than L_{dn} 3 dB, or create noise impacts that would increase noise levels to more than L_{dn} 60 dB at the property line of the noise receiving use, whichever is the more restrictive standard.

b. Performance Standards for Uses Affecting Nonresidential and Mixed Use Districts. New nonresidential projects shall not increase noise levels in a nonresidential or mixed-use district by more than L_{dn} 5 dB, or create noise impacts that would increase noise levels to more than L_{dn} 65 dB (Office, Retail) or L_{dn} 70 dB (Industrial), at the property line of the noise receiving use, whichever is the more restrictive standard.

c. Waiver. These standards may be waived if, as determined by an acoustical study, there are mitigating circumstances (such as higher existing noise levels), and no uses would be adversely affected.

N-4a. Require Acoustical Study. Identify through an acoustical study noise mitigation measures to be designed and built into new nonresidential and mixed-use development, and encourage absorptive types of mitigation measures between noise sources and residential districts.

Responsibility: Community Development
Timeframe: Ongoing
Resources: Fees

N-5: Traffic Noise from New Development.

Minimize noise impacts of increased off-site traffic caused by new development. Where the exterior L_{dn} is 65 dB or greater at a residential building or outdoor use area and a plan, program, or project increases traffic noise levels by more than L_{dn} 3 dB, reasonable noise mitigation measures shall be included in the plan, program or project.

N-5a. Traffic Noise Studies. Require acoustical studies to evaluate potential off-site noise impacts resulting from traffic generated by new development.

Responsibility: Community Development
Timeframe: Ongoing
Resources: Fees

N-9: Nuisance Noise.

Minimize impacts from noise levels that exceed community sound levels.

N-9b: Mitigation for Construction Activity Noise. Through environmental review, identify mitigation measures to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity.

Responsibility: Community Development
Timeframe: Ongoing
Resources: Fees



4.3 City of San Rafael Municipal Code

The City of San Rafael Municipal Code Chapter 8.13 includes standards, including noise limits, to protect the peace, health, safety and general welfare of the citizens of San Rafael from excessive, unnecessary and unreasonable noises from any and all sources in the community.

8.13.040 - General noise limits.

Subject to the exceptions and exemptions set forth in Sections 8.13.050 and 8.13.060 of this chapter, the general noise limits set forth in this section shall apply. A summary of the general noise limits set forth in this section is set forth in Table 8.13-1 [Table 1 of this report]. Where two or more noise limits may apply, the more restrictive noise limit shall govern. For purposes of determining sound levels from any source of sound, a sound level measurement shall be made at any point on any receiving private or public property. Notwithstanding the foregoing, in multi-family structures, the microphone shall be placed no closer than 3-½ feet from a wall through which the source of sound at issue is transmitting, and shall also be placed five (5) feet above the floor regardless of whether the source of sound at issue transmits through the floor, ceiling or wall. Sound level measurements shall be made with a sound level meter (Type 1 or 2) set to A-weighting, and "fast" response for intermittent sound. Slow or fast response may be used for constant noise sources. For intermittent sound, the one second rms maximum level (L_{max}) shall be used. For constant sound, the average level (L_{eq}) shall be used.

Table 1: City of San Rafael General Noise Level Limits (Municipal Code Table 8.13-1)

Property type or zone	Daytime limits 7 a.m. to 9 p.m. Sun to Thu 7 a.m. to 10 p.m. Fri to Sat	Nighttime limits 9 p.m. to 7 a.m. Sun to Thu 10 p.m. to 7 a.m. Fri to Sat
Residential	60 dBA Intermittent 50 dBA Constant	50 dBA Intermittent 40 dBA Constant
Mixed-use	65 dBA Intermittent 55 dBA Constant	55 dBA Intermittent 45 dBA Constant
Multifamily residential (interior sound source)	40 dBA Intermittent 35 dBA Constant	35 dBA Intermittent 30 dBA Constant
Commercial	65 dBA Intermittent 55 dBA Constant	65 dBA Intermittent 55 dBA Constant
Industrial	70 dBA Intermittent 60 dBA Constant	70 dBA Intermittent 60 dBA Constant

Property type or zone	Daytime limits 7 a.m. to 9 p.m. Sun to Thu 7 a.m. to 10 p.m. Fri to Sat	Nighttime limits 9 p.m. to 7 a.m. Sun to Thu 10 p.m. to 7 a.m. Fri to Sat
Public Property	Most restrictive noise limit applicable to adjoining private property	Most restrictive noise limit applicable to adjoining private property

8.13.050 - Standard exceptions to general noise limits.

The following standard exceptions to the provisions of Section 8.13.040 shall be allowed as of right, to the extent and during the hours specified. A summary of the standard exceptions provided in this section is set forth in Table 8.13-2.

- A. Construction. Except as otherwise provided in subsection B of this section, or by the planning commission or city council as part of the development review for the project, on any construction project on property within the city, construction, alteration, demolition, maintenance of construction equipment, deliveries of materials or equipment, or repair activities otherwise allowed under applicable law shall be allowed between the hours of seven a.m. (7:00 a.m.) and six p.m. (6:00 p.m.), Monday through Friday, and nine a.m. (9:00 a.m.) and six p.m. (6:00 p.m.) on Saturdays, provided that the noise level at any point outside of the property plane of the project shall not exceed ninety (90) dBA. All such activities shall be precluded on Sundays and holidays. Violation of the foregoing may subject the permittee to suspension of work by the chief building official for up to two (2) days per violation.

For any construction project involving the construction of one or more new buildings or residences within the city, or when required by the planning commission or city council as part of their development review for the property, the property owner or occupant shall post a sign at all entrances to the construction site upon commencement of construction, for the purpose of informing all contractors and subcontractors, their employees, agents, materialmen and all other persons at the construction site, of the basic requirements of this chapter.

1. Said sign(s) shall be posted in a conspicuous place visible from the public right-of-way near the entrance to the job site, at least five feet (5') above ground level, and shall be of a white background, with legible black lettering, which lettering shall be a minimum of one and one-half inches (1 1/2") in height.
2. Said sign shall read as follows (or as consistent with other hours approved by the planning commission or city council):



CONSTRUCTION HOURS
(includes any and all deliveries)

MONDAY—FRIDAY	7:00 a.m. to 6:00 p.m.
SATURDAY	9:00 a.m. to 6:00 p.m.
SUNDAY/HOLIDAYS	Prohibited

NOISE LIMITS

Noise level at any point outside of the construction property plane shall not exceed ninety (90) dBA.

Violation of the construction hours and noise limits may be enforced as either an infraction or a misdemeanor punishable by fines or jail time or both, or by an administrative citation with a fine, or by a civil action with a monetary penalty, injunction and/or other remedies, as provided in Chapter 1.42 of this code. In addition, the chief building official may issue a stop work order requiring suspension of work for up to two (2) days per violation.

8.13.060 - Exceptions allowed with permit.

- A. In addition to the standard exceptions permitted pursuant to Section 8.13.050 of this chapter, the director of community development or his designee may grant a permit allowing an exception from any or all provisions of this chapter where the applicant can show that a diligent investigation of available noise abatement techniques indicates that immediate compliance with the requirements of this chapter would be impractical or unreasonable, or that no public detriment will result from the proposed exception. Any such permit shall be issued with appropriate conditions to minimize the public detriment caused by the permitted exceptions. Any such permit shall be of such duration, as approved by the director of community development or his designee, up to a maximum period of six (6) months, but shall be renewable upon a showing of good cause, and shall be conditioned by a schedule for compliance and details of methods therefor in appropriate cases. At the discretion of the director of community development or his designee, an exception permit may be issued and reissued for successive short periods of time in order to allow monitoring of the adverse noise impacts of the excepted activity, and additional conditions may be imposed upon reissuance of the permit, if the director of community development or his designee determines that such additional conditions are necessary to mitigate noise impacts from the excepted activity to a level he deems acceptable under all the circumstances.



- B. Any application for an exception permit under this section shall be accompanied by a fee to be set by resolution of the city council.
- C. Prior to granting any permit under this section, the director of community development or his designee shall provide at least ten (10) calendar days' written notice to all property owners within three hundred feet (300') of the property for which the application is made, and shall consider any objections to the granting of such permit received before issuance of the permit.
- D. Any person aggrieved with the decision of the director of community development or his designee may appeal to the city council, by writing filed with the city clerk within five (5) business days after the date of such decision; however, such decision shall not stay the effective date of the permit.

14.16.260 – Noise Standards.

Any new development located in a "conditionally acceptable" or "normally unacceptable" noise exposure area, based on the land use compatibility chart standards in the general plan, shall require an acoustical analysis. Noise mitigation features shall be incorporated where needed to assure consistency with general plan standards. New construction is prohibited in noise exposure areas where the land use compatibility chart indicates the noise exposure is "clearly unacceptable."

- A. Residential Development. The following standards apply to residential development:
 - 1. Acoustical studies shall be required for all new residential development within projected sixty (60) dBA (L_{dn}) noise contours so that noise mitigation measures can be incorporated into project designs.
 - 2. Usable outdoor area in low and medium density districts shall be sixty (60) dBA (L_{dn}) or less.
 - 3. In high density and mixed use districts, residential interior standards shall be met and common, usable outdoor areas shall be designed to minimize noise impacts. Where possible, a sixty (60) dBA (L_{dn}) standard shall be applied to usable outdoor areas.
 - 4. Interior noise standards for new single-family residential and residential health care development shall be forty (40) dBA (L_{dn}) for bedrooms and forty-five (45) dBA (L_{dn}) for other rooms. New hotels and motels shall meet a forty-five (45) dBA (L_{dn}) standard. For new multifamily development, hotels and motels, interior noise standards shall be described by State Administrative Code standards, Title 25, Part 2.

5. Noise standards shall be applied to multifamily remodeling requiring major environmental design review permits.
 6. Post-construction monitoring and approval by an acoustical engineer shall be required in residential development near high noise sources to insure that city standards have been met.
- B. Development Adjacent to Residential Areas. New nonresidential construction adjacent to residential areas shall not increase noise levels in a residential area by more than three (3) dBA (L_{dn}), or create noise impacts which would increase noise levels to more than sixty (60) dBA (L_{dn}) at the boundary of a residential area, whichever is the more restrictive standard. This standard may be waived by the planning director if, as determined by a noise analysis, there are mitigating circumstances (such as higher existing noise levels), and no uses would be adversely affected.
- D. Traffic Noise Mitigation. A sixty-five (65) dBA (L_{dn}) level is considered an acceptable upper limit for existing residences constructed before July, 1988. Where exterior levels are sixty-five (65) dBA (L_{dn}) or greater at the face of a residential building, and traffic noise level increases of more than three (3) dBA (L_{dn}) affecting residential areas will be created by a program or development, reasonable noise mitigation measures shall be included in the program or development which is creating the increase.

4.4 CEQA Guidelines

In accordance with Section XI of Appendix G of the *CEQA Guidelines*, a proposed project could have a significant environmental impact if it would result in:

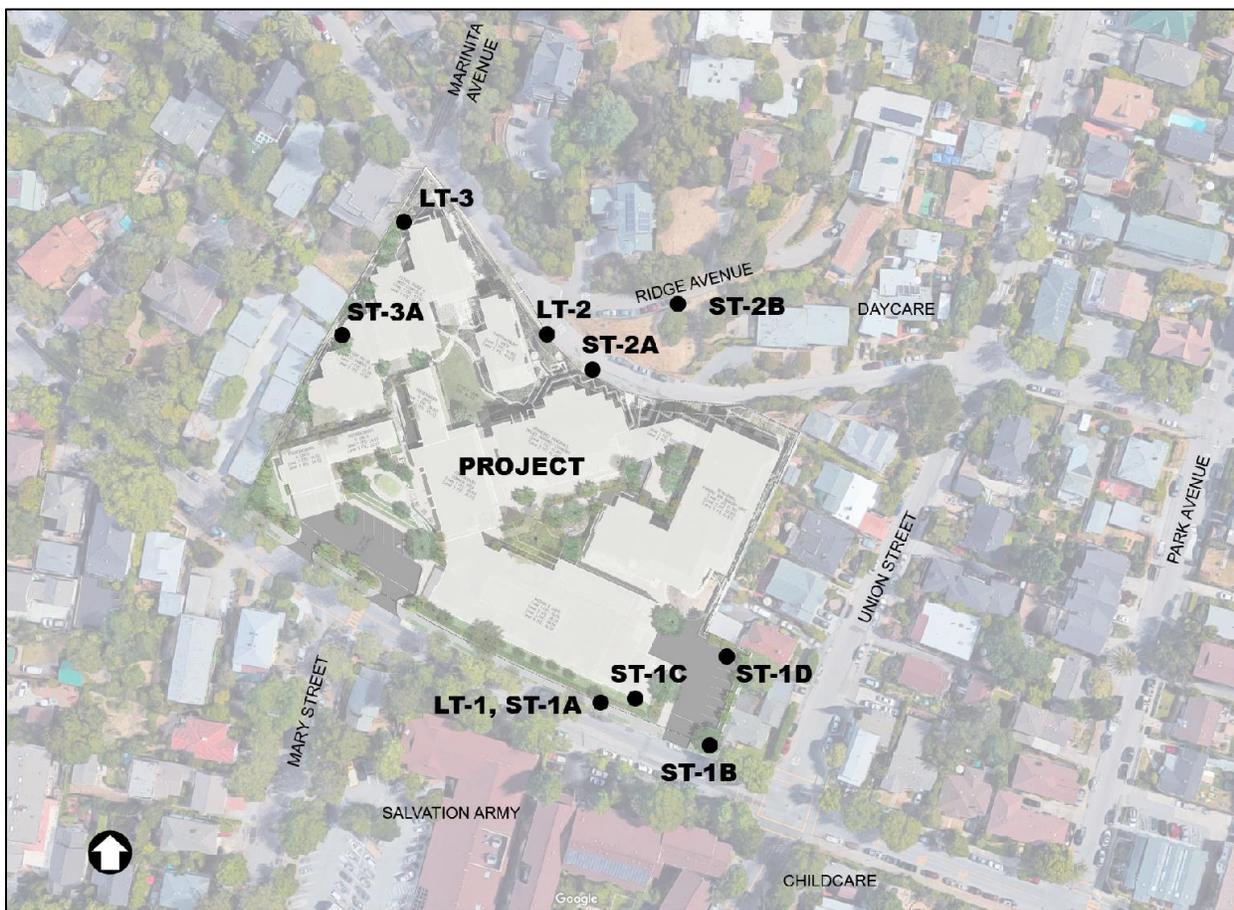
- a. *Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.*
- b. *Generation of excessive groundborne vibration or groundborne noise levels.*
- c. *For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels.*

5 Noise Environment

The project site is located in the Central San Rafael neighborhood, bordered by Belle Avenue to the north, Union Street to the east, Mission Avenue to the south, and multi-family residential/duplexes to the west. The project site is in a primarily residential area. There is a Salvation Army building across Mission Avenue to the south. The major noise source affecting the project site is vehicular traffic.

Noise measurements were made between 5 October 2020 and 8 October 2020 to quantify the existing noise levels. The noise measurements consisted of long-term, 3-day, noise measurements at three locations (LT-1 to LT-3) and short-term (ST), generally 15-minute, noise measurements at seven locations around the project site. The noise measurement locations are shown in Figure 2.

Figure 2: Noise Measurement Locations



The long-term noise monitor at LT-1 was on a utility pole along Mission Avenue and was approximately 12 feet above ground. Hourly average noise levels at this location typically ranged from L_{eq} 60 to 66 dBA during the day (7 AM – 10 PM) and L_{eq} 47 to 63 dBA during the night (10 PM – 7 AM). The calculated L_{dn} was 66 dBA.

The long-term noise monitor at LT-2 was located on a utility pole along Belle Avenue at approximately 12 feet above ground. Hourly average noise levels at this location typically ranged from L_{eq} 50 to 59 dBA during the day (7 AM – 10 PM) and L_{eq} 45 to 56 dBA during the night (10 PM – 7 AM). The calculated weekly L_{dn} was 60 dBA.

The long-term noise monitor at LT-3 was located on a tree near the west property line and was approximately 10 feet above ground. Hourly average noise levels at this location typically ranged from L_{eq} 50 to 57 dBA during the day (7 AM – 10 PM) and L_{eq} 47 to 56 dBA during the night (10 PM – 7 AM). The calculated weekly L_{dn} was 59 dBA.

Short-term measurements were conducted at around the project site at a height of 5 feet above ground. Short-term measurements ST-1A, ST-1B, ST-1C, and ST-1D were made at the southeast portion of the site near the long-term monitor LT-1. The short-term measurement at ST-1A was next to LT-1. The short-term measurement at ST-1B was made on the sidewalk near the southeast corner of the project site. The short-term measurement at ST-1C was made at the setback of the proposed 35-unit independent living building. The short-term measurement at ST-1D was made at approximately 100 feet from the Mission Avenue roadway centerline.

The short-term measurements at ST-2A and ST-2B were made in the areas north of the project site. The short-term measurement at ST-2A was made along Belle Avenue to the east of the long-term monitor at LT-2. The short-term measurement at ST-2B was made along Ridge Avenue.

The short-term measurement at ST-3A was made at the west side of the project site.

The noise measurements were made with a Larson Davis Model 820 or 824 Sound Level Meter meeting Type 1 specifications (ANSI S1.4). Calibrations were checked with a Larson Davis Cal200 calibrator.

Figures 3, 4 and 5 show the long-term noise measurement results. Table 2 shows the short-term measurement results.

Figure 3: Noise Measurement Results Location LT- 1 (L_{dn} 66 dBA)

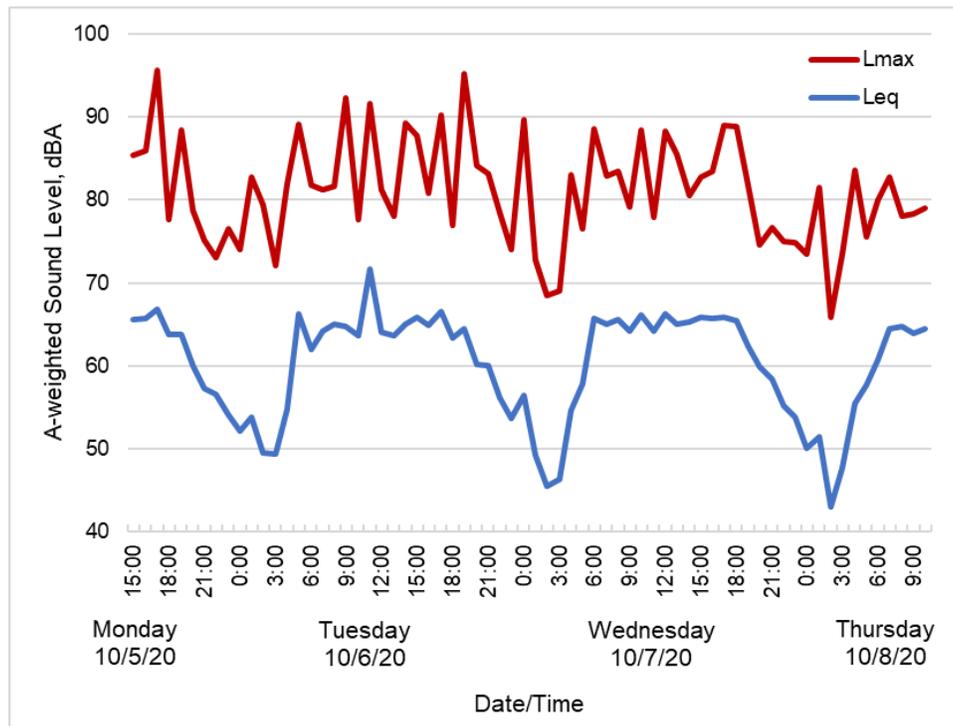


Figure 4: Noise Measurement Results Location LT- 2 (L_{dn} 60 dBA)

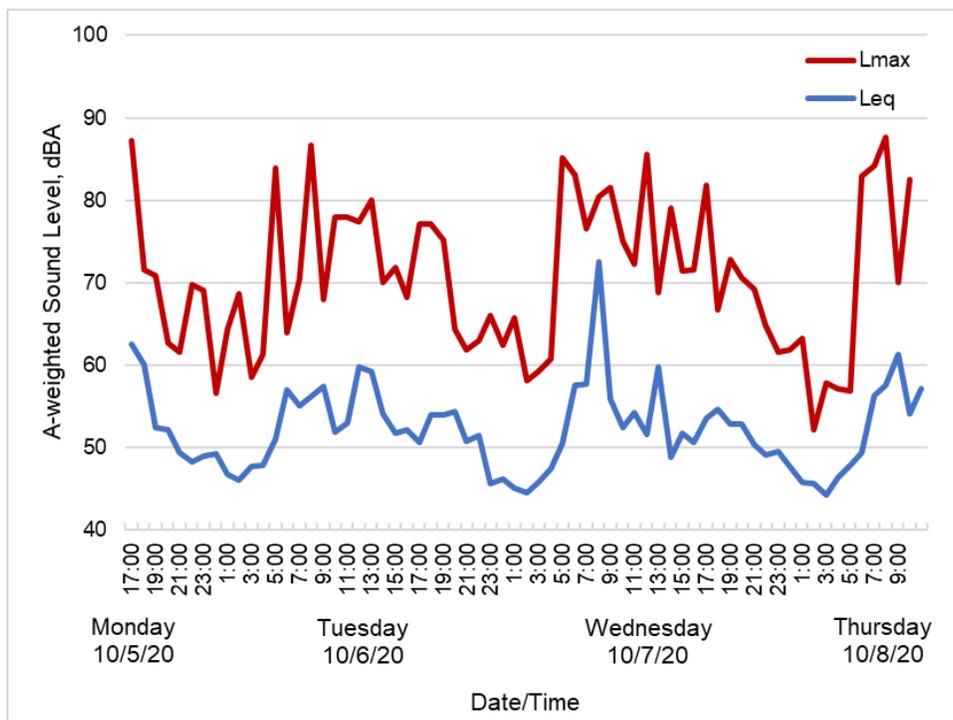


Figure 5: Noise Measurement Results Location LT- 3 (L_{dn} 59 dBA)

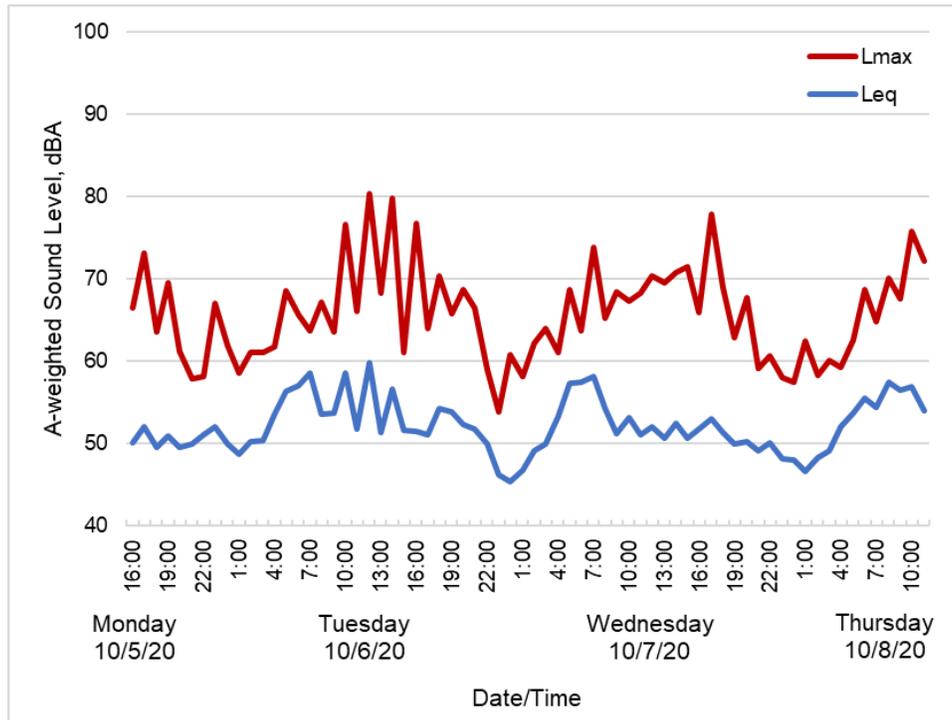


Table 2: Short-Term Noise Measurement Results

Location	Date/Time	L _{eq}	L ₁	L ₁₀	L ₃₃	L ₅₀	L ₉₀	L _{dn} [*]
ST-1A	5 Oct 20 4:12 pm – 4:27 pm	62	70	66	62	58	47	64
ST-1B	5 Oct 20 4:28 pm – 4:33 pm	67	79	69	65	62	50	66
ST-1C	8 Oct 20 12:08 pm – 12:23 pm	60	69	64	59	54	48	61
	8 Oct 20 1:53 pm – 2:08 pm	60	68	64	59	55	50	

Table 2: Short-Term Noise Measurement Results (cont.)

ST-1D	8 Oct 20 12:27 pm – 12:42 pm	54	60	53	50	49	47	56
	8 Oct 20 2:09 pm – 2:23 pm	55	59	56	55	54	53	
ST-2A	5 Oct 20 5:04 pm – 5:19 pm	67	77	58	49	46	45	61
ST-2B	8 Oct 20 11:20 am – 11:38 pm	54	61	55	53	53	51	62
	8 Oct 20 1:22 pm – 1:37 pm	54	59	55	54	54	53	
ST-3A	5 Oct 20 3:51 pm – 4:06 pm	50	59	52	47	46	45	57

*L_{dn} calculated based on correlation with simultaneous measurement at long-term location.

Future Noise Environment

The traffic study prepared for this project included project generated traffic but did not include data on overall growth in the area. To account for the potential increase in future traffic noise from growth in the area, we are including a 1 dBA increase in the L_{dn}. A 1 dBA increase corresponds to approximately 25% increase in future traffic volumes.

Therefore, we estimate that the future noise environment at the site would be up to L_{dn} 62 dBA at the setback of the proposed independent living building along Mission Avenue (ST-1C), L_{dn} 62 dBA along Belle Avenue (ST-2A), and L_{dn} 58 dBA at the west end of the site (ST-3A).

6 General Plan Compliance / Land Use Compatibility

The proposed project is exposed to noise levels up to L_{dn} 62 dBA. According to the General Plan's Land Use Compatibility Standards (Figure 1), residential land uses exposed to noise levels between L_{dn} 60 dBA and 75 dBA are considered "conditionally acceptable". Residential land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features are included in the design.

Exterior Noise

Per San Rafael General Plan N-2, the exterior noise standard for backyards and/or common usable outdoor areas in new residential development is up to L_{dn} of 60 dB. In common usable outdoor areas in Downtown, mixed-use residential, and high-density residential districts, up to L_{dn} of 65 dB may be allowed if determined acceptable through development review.

There are four main common/usable outdoor areas located near the center of the project site. Figure 6 shows the landscape plan and each of these common usable areas. These outdoor areas benefit from the increased distance from local roadways which helps to attenuate the noise levels. With the exception of the outdoor space next to the parking lot along Mission Avenue, these common usable outdoor areas also benefit from the acoustical shielding provided by the existing and proposed buildings. As a result, all common outdoor use areas would be exposed to an L_{dn} of 60 dBA or less. This meets the requirement of General Plan Program N-2.

Figure 6: Landscape Plan and Common Outdoor Use Areas



Interior Noise Level

Per San Rafael General Plan Program N-1a and the General Plan's Land Use Compatibility Standards for New Development, the project site's noise exposure is considered "conditionally acceptable." This means that an acoustical study shall be required so that noise mitigation measures can be incorporated into the project design.

The General Plan's Land Use Compatibility Standards for New Development shows that the "normally acceptable" interior noise exposure for residential units not in Downtown is L_{dn} 40 dBA in bedrooms and L_{dn} 45 dBA in other rooms.

These interior noise standards can likely be achieved with standard construction grade windows and doors. However, some units may require use of sound-rated windows and exterior doors. Recommendations for sound ratings should be determined during the architectural design phase as the unit plans are developed.

In addition, operable windows in certain dwelling units along the project perimeter will need to be in the closed position to meet the interior noise standard. Therefore, there must be an alternative form of ventilation to provide any required outside air to meet building code requirements. This ventilation system must not compromise the sound insulation of the façade.

Required Noise Control Measure 1: Interior Sound Levels

Prepare a design level noise study that identifies the required noise control measures (window and door sound ratings) that will reduce interior noise levels to the City and State requirement of L_{dn} 40 in bedrooms and L_{dn} 45 in other rooms.

The study must also identify locations where windows must remain in the closed position to meet the required interior sound level. If the Mechanical Engineer determines that these rooms require outdoor air, then natural ventilation via open windows should not be relied upon and an alternate means of supplying outdoor air should be provided (e.g. mechanical ventilation). The alternate means for supplying outdoor air must be reviewed by the Acoustical Consultant to confirm that it does not compromise the noise reduction provided by the exterior window and wall assembly.

7 CEQA Impact Assessment

7.1 Construction Noise (CEQA Checklist a)

7.1.1 Thresholds of Significance

The City of San Rafael Municipal Code Section 8.13.050 provides exemptions for construction noise from the municipal code's general noise level limits set forth in Section 8.13.040 provided that:

- a) Construction hours (including deliveries) occur during the allowable hours of Monday to Friday 7 a.m. to 6 p.m. and Saturday 9 a.m. to 6 p.m., and
- b) The noise level at any point outside of the property plane of the project shall not exceed 90 dBA.

Therefore, a significant impact would occur if construction hours occur outside of the allowable hours or exceed 90 dBA at the property plane.

7.1.2 Construction Noise Impact Assessment

The project will be constructed in four phases over four years as follows²:

Phase 1 consists of the demolition of three buildings (12-units) along Mission Blvd, and the construction of a new 35-unit independent living building, the renovation of four existing units, and the demolition/rebuilding of four existing units. Phase 1 also includes the expansion of community space and central courtyard and outdoor space improvements. Phase 1 is expected to start in January 2023 and end in September 2024.

Phase 2 includes the demolition of an existing 8-unit building, the addition of a new service building along Belle Ave, renovation of existing nursing facility and expansion of outdoor memory care garden. Phase 2 is expected to start in January 2025 and end in October 2025.

Phase 3 consists of the renovation of two existing units and the expansion of four units at a building along Belle Avenue. Phase 3 also would improve outdoor spaces with landscaping and define a core active space (activity lawn) for residents. Phase 3 is expected to start in January 2025 and end in September 2025.

Phase 4 includes the demolition of two buildings (14 units) and the addition of a new 15-unit independent living building along the western property line. Construction activities associated with Phase 4 is expected to start in January 2026 and end in March 2027.

Figure 7 shows the existing site plan with existing buildings to be demolished. Figure 8 shows the construction phases. Tables 3 to 6 show the project's construction phases with start and end dates³. Construction hours would be 7 a.m. to 3:30 p.m.

² Conceptual Design Review Submittal for Aldersly Retirement Community, Perkins Eastman, 05/29/20

³ Lin, Alice, Greenbrier. "RE: Aldersly noise study – consulting agreement." Email to Alan Rosen, RGD Acoustics, Inc. 22 October 2020.



Figure 7: Existing Site Plan

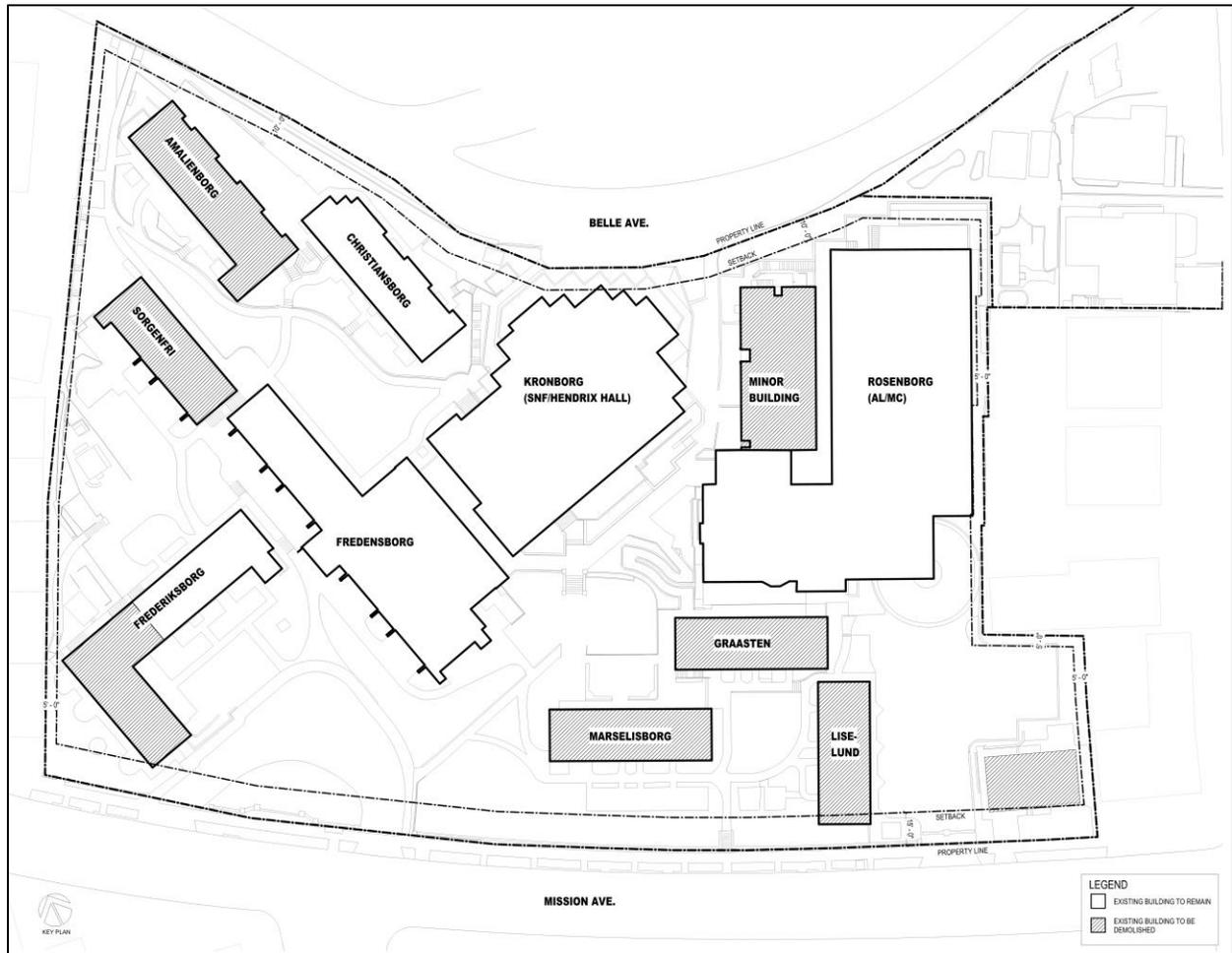


Figure 8: Construction Phases

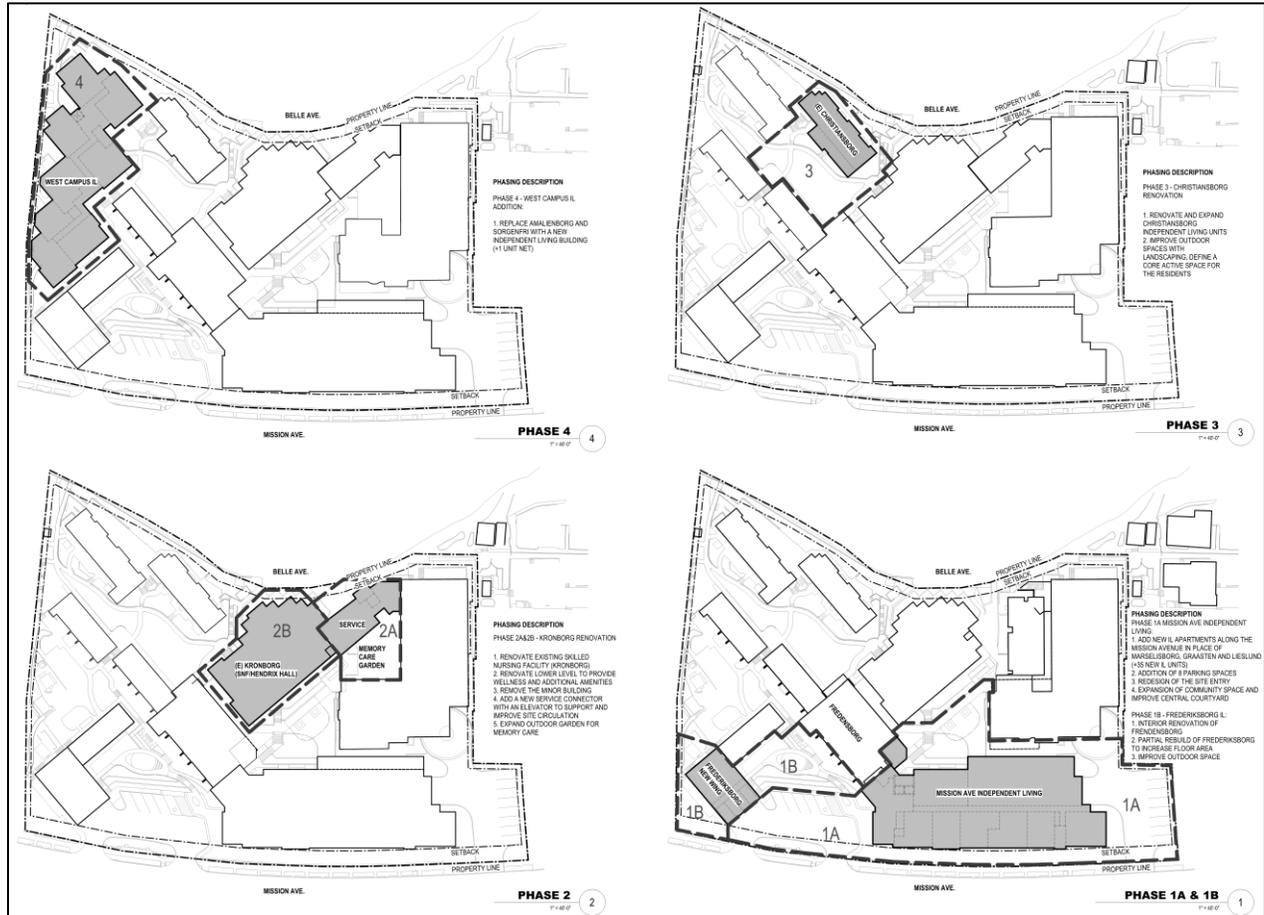


Table 3: Construction Phase 1

Qty	Construction Phase and Equipment	Start Date	End Date	Hours/day	Total Work Days	Average Hours per day
Demolition		1/1/2023	2/1/2023		20	
2	Concrete/Industrial Saws			4	10	2.0
2	Excavators			7	15	5.3
1	Rubber-Tired Dozers			4	15	3.0
2	Tractors/Loaders/Backhoes			7	4	1.4
Site Preparation		2/1/2023	2/28/2023		18	
1	Graders			7	5	1.9
2	Rubber Tired Dozers			7	10	3.9
2	Tractors/Loaders/Backhoes			7	13	5.1
Grading / Excavation		3/1/2023	3/15/2023		16	
1	Excavators			7	10	4.4
1	Graders			7	10	4.4
1	Rubber Tired Dozers			7	10	4.4
1	Tractors/Loaders/Backhoes			7	10	4.4
Trenching/Foundation		3/15/2023	4/15/2023		23	
1	Tractor/Loader/Backhoe			7	23	7.0
1	Excavators			7	6	1.8
Building - Exterior		4/15/2023	5/1/2024		262	
1	Cranes			6	126	2.9
1	Forklifts			3	262	3.0
1	Generator Sets			6	78	1.8
1	Tractors/Loaders/Backhoes			6	131	3.0
1	Welders			6	78	1.8
Building - Interior/Architectural Coating		4/15/2023	9/30/2024		368	
2	Air Compressors			4	250	2.7
6	Aerial Lift			4	250	2.7
Paving		7/1/2024	9/30/2024		64	
1	Cement and Mortar Mixers			7	20	2.2
1	Pavers			7	3	0.3
1	Paving Equipment			7	9	1.0
1	Rollers			7	42	4.6
1	Tractors/Loaders/Backhoes					



Table 4: Construction Phase 2

Qty	Construction Phase and Equipment	Start Date	End Date	Hours/day	Total Work Days	Average Hours per day
Demolition		1/1/2025	2/1/2025		21	
2	Concrete/Industrial Saws			4	10	1.9
1	Excavators			7	10	3.3
1	Rubber-Tired Dozers			4	10	1.9
1	Tractors/Loaders/Backhoes			7	4	1.3
Site Preparation		2/1/2025	2/28/2025		18	
1	Graders			7	5	1.9
1	Tractors/Loaders/Backhoes			7	13	5.1
Grading / Excavation		3/1/2025	3/15/2025		10	
1	Excavators			7	8	5.6
1	Graders			7	3	2.1
1	Rubber Tired Dozers			7	9	6.3
1	Tractors/Loaders/Backhoes			7	9	6.3
Trenching/Foundation		3/15/2025	4/1/2025		12	
1	Tractor/Loader/Backhoe			7	12	7.0
1	Excavators			7	12	7.0
Building - Exterior		4/1/2025	9/1/2025		129	
1	Cranes			6	60	2.8
1	Forklifts			3	129	3.0
1	Generator Sets			6	45	2.1
1	Tractors/Loaders/Backhoes			6	62	2.9
1	Welders			6	78	3.6
Building - Interior/Architectural Coating		4/15/2025	10/31/2025		141	
2	Air Compressors			4	121	3.4
6	Aerial Lift			4	90	2.6
Paving		9/1/2025	10/31/2025		44	
1	Cement and Mortar Mixers			7	34	5.4
1	Pavers			7	3	0.5
1	Paving Equipment			7	9	1.4
1	Rollers			7	16	2.5
1	Tractors/Loaders/Backhoes			7	20	3.2



Table 5: Construction Phase 3

Qty	Construction Phase and Equipment	Start Date	End Date	Hours/day	Total Work Days	Average Hours per day
Demolition		1/1/2025	2/1/2025		21	
1	Concrete/Industrial Saws			7	5	1.7
1	Excavators			7	6	2.0
Site Preparation		1/1/2025	2/28/2025		39	
1	Graders			7	5	3.5
1	Tractors/Loaders/Backhoes			7	13	9.1
Grading / Excavation		3/1/2025	3/15/2025		10	
1	Excavators			7	5	3.5
1	Graders			7	1	0.7
1	Rubber Tired Dozers			7	9	6.3
1	Tractors/Loaders/Backhoes			7	9	6.3
Trenching/Foundation		3/1/2025	3/15/2025		10	
1	Tractor/Loader/Backhoe			7	2	1.4
1	Excavators			7	3	2.1
Building - Exterior		4/1/2025	9/1/2025		129	
1	Forklifts			3	129	3.0
1	Generator Sets			6	45	2.1
1	Tractors/Loaders/Backhoes			6	62	2.9
1	Welders			6	78	3.6
Building - Interior/Architectural Coating		3/1/2025	9/1/2025		127	
2	Air Compressors			4	121	3.8
6	Aerial Lift			4	90	2.8
Paving		7/1/2025	9/1/2025		43	
1	Cement and Mortar Mixers			7	34	5.5
1	Rollers			7	8	1.3
1	Tractors/Loaders/Backhoes			7	20	3.3



Table 6: Construction Phase 4

Qty	Construction Phase and Equipment	Start Date	End Date	Hours/day	Total Work Days	Average Hours per day
Demolition		1/1/2026	2/1/2026		20	
2	Concrete/Industrial Saws			4	10	4.0
2	Excavators				15	
2	Rubber-Tired Dozers				15	
2	Tractors/Loaders/Backhoes				4	
Site Preparation		2/1/2026	2/28/2026		19	
1	Graders			7	5	1.8
2	Rubber Tired Dozers			7	10	3.7
2	Tractors/Loaders/Backhoes			7	13	4.8
Grading / Excavation		3/1/2026	4/1/2026		22	
2	Excavators			7	12	3.8
1	Graders			7	10	3.2
1	Rubber Tired Dozers			7	10	3.2
1	Tractors/Loaders/Backhoes			7	10	3.2
Trenching/Foundation		3/15/2026	4/15/2026		23	
1	Tractor/Loader/Backhoe			7		
1	Excavators			7		
Building - Exterior		4/15/2026	1/1/2027		180	
1	Cranes			6	126	4.2
1	Forklifts			3	180	3.0
1	Generator Sets			6	78	2.6
1	Tractors/Loaders/Backhoes			6	22	0.7
1	Welders			6	30	1.0
Building - Interior/Architectural Coating		4/15/2026	2/1/2027		200	
2	Air Compressors			4	180	
6	Aerial Lift			4	110	
Paving		2/1/2027	3/31/2027		41	
1	Cement and Mortar Mixers			7	25	4.3
1	Pavers			7	3	0.5
1	Paving Equipment			7	9	1.5
1	Rollers			7	16	2.7
1	Tractors/Loaders/Backhoes					



Table 7 shows reference noise levels for the construction equipment that is expected to be used during the project construction.

Table 7: Construction Equipment Noise Levels

Construction Equipment	Ref. Noise Level at 50 feet, dBA
Concrete/Industrial Saws	90
Excavators	81
Rubber-Tired Dozers	82
Tractors/Loaders/Backhoes	78
Graders	85
Cranes	81
Forklifts	78
Generator Sets	81
Air Compressors	78
Pneumatic Tools	85
Aerial Lift	75
Cement and Mortar Mixers	79
Pavers	77
Paving Equipment	77
Rollers	80
Welders	74

*Source: FHWA, *Roadway Construction Noise Model*, 2006.

Construction work area will vary depending on the construction phase. During Phase 1 of construction, activities will be at the southern side of the project site near the adjacent homes to the east and west of the project property line and the homes across Mission Avenue. During Phase 2 and Phase 3, construction activities will occur at the northern side of the project site, near homes along Ridge Avenue. During Phase 4, construction activities will occur at the west side of the project site, near homes along the project's west property line. Table 8 shows the distances from the construction work area to the nearest homes in each direction.

Table 8: Construction Distances

Construction Phase	Distance to Nearest Homes, feet			
	Homes to the East along Union Street	Homes to the South across Mission Avenue	Homes to the West along the Property Line	Homes to the North on Ridge Avenue
1	10	75	9	200
2	100	248	170	106
3	250	225	90	96
4	381	145	9	90



Construction will temporarily increase noise levels at adjacent land uses. Based on a typical (average) source noise level of 80 dBA at 50 feet, construction equipment noise from Phase 1, is calculated to be up to 95 dBA at the homes abutting the project's east and west property lines. Construction noise from Phase 2 and Phase 3 would be up to 75 dBA at the nearest homes. Construction noise from Phase 4 would be up to 95 dBA at the nearest homes. Table 9 summarizes the maximum instantaneous exterior noise levels from project-related construction equipment at the nearby homes during each phase of construction.

Table 9: Typical Construction Equipment Noise Levels at Nearby Land Uses

Construction Phase	Maximum Noise Levels (L _{max}) for Typical Construction Activities, dBA*			
	Nearest homes to the east along Union Street	Nearest homes across Mission Avenue	Nearest homes to the west	Nearest home to the north on Ridge Avenue
Phase 1	94	76	95	63
Phase 2	69	61	64	73
Phase 3	61	62	75	74
Phase 4	57	70	95	75

*Noise levels in **bold** exceed impact threshold

The noise levels in Table 9 are based on the distance between the receiver and the nearest proposed project building footprint using the methodology of the Federal Highway Administration's (FHWA) Roadway Construction Noise Model (2006). Where appropriate, adjustments to account for acoustical shielding provided by the project buildings are also included.

The City's municipal code limits construction noise to 90 dBA at the property plane. The noisiest equipment used at the site will likely be concrete saws which generates an L_{max} of 90 dBA at 50 feet. Figures 9 to 12 identify any residences that could potentially be exposed to noise levels of 90 dBA or greater based on the noisiest equipment (concrete saw). Where residential homes are located within the 90 dBA noise contours, the homes are outlined in blue in Figures 9 to 12.



Figure 9: Construction Noise Levels over 90 dBA – Phase 1

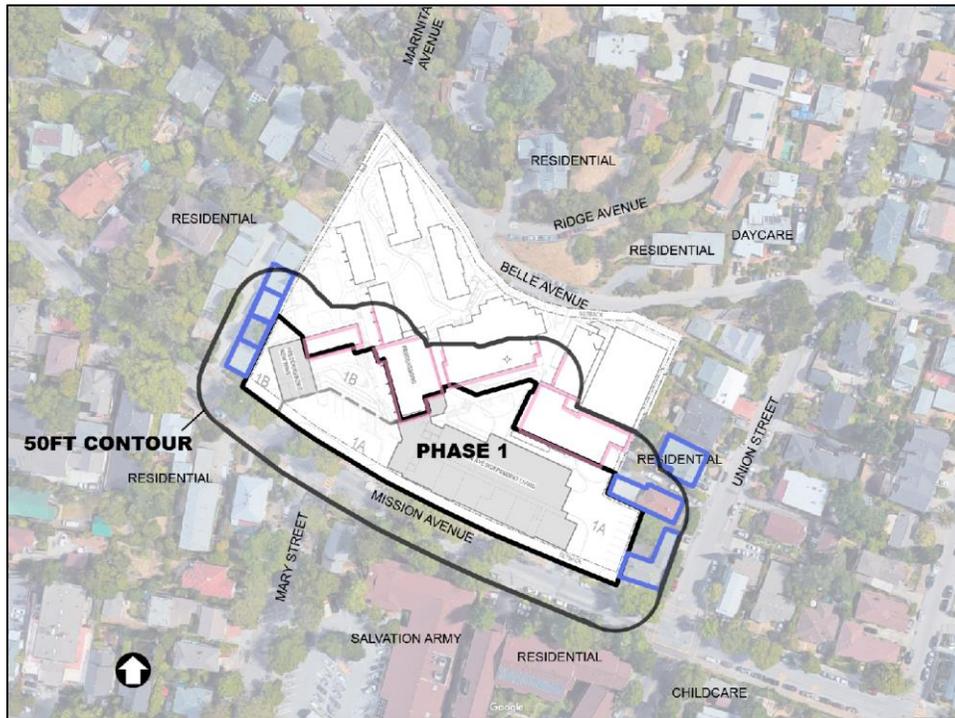


Figure 10: Construction Noise Levels over 90 dBA – Phase 2

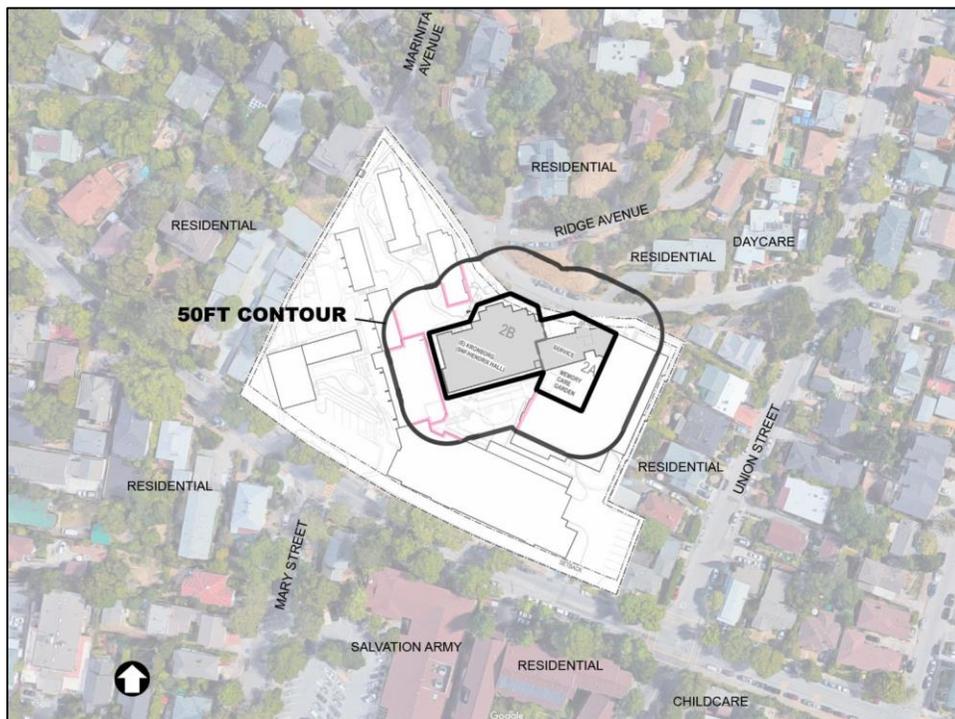


Figure 11: Construction Noise Levels over 90 dBA – Phase 3

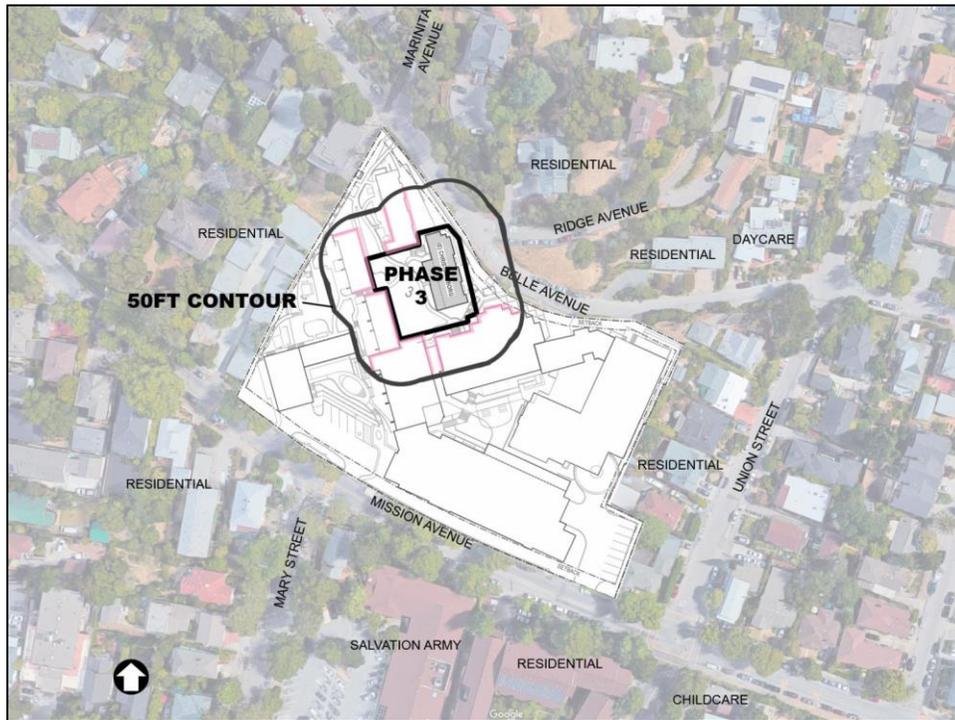
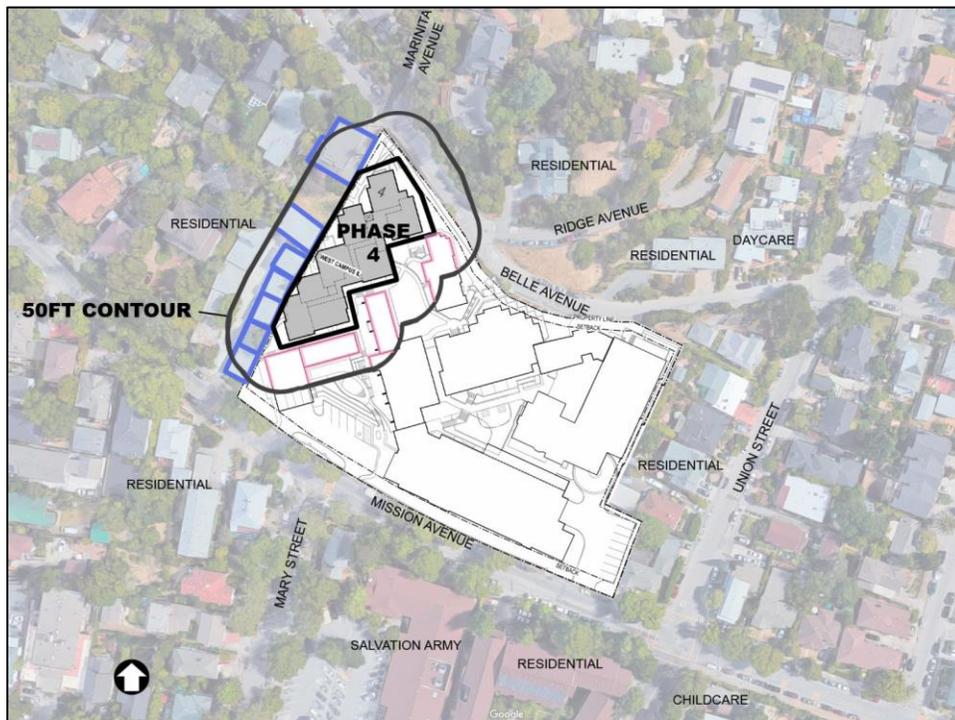


Figure 12: Construction Noise Levels over 90 dBA – Phase 4



Figures 9 to 12 show that during Phase 1 and Phase 4 of construction, there are homes along the project’s east and west property lines that may be subject to noise levels of 90 dBA. There would also be on-site residences located within the 90 dBA construction noise contour. The facades of the on-site residences within the contour are indicated by a red shading.

Given the close proximity of the construction work areas to the property plane, there may be times when it is impractical to meet the 90 dBA limit at the property plane. Per Municipal Code 8.13.060, the City’s Director of Community Development or his designee may grant a permit allowing an exception provided that an investigation of available noise abatement indicates that compliance with the 90 dBA criteria at the property plane would be impractical or unreasonable.

In general, noise from construction will be clearly noticeable at times and may temporarily interfere with normal outdoor activities such as speech communications. Typically, the noisiest activities tend to occur near the beginning of each project phase and are caused by the diesel equipment associated with demolition, grading, and excavation for foundations.

The City’s municipal code limits construction activities to weekdays between 7 a.m. and 6 p.m. and Saturdays between 9 a.m. to 6 p.m. To reduce the potential for annoyance, the project should schedule high noise-producing activities during times when they would be least likely to interfere with the noise sensitive activities of the neighboring land use, when possible.

Additionally, a temporary noise barrier and other construction noise reduction measures would provide a noticeable reduction of the noise impinging upon residential receivers on neighboring properties. This could reduce typical construction noise to 90 dBA or less at the homes. As construction activities move indoors or occur farther from the homes, construction noise levels will also be reduced. Table 10 shows the minimum distances that construction equipment can be located from the property plane and meet the City’s 90 dBA limit.

Table 10: Minimum Distances to Meet 90 dBA

Construction Equipment	Distances, feet
Concrete/Industrial Saws	50
Excavators	18
Rubber-Tired Dozers	20
Tractors/Loaders/Backhoes	13
Graders	28
Cranes	18
Forklifts	13
Generator Sets	18
Air Compressors	13
Aerial Lift	9
Cement and Mortar Mixers	14
Pavers	11
Paving Equipment	11
Rollers	16
Welders	8



In summary, the project can reduce construction noise levels and the potential for annoyance with the implementation of Mitigation Measure NO-1. This is considered a less than significant impact with mitigation.

Mitigation Measure NO-1: Construction Noise

Per Municipal Code Section 8.13.050, the project owner shall post a sign at all entrances to the construction site upon commencement of construction, for the purpose of informing all contractors and subcontractors, their employees, agents, materialmen and all other persons at the construction site, of the basic requirements of the Municipal Code chapter. This includes construction hours and construction noise limits.

- The sign shall be posted in a conspicuous place visible from the public right-of-way near the entrance to the job site, at least five feet (5') above ground level, and shall be of a white background, with legible black lettering, which lettering shall be a minimum of one and one-half inches (1 1/2") in height.
- The sign shall read as follows (or as consistent with other hours approved by the planning commission or city council):

**CONSTRUCTION HOURS
(includes any and all deliveries)**

MONDAY—FRIDAY	7:00 a.m. to 6:00 p.m.
SATURDAY	9:00 a.m. to 6:00 p.m.
SUNDAY/HOLIDAYS	Prohibited

Additionally, the project applicant shall submit a Construction Noise Management Plan (CNMP) prepared by a qualified acoustical consultant. The CNMP shall contain a set of site-specific noise attenuation measures to further reduce potential disruption and annoyance associated with construction noise. The CNMP shall be submitted and approved by the City prior to onset of major site construction activities. Potential attenuation measures may include, but are not limited to, the following:

- Limit construction activities and deliveries to the hours specified in the City of San Rafael’s Municipal Code (7 a.m. to 6 p.m. on weekdays and 9 a.m. to 6 p.m. on Saturdays).
- Installation of a temporary noise barrier along the east and west property lines of the site. The barrier can be constructed with plywood or another appropriate material with cracks or no gaps. The purpose of the barrier is to provide a noticeable reduction of the noise and meet 90 dBA at residential receivers on neighboring properties along the common east and west property lines, where reasonably feasible. This may require a fairly tall (12-foot) barrier. The exact height should be determined during the preparation of the Construction Noise Management Plan and take into account the height of the construction noise sources and site grading.



- All construction equipment shall be equipped with mufflers and sound control devices (e.g., intake silencers and noise shrouds) that are in good condition and appropriate for the equipment.
- Maintain all construction equipment to minimize noise emissions.
- Stationary equipment shall be located on the site to maintain the greatest possible distance to the existing residences, where feasible.
- Unnecessary idling of internal combustion engines should be strictly prohibited.
- Provide advance notification to surrounding land uses disclosing the construction schedule, including the various types of activities that would be occurring throughout the duration of the construction period.
- The construction contractor shall provide the name and telephone number an on-site construction liaison. If construction noise is found to be intrusive to the community (complaints are received), the construction liaison shall investigate the source of the noise and require that reasonable measures be implemented to correct the problem.
- Schedule high noise-producing activities during times when they would be least likely to interfere with the noise sensitive activities of the neighboring land use, when possible.
- Use noise control blankets on temporary fencing that are used to separate construction areas from occupied on-site areas.
- Temporarily relocate residents of on-site dwelling units that are very close to the construction activities.
- Consider upgrading windows to reduce construction noise at on-site dwelling units closest to the construction activities.

7.2 Construction Vibration (CEQA Checklist b)

7.2.1 Thresholds of Significance

Neither CEQA nor the State specifies acceptable vibration levels from construction activities. The City's General Plan Program N-11A adopts standard conditions of approval to reduce the potential for vibration-related construction impacts for development projects near sensitive uses such as housing. Per Program N-11A, vibration impacts shall be considered as part of project level evaluation and approval for individual future projects.

For the purposes of this assessment, the guideline criteria for building damage recommended by Caltrans⁴ is used. The construction vibration damage criteria for older residential structures is a Peak Particle Velocity (PPV) of 0.3 inches/second.

7.2.2 Construction Vibration Impact Assessment

Vibration generated by construction equipment depends on the distance from the equipment to the receiver. During Phase 1 of construction, the nearest neighboring residential home is, at the

⁴ Caltrans, *Transportation and Construction Vibration Guidance Manual*, September 2013.



closest, approximately 10 feet from the demolition of the existing structures. The duration of the demolition phase is 20 days. Construction activities including any site preparation and grading activities would occur up to the south, west, and east property lines. The construction of the new buildings would be, at the closest, approximately 10 feet from the nearest home to the west.

During Phase 2 of construction, the removal of the existing (“Minor”) building is, at the closest, approximately 94 feet from the nearest home. The duration of the demolition phase is 21 days. Construction of the new building would be, at the closest, 80 feet from the nearest home to the northeast.

During Phase 3 of construction, construction activities would be, at the closest, 96 feet from the nearest home to the north.

During Phase 4 of construction, the demolition of the existing buildings along the west portion of the site is, at the closest, approximately 9 feet from the nearest homes to the west. The duration of the demolition phase is 20 days. Construction of the new project building would be approximately 11 feet from the nearest home. Site preparation, grading/excavation, and/or foundation work may occur up to the west property line. There is an existing home to the west that is located on the shared property line.

Table 11 summarizes the distances to the nearest neighboring residences. Table 12 shows the calculated vibration levels at various distances based on information from the Federal Transit Administration⁵.

Table 11: Distances to Nearest Neighboring Residences

Phase	Distance to nearest offsite residential structure, feet		
	Demolition of existing building	Construction of project building	Construction work area
Phase 1	10	10	3
Phase 2	94	80	80
Phase 3	---	99	96
Phase 4	9	11	along property line

⁵ Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018



Table 12: Calculated Vibration Levels at Various Distances

Equipment	PPV (inches/sec)*					
	10 feet	25 feet	50 feet	80 feet	100 feet	120 feet
Clam Shovel Drop	0.80	0.20	0.07	0.04	0.03	0.03
Vibratory Roller	0.83	0.21	0.07	0.04	0.03	0.02
Hoe Ram	0.35	0.09	0.03	0.02	0.01	0.01
Large Bulldozer	0.35	0.09	0.03	0.02	0.01	0.01
Caisson Drilling	0.35	0.09	0.03	0.02	0.01	0.01
Loaded Trucks	0.30	0.08	0.03	0.01	0.01	0.01
Jackhammer	0.14	0.04	0.01	0.01	< 0.01	< 0.01
Small Bulldozer	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

* Numbers in **bold** indicate vibration levels at or above the impact threshold

Construction vibration has a potential to be feelable and cause annoyance for nearby residences. Caltrans categorizes a PPV of 0.04 inches/sec to be “distinctly perceptible”, a PPV of 0.10 inches/sec to be “strongly perceptible”, and a PPV of 0.4 inches/sec to be “severe”. At a distance of 25 feet, construction vibration levels from the vibratory roller would be greater than Caltrans’ “strongly perceptible” level of PPV 0.1 inches/sec but less than the “severe” level of PPV 0.4 inches/sec. Vibration from a jackhammer would be “distinctly perceptible” and other construction equipment would not be “distinctly perceptible”. In addition, construction equipment vibration at a distance of 25 feet would be less than the guideline vibration damage potential threshold of 0.3 inches/second for older residential structures.

At a distance of 10 feet, vibration from construction equipment such as a bulldozer and jackhammer would be “strongly perceptible” but less than the levels for “severe”. However, vibrations from equipment such as a clam shovel drop, vibratory roller, hoe ram, large bulldozer, and loaded trucks would exceed the guideline vibration damage potential threshold of 0.3 inches/second for older residential structures. Table 13 shows the calculated minimum distances to not exceed the criterion for potential building damage for older residential structures.

Table 13: Minimum Distances to Avoid Exceeding Building Damage Criterion (0.3 inches/second, PPV)

Equipment	Minimum Distance, feet
Clam Shovel Drop	19
Vibratory Roller	20
Hoe Ram	11
Large bulldozer	11
Caisson drilling	11
Loaded trucks	10
Jackhammer	6
Small Bulldozer	2



Since vibration from construction could exceed the threshold for potential building damage for the neighboring homes along the project's east and west property lines, this is considered a potentially significant impact.

Mitigation Measure NO-2 is provided to address the potential for building damage at the homes along the east and west property lines within the calculated minimum distances shown in Table 13. With the implementation of Mitigation Measure NO-2, this is a less than significant impact with mitigation.

There are several buildings within the project site that would remain and there are some new buildings that would be located in close proximity to demolition and construction activities for subsequent phases. Therefore, these buildings could be subject to potentially damaging levels of vibrations. However, consideration of damage to buildings on the project's own property is a standard part of the design and review process for development. This process would ensure that the remaining buildings remain in good condition both during and after the implementation of the Master Plan. Therefore, the potential for construction vibration to damage existing and future buildings on the Aldersly site is considered a less than significant impact.

Mitigation Measure NO-2: Construction Vibration Reduction Measures

A construction vibration analysis must be conducted prior to onset of major construction activities including the issuance of a demolition building permit. The analysis shall take into account project specific construction information, including the location of the various types of equipment used during each phase of the project, in order to determine whether project construction may cause damage to neighboring buildings. The analysis shall also recommend measures to avoid the potential building damage, if feasible and practical. The analysis shall consider the following measures:

- Demolish the existing structures gradually. The structures will be demolished using an excavator. Ground vibration levels can be reduced by limiting the impact forces of the excavator shovel hitting the structures and by carefully taking down the structure in sections, bit-by-bit. The goal is to limit the height from which material falls and hits the ground and to move the shovel slowly when breaking up the building materials as opposed to using fast, sharp impacts. If possible, larger debris pieces should be moved away from the property line (a distance of at least 25 feet) before the excavator or hoe-ram is used to break up the larger pieces.
- Limit the movement of tracked vehicles near existing buildings. Ideally tracked vehicles should be at least 25 feet from the existing buildings. If they are closer than this distance the movements should be limited and slow.
- Vibratory rollers should be kept at least 20 feet from existing buildings. If they must be used closer, consider using smaller models or at lower vibration settings.
- Conduct construction vibration monitoring. Establish warning and stop work thresholds for monitoring. Implement visual and audible signals that are triggered by a vibration monitor when exceedances of warning and stop work thresholds occur.
- Prepare an existing conditions study. If the construction vibration analysis finds that there are no feasible and practical methods to eliminate the potential for damage, a



structural engineer or other appropriate professional shall, with the consent of affected property owners, undertake an existing conditions study of any structures that may experience damage. The existing conditions study shall be undertaken directly before the vibration-producing construction activity is scheduled to occur and will establish the baseline condition of these structures, including, but not limited to, the location and extent of any visible cracks or spalls. The existing conditions study shall include written descriptions and photographs. Immediately upon completion of the applicable phase, the structures previously inspected will be resurveyed, and any new cracks or other changes shall be compared to pre-construction conditions and a determination shall be made as to whether the proposed project caused the damage. If it is determined that project construction has resulted in damage to the structure, the damage shall be repaired to the pre-existing condition by the project sponsor, provided that the property owner approves of the repair.

7.3 Operational Noise (CEQA Checklist a)

7.3.1 Traffic Noise

7.3.1.1 *Thresholds of Significance*

A significant impact would occur if the project would cause a substantial increase in traffic noise. San Rafael General Plan N-5 includes performance standards to maintain an acceptable noise environment in San Rafael, specifically:

“Where the exterior L_{dn} is 65 dB or greater at a residential building or outdoor use area and a plan, program, or project increases traffic noise levels by more than L_{dn} 3 dB, reasonable noise mitigation measures shall be included in the plan, program or project.”

A significant impact would occur if noise from project-generated traffic increases the ambient noise levels by more than L_{dn} 3 dBA.

7.3.1.2 *Traffic Noise Impact Assessment*

According to the project traffic engineer, the project-generated trip volumes under the full buildout condition would result in a net AM peak-hour increase of 1 trip and a PM peak-hour increase of 2 trips. The net change per day is an increase of 28 trips⁶.

In order to determine the increase in traffic noise due to the project, we reviewed existing traffic data from the City provided by the project traffic engineer. According to the City’s traffic data for Mission Avenue, the total AM and PM peak-hour volumes are 807 trips and 769 trips, respectively. The annual average daily traffic (ADT) is 9,999 trips⁷.

⁶ Bergman, Barry, W-Trans. “trip generation for proposed Aldersly expansion.” Email to Anthony Wong, RGD Acoustics, Inc. 22 October 2020.

⁷ Bergman, Barry, W-Trans. “RE: Aldersly noise study – consulting agreement.” Email to Anthony Wong, RGD Acoustics, Inc. 21 October 2020.



Based on the existing traffic and project-generated traffic volumes, traffic noise levels were calculated using the Federal Highway Administration's Traffic Noise Model (TNM 2.5). The TNM model takes into account the vehicle class, speed, road surface, and distance from roadway to receptor. The TNM model calculates an L_{eq} based on peak-hour traffic data at a distance of 35 feet from the roadway centerline. The L_{dn} was then determined based on the difference between the peak-hour L_{eq} and L_{dn} measured at the long-term monitor location (LT-1).

Based on our calculations, the increase in traffic noise due to project-generated traffic would be less than 0.5 dBA (L_{dn}). Since this is less than the significance threshold of an increase of 3 dBA, this is a less than significant impact.

7.3.2 Mechanical Equipment (HVAC) (CEQA Checklist a)

7.3.2.1 *Thresholds of Significance*

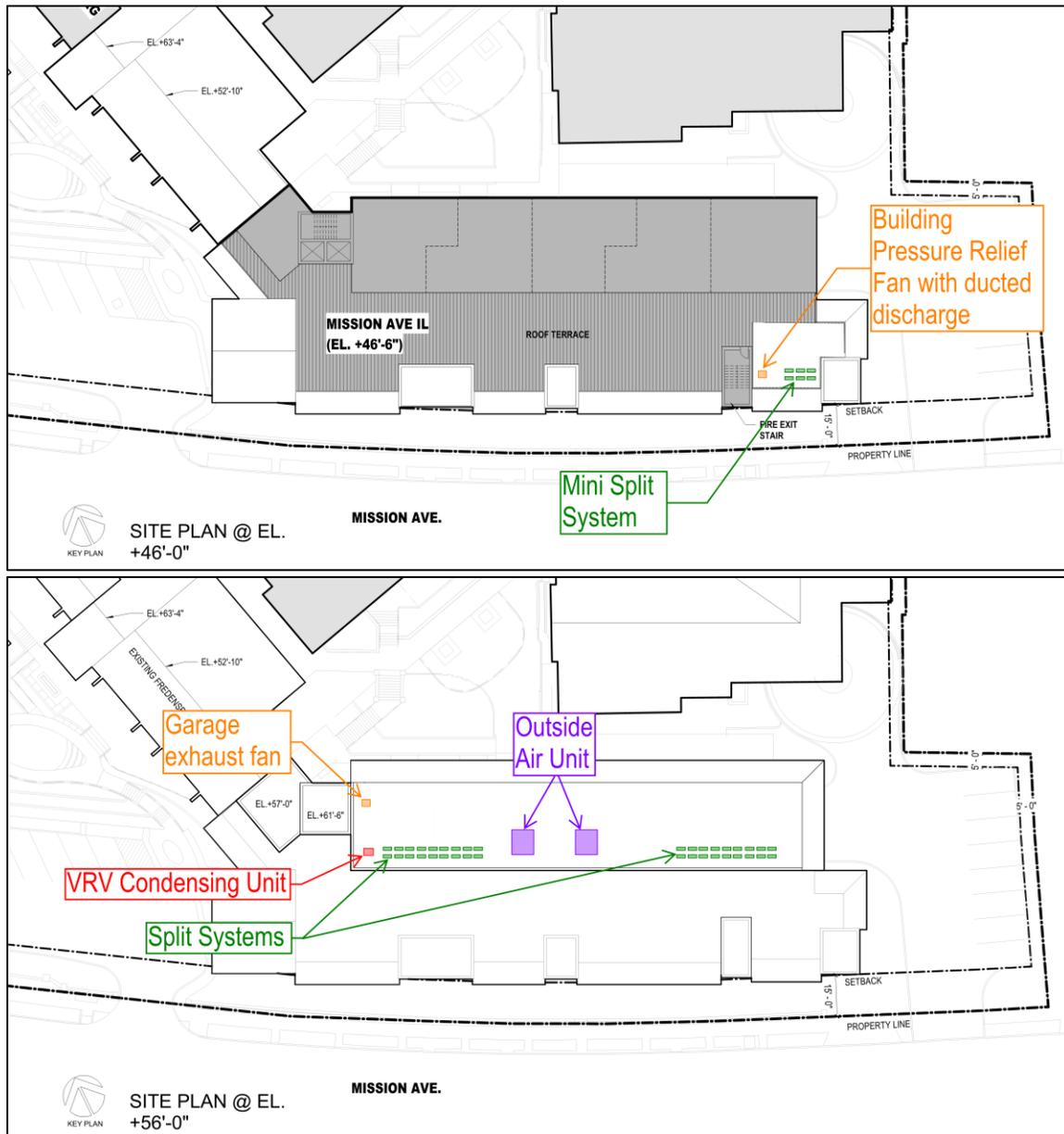
Mechanical equipment noise that exceeds the limits set forth in the City's Municipal Code Section 8.13.040 (Table 1) is considered a significant impact.

7.3.2.2 *Mechanical Equipment Noise Impact Assessment*

Typical residential developments have outdoor mechanical equipment associated with building ventilation/air-conditioning systems. This equipment is usually located adjacent to or on the buildings that include the residential units being served. According to the project architect, the preliminary mechanical system design for the new 35-unit independent living building along Mission Avenue would include 42 split systems, two outside air handling units, one garage exhaust fan, one condensing unit, and one pressure relief fan⁸. Figure 13 shows the preliminary outdoor mechanical equipment locations.

⁸ Im, Soo, Perkins Eastman. "Aldersly electrical and mechanical information." Email to Anthony Wong, RGD Acoustics, Inc. 22 October 2020.

Figure 13: Preliminary Outdoor Mechanical Equipment Locations



According to the City's municipal code, maximum allowable exterior noise levels from the project are determined by the property type and shall be measured at the receiving property. For steady mechanical equipment noise, the maximum noise levels for residential is:

- 50 dBA during the City's daytime hours of 7 a.m. to 9 p.m. Sunday to Thursday and 7 a.m. to 10 p.m. Friday to Saturday.
- 40 dBA during the City's nighttime hours of 9 p.m. to 7 a.m. Sunday to Thursday and 10 p.m. to 7 a.m. Friday to Saturday.

At the time of this report, there is no information on manufacturer or model of the mechanical equipment. Therefore, we calculated mechanical equipment noise using typical commercial equipment noise data. Our calculations indicate that with all mechanical equipment turned on, noise from mechanical equipment would be approximately 46 dBA at the residential property across Mission Avenue and approximately 38 dBA at the residential property to the east of the project site. A noise level of 46 dBA at the residences across Mission Avenue would comply with the City's daytime noise limits but exceed the nighttime noise limit. Measures to reduce the mechanical equipment noise to the City standards are feasible and would include selecting quieter mechanical equipment, relocation of equipment and/or installation of a noise reducing screen.

Any outdoor mechanical equipment would need to comply with the City's municipal code requirements. Detailed analysis of noise from the project's final mechanical system design must be conducted during the architectural design phase to determine if the proposed mechanical equipment will comply with the City's municipal code requirements.

This is considered a less than significant impact with Mitigation Measure NO-3.

Mitigation Measure NO-3: Mechanical Equipment Noise

Analysis of noise from any proposed project's outdoor mechanical equipment must be conducted to determine what, if any, noise control measures must be included in the design such that the combined noise level generated by all noise-generating outdoor mechanical equipment shall comply with the City's municipal code requirements per Section 8.13.040. This analysis must be completed prior to building permit issuance.

7.4 Airport Noise (CEQA Checklist c)

7.4.1.1 Thresholds of Significance

A significant impact would occur if the project would expose people residing or working in the project area to excessive aircraft noise levels.

7.4.1.2 Airport Noise Impact Assessment

There is no airport located within a 2-mile radius of the project site. The project is also not located within the nearest airport's noise contour as shown in San Rafael General Plan Exhibit 32. Therefore, there is no impact.

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22 November 2021

Gilbert Carrasco
Aldersly Inc.
326 Mission Ave.
San Rafael, CA 94901

Subject: Groundborne Vibration from Construction
Project: Aldersly Retirement Community – Master Plan Amendment
RGD #: 20-057

Dear Mr. Carrasco:

We recently received a comment from the City regarding the environmental noise study we prepared for the Master Plan Amendment (RGD project number 20-057, report dated 6 November 2020). The comment relates to the analysis of potential impacts associated with groundborne vibration from construction. Apparently, there was a change in Policy N-1.11 between the draft and final versions of General Plan 2040. As a result, there was a question as to whether that change affects the results of our impact analysis.

In summary, the change in Policy N-1.11 between the draft and final version of the 2040 General Plan does not alter our original finding that the potential impact of groundborne vibration from construction is less than significant with mitigation.

Background

During the preparation of our study, the City's current general plan (2020) did not have any specific policy with respect to groundborne vibration from construction. Therefore, we looked toward General Plan 2040 which was in "draft for public review" form. Draft General Plan 2040 included *Policy N-1.11* and associated *Program N-1.11A* which stated that vibration impacts shall be considered as part of project level evaluation and approval for individual future projects.

While the policy and program stated that the vibration impacts needed to be considered, it did not provide any guidance on what specific criteria should be used for an assessment. Therefore, we used criteria promulgated by Caltrans and found that construction vibration could affect some nearby residences. We concluded that the potential impact from vibration could be mitigated through the adoption of Mitigation Measure NO-2.

Discussion and Conclusion

The environmental noise study uses guideline criteria for building damage recommended by Caltrans which is a peak particle velocity (PPV) of 0.3 in/sec for older residential structures. Our study found that the vibration damage threshold could be exceeded at some nearby buildings along the projects east and west property line. However, it was concluded that this potential impact could be mitigated with the implementation of Mitigation Measure NO-2 Constriction Vibration Reduction Measures.

With the adoption of the City's General Plan 2040 (in its final form), the language in program N-1.11A specifies use of the FTA vibration damage criteria. Therefore, we did a comparison of Caltrans and FTA criteria as it relates to building damage. While the FTA uses the same metric as Caltrans (PPV), it does adopt a slightly lower (more restrictive) limit for non-engineered timber and masonry buildings; a PPV of 0.2 in/sec.

The difference between the FTA and Caltrans criteria is relatively minor and results in a small change in the affected area. For example, using Caltrans criteria, a vibratory roller would have the potential to exceed the vibration damage threshold at any building within 20 feet. Using the FTA criteria, this zone would increase by about six feet to 26 feet. The distance from a hoe ram would increase by about four feet from 11 feet to 15 feet.

In conclusion, the use of the FTA criteria for building damage in lieu of Caltrans' results in a relatively small change in the areas that could be adversely affected by vibration from construction. The result is that there is no change to the original impact finding or the resulting mitigation measure NO-2.

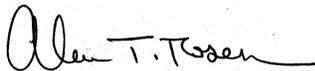
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This concludes our discussion. Should you have any questions please do not hesitate to contact me.

Sincerely,



Alan Rosen
Principal
RGD Acoustics, Inc.