S Bernardo Townhomes

Sunnyvale, California

ENVIRONMENTAL NOISE ASSESSMENT

4 June 2025

Prepared for: Mozart Development | Classic Communities
Forrest Mozart — fmozart@mozartdev.com
1068 East Meadow Circle
Palo Alto, CA 94303

Prepared by: Salter
Josh Roper, PE, LEED® AP — jroper@salter-inc.com
Niko Abenoja — nabenoja@salter-inc.com

Salter Project 25-0200

INTRODUCTION

This report summarizes our environmental noise assessment for the S Bernardo Townhomes project at 494 S. Bernardo Avenue in Sunnyvale, California. The residential project consists of 28 three-story townhome units in six 4-, 5-, or 7-plex buildings. The approximately 63,000 square foot site is generally flat and located about a block north of El Camino Real. Surrounding land uses appear to be residential, with commercial uses fronting El Camino Real. The purpose of this study is to quantify the noise environment at the site, compare it with applicable City standards, and provide conceptual noise reduction measures as needed. Readers less familiar with the fundamental concepts of environmental acoustics, please refer to Appendix A attached.

Following is a summary of our findings:

1. Exterior-to-Interior Noise – Preliminary estimates suggest that windows and exterior doors with sound insulation ratings up to STC 34 will be needed to meet the L_{dn}[1] 45 dB(A)[2] goal indoors, due to exterior sources. Since windows will need to be closed to meet this goal, ventilation systems must not compromise exterior-to-interior sound insulation.
2. Outdoor Use Spaces – Common outdoor use space will be provided between the 4-plex buildings in the center portion of the site, between the 4- and 5-plex buildings along S Bernardo Avenue, and in landscaped areas adjacent to portions of the northern and eastern property lines. Estimated traffic noise at the center of these open spaces is L_{dn} 65 dB(A) or less, which meets the City's goal.
3. Construction of the project will be subject to Section 16.08.030 of the Municipal Code. Allowable hours of construction activities, and noise reduction measures, are summarized in the Construction Noise section below.

ACOUSTICAL CRITERIA

Sunnyvale General Plan

The Safety and Noise chapter of the Sunnyvale General Plan includes interior and exterior noise standards for residential projects which are summarized as follows:

---

1 L_{dn} (Day-Night Average Sound Level) – A descriptor for a 24-hour A-weighted average noise level. L_{dn} accounts for the increased acoustical sensitivity of people to noise during the nighttime hours. L_{dn} penalizes sound levels by 10 dB during the hours from 10 PM to 7 AM. For practical purposes, the L_{dn} and CNEL are usually interchangeable. L_{dn} is sometimes written as DNL.

2 A-Weighted Sound Level – The A-weighted sound pressure level, expressed in decibels (dB). Sometimes the unit of sound level is written as dB(A). A weighting is a standard weighting that accounts for the sensitivity of human hearing to the range of audible frequencies. People perceive a 10 dB increase in sound level to be twice as loud.

- The interior noise goal is L_{dn} 45 dB(A), measured with doors and windows closed, as outlined in Policy SN-8.2.[3] Consistent with the California Building Code, this assessment applies this criterion to habitable rooms.
- Table 6-6 and Policy SN-8.9 identify L_{dn} 65 dB(A) as the "normally acceptable" exterior noise level for primary useable open space (the policy states that it is to be applied to the center of the open space and does not apply to front yards, balconies, or porches).

In addition, the General Plan includes Policy SN-8.4 which states: *Require development projects to assess potential construction noise impacts on nearby noise-sensitive land uses and to minimized impacts on those uses, to the extent feasible, as determined by the director of community development.*

Sunnyvale Municipal Code

Section 16.08.030 of the Sunnyvale Municipal Code limits construction activity as follows:

- Construction activity is only acceptable between 7:00 AM and 6:00 PM, Monday through Friday, and between 8:00 AM and 5:00 PM on Saturdays. Construction is not permitted on Sundays or federal holidays when City offices are closed.
- The section states: "No loud environmentally disruptive noises, such as air compressors without mufflers, continuously running motors or generators, loud playing musical instruments, radios, etc., will be allowed where such noises may be a nuisance to adjacent residential neighborhoods", except where emergency conditions exist.

California Building Code (CBC)

The 2022 California Building Code, Section 1206.4, states that interior noise levels in habitable rooms, attributable to exterior sources, shall not exceed L_{dn} 45 dB(A) in any habitable room.

NOISE ENVIRONMENT

Environmental noise at the site is dominated by vehicular traffic on S Bernardo Avenue and El Camino Real. To quantify the noise environment, two multi-day monitors continuously measured noise levels at the site between 7 and 9 May 2025. In addition, a short-term "spot" measurement was conducted, and the data was compared with corresponding time periods of the multi-day monitors to determine how noise levels vary with location and elevation. Table 1, below, summarizes measured noise levels. Figure 1, attached, shows the approximate measurement locations.

[3] Policy SN-8.3 states: *Attempt to achieve a maximum instantaneous noise level of 50 dB(A) in bedrooms and 55 dB(A) in other areas of residential units exposed to transit (e.g., freight, Caltrain, High Speed Rail, VTA Light Rail).* The site is not exposed to significant train noise; therefore, this criterion has not been discussed further in this assessment.

Table 1: Existing Noise Environment

Site	Location[4]	Date/Time	L_{dn}
LT-1	S. Bernardo Avenue Monitor Approx. 25' from roadway centerline	7 to 9 May 2025	71 dB(A)
LT-2	W. Olive Avenue Monitor Approx. 20' from roadway centerline		60 dB(A)
ST-1	Corner of Bernardo and Olive Spot Approx. 45' from S Bernardo centerline	7 May 2025 4:40 – 4:55 PM	66 dB(A)

A traffic study has not been provided for this project. The following analysis uses a 1 dB increase in noise levels across the site to account for future traffic increases.[5]

ANALYSIS AND RECOMMENDATIONS

Exterior-to-Interior Noise

Exterior building assemblies nearest S Bernardo Avenue will need to be sound rated to reduce transportation noise to the L_{dn} 45 dB(A) interior noise criterion outlined above. Preliminary estimates suggest that windows and exterior doors will need to have sound insulation ratings of STC[6] 34 in rooms along S. Bernardo Avenue and STC 30 in dining rooms of end units along this roadway. In other locations, STC 28 ratings should suffice. These preliminary estimates are based on the following assumptions, and will need to be updated based on unit floor plans prior to construction:

- Site Plan dated 21 February 2025
- Bedrooms will be approximately 12 feet by 10 feet, living rooms approximately 15 feet by 12 feet, and all rooms approximately 9 feet tall
- Windows and doors comprise approximately 40-percent of the exterior façade of each room
- Exterior walls will be equivalent to 3-coat stucco over wood sheathing, 2x wood studs with batt insulation in stud cavities, with at least 1 layer of gypsum board on the interior
- Ventilation systems will not compromise exterior to interior sound isolation in residences

For reference, standard construction grade dual-pane windows and sliding glass doors typically have sound insulation ratings of STC 26 to 28. Sound insulation ratings should be for the complete assembly,

4 Multi-day monitors LT-1 and LT-2 were at a height of approximately 10-feet above grade, short-term monitor ST-1 was at heights of approximately 5 and 25-feet above grade.

5 The California Department of Transportation assumes a traffic volume increase of three percent per year, which corresponds to a 1 dB increase in DNL over a ten-year period.

6 STC (Sound Transmission Class) – A single-number rating defined in ASTM E90 that quantifies the airborne sound insulating performance of a partition under laboratory conditions. Increasing STC ratings correspond to improved airborne sound insulation.

including glass and frame, and should be based on laboratory test reports of similar sized samples from an NVLAP accredited lab.

Ventilation systems should not compromise the sound insulation of the exterior wall assemblies. Because windows will need to be closed to meet the interior noise criterion, an alternate means of providing outside air to habitable spaces should be provided.

Outdoor Use Spaces

The project will include common outdoor use space between the 4-plex buildings in the center portion of the site, between the 4- and 5-plex buildings along S Bernardo Avenue, and in landscaped areas adjacent to portions of the northern and eastern property lines. Estimated traffic noise at the center of these open spaces is L_{dn} 65 dB(A) or less, which meets the City's goal.

CONSTRUCTION NOISE

The site is located adjacent to single and multi-family residences on the adjacent sites. Construction of the project will include demolition of the existing single-story childcare center building currently on the site, site preparation and foundations, new building framing, and finishing. Construction is expected to begin around January of 2026 and generally last about a year with portions of the following Phases II and III progressing concurrently:

- Phase I: Demolition and site cleaning - 1 month
- Phase II: Site work – 2-3 months
- Phase III: Home/building construction - 10 months

Foundations will be slab on grade so construction will not include pile driving. Noise levels from construction activities will vary depending on the type of equipment being used, the process, and the location. Table 1 below shows typical sound levels for various construction activities anticipated for this project at a reference distance of 50 feet.[7]

Table 1: Typical Construction Equipment Sound Levels[8]

Equipment	Typical Sound Level 50 feet from Source
Concrete Pump and Mixer, Backhoe, Dozer, Impact Wrench, Loader, Pneumatic Tools, Air Compressors, Jack Hammers	80 to 88 dB(A)

[7] Construction noise typically drops off at a rate of 6 dB(A) per doubling of distance. Therefore, corresponding noise levels at distances farther than 50 feet will be lower. For reference, the center of the project site is more than 50 feet from neighboring property lines.

[8] Source: Table 12-1: Construction Equipment Noise Emission Levels, Transit Noise and Vibration Impact Assessment, US Department of Transportation, May 2006.

Construction of the project will be subject to provisions in Section 16.08.030 of the Sunnyvale Municipal Code. Following is a list of measures that will be adopted by the contractor to reduce the impact of general construction noise on neighbors:

1. Consistent with Section 16.08.030 of the Sunnyvale Municipal Code, construction will be limited to between 7:00 AM and 6:00 PM, Monday through Friday, and between 8:00 AM and 5:00 PM on Saturdays. Construction will not occur on Sundays or federal holidays when City offices are closed.
2. Contractors shall utilize 'quiet' models of air compressors and other stationary noise sources where technology exists.
3. Internal combustion engine-driven equipment shall be equipped with mufflers which are in good condition and appropriate for the equipment.
4. Stationary noise-generating equipment, such as air compressors and portable power generators, shall be located as far away as possible from adjacent land uses including residences.
5. Staging areas and construction material areas shall be located as far away as feasible from adjacent residences.
6. Prohibit all unnecessary idling of internal combustion engines (engines will be turned off when not in use to avoid unnecessary idling).
7. Administrative controls will limit the volume on construction workers' radios, so they are not audible at adjacent residences.
8. The contractor shall designate a "noise disturbance coordinator/superintendent" who will be responsible for tracking and responding to any local complaints about construction noise. The noise disturbance coordinator/superintendent will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures are implemented to correct the problem.
9. The telephone number for the noise disturbance coordinator/superintendent will be posted at the construction site and included in any construction notices sent to neighbors.

* * *

SOUTH BERNARDO TOWNHOMES MEASUREMENT LOCATIONS AND MEASURED NOISE LEVELS

FIGURE 1

Salter #	NA/JMR
25-0200	05.XX.25

APPENDIX A

Fundamental Concepts of Environmental Noise

This section provides background information to aid in understanding the technical aspects of this report. Three dimensions of environmental noise are important in determining subjective response. These are:

- The intensity or level of the sound
- The frequency spectrum of the sound
- The time-varying character of the sound

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB), with 0 dB corresponding roughly to the threshold of hearing.

The "frequency" of a sound refers to the number of complete pressure fluctuations per second in the sound. The unit of measurement is the cycle per second (cps) or hertz (Hz). Most of the sounds which we hear in the environment, do not consist of a single frequency, but of a broad band of frequencies, differing in level. The name of the frequency and level content of a sound is its sound spectrum. A sound spectrum for engineering purposes is typically described in terms of octave bands, which separate the audible frequency range (for human beings, from about 20 to 20,000 Hz) into ten segments.

Many rating methods have been devised to permit comparisons of sounds having quite different spectra. Surprisingly, the simplest method correlates with human response practically as well as the more complex methods. This method consists of evaluating all of the frequencies of a sound in accordance with a weighting that progressively de-emphasizes the importance of frequency components below 1000 Hz and above 5000 Hz. This frequency weighting reflects the fact that human hearing is less sensitive at low frequencies and at extreme high frequencies relative to the mid-range.

The weighting system described above is called "A"-weighting, and the level so measured is called the "A-weighted sound level" or "A-weighted noise level." The unit of A-weighted sound level is sometimes abbreviated "dB." In practice, the sound level is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting characteristic. All U.S. and international standard sound level meters include such a filter. Typical sound levels found in the environment and in industry are shown below.

Although a single sound level value may adequately describe environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise is a conglomeration of distant noise sources, which results in a relatively steady background noise having no identifiable source. These distant sources may include traffic, wind in trees, industrial activities, etc. and are relatively constant from moment to moment. As natural forces change or as human activity follows its daily cycle, the sound level may vary slowly from hour to hour. Superimposed on this slowly varying background is a succession of

identifiable noisy events of brief duration. These may include nearby activities such as single vehicle pass-bys, aircraft flyovers, etc. which cause the environmental noise level to vary from instant to instant.

To describe the time-varying character of environmental noise, statistical noise descriptors were developed. "L10" is the A-weighted sound level equaled or exceeded during 10 percent of a stated time period. The L10 is considered a good measure of the maximum sound levels caused by discrete noise events. "L50" is the A-weighted sound level that is equaled or exceeds 50 percent of a stated time period; it represents the median sound level. The "L90" is the A-weighted sound level equaled or exceeded during 90 percent of a stated time period and is used to describe the background noise.

As it is often cumbersome to quantify the noise environment with a set of statistical descriptors, a single number called the average sound level or "Leq" is now widely used. The term "Leq" originated from the concept of a so-called equivalent sound level which contains the same acoustical energy as a varying sound level during the same time period. In simple but accurate technical language, the Leq is the average A-weighted sound level in a stated time period. The Leq is particularly useful in describing the subjective change in an environment where the source of noise remains the same but there is change in the level of activity. Widening roads and/or increasing traffic are examples of this kind of situation.

In determining the daily measure of environmental noise, it is important to account for the different response of people to daytime and nighttime noise. During the nighttime, exterior background noise levels are generally lower than in the daytime; however, most household noise also decreases at night, thus exterior noise intrusions again become noticeable. Further, most people trying to sleep at night are more sensitive to noise. To account for human sensitivity to nighttime noise levels, a special descriptor was developed. The descriptor is called the Ldn (Day/Night Average Sound Level), which represents the 24-hour average sound level with a penalty for noise occurring at night. The Ldn computation divides the 24-hour day into two periods: daytime (7:00 am to 10:00 pm); and nighttime (10:00 pm to 7:00 am). The nighttime sound levels are assigned a 10 dB penalty prior to averaging with daytime hourly sound levels.

For highway noise environments, the average noise level during the peak hour traffic volume is approximately equal to the DNL.

The effects of noise on people can be listed in three general categories:

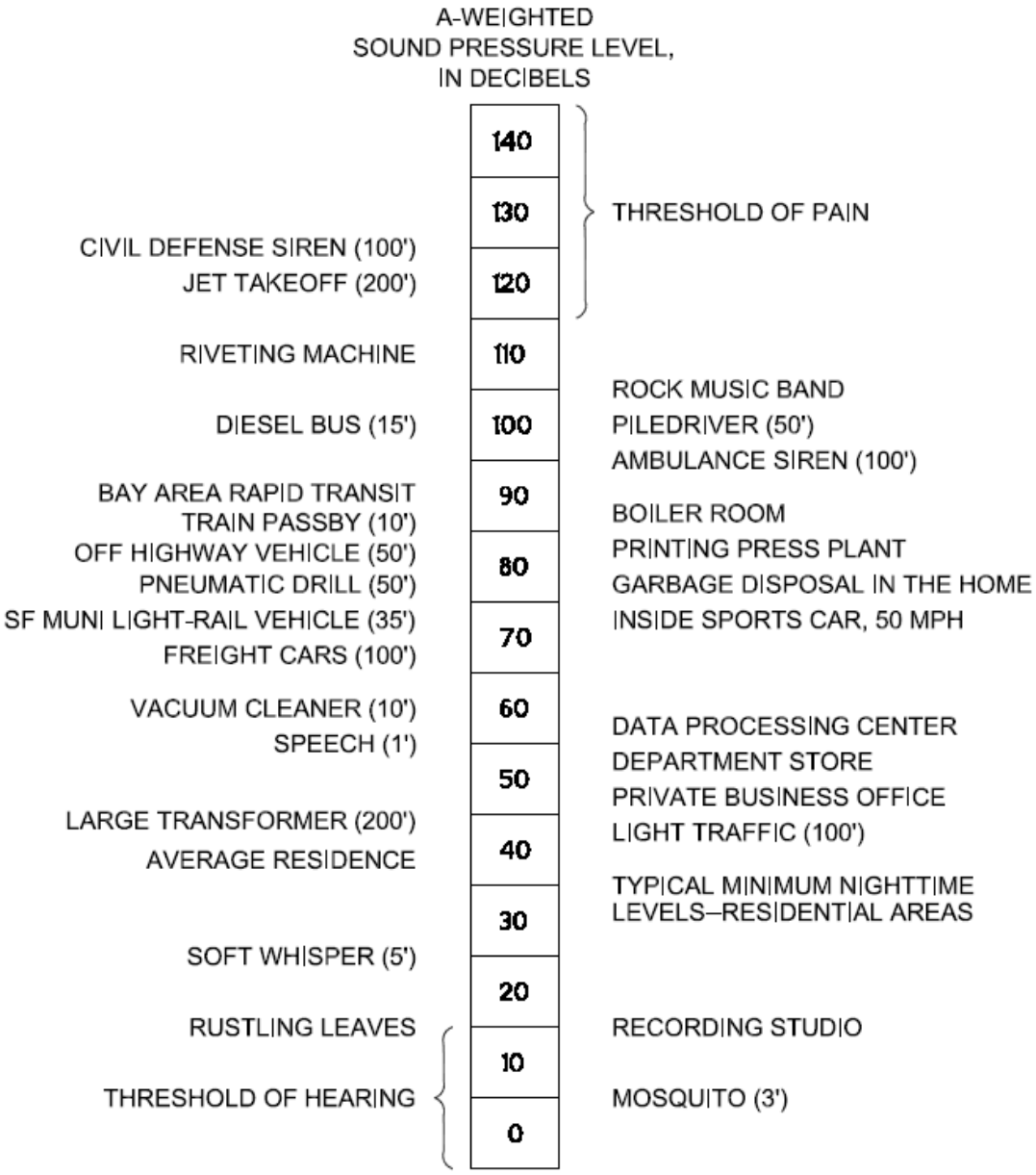
- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as startle, hearing loss

The sound levels associated with environmental noise usually produce effects only in the first two categories. Unfortunately, there has never been a completely predictable measure for the subjective effects of noise nor of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over time.

Thus, an important factor in assessing a person's subjective reaction is to compare the new noise environment to the existing noise environment. In general, the more a new noise exceeds the existing, the less acceptable the new noise will be judged.

With regard to increases in noise level, knowledge of the following relationships will be helpful in understanding the quantitative sections of this report:

Except in carefully controlled laboratory experiments, a change of only 1 dB in sound level cannot be perceived. Outside of the laboratory, a 3 dB change is considered a just-noticeable difference. A change in level of at least 5 dB is required before any noticeable change in community response would be expected. A 10 dB change is subjectively heard as approximately a doubling in loudness and would almost certainly cause an adverse community response.


A-WEIGHTED
SOUND PRESSURE LEVEL,
IN DECIBELS
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
THRESHOLD OF PAIN
CIVIL DEFENSE SIREN (100')
JET TAKEOFF (200')
RIVETING MACHINE
DIESEL BUS (15')
ROCK MUSIC BAND
PILEDRIVER (50')
AMBULANCE SIREN (100')
BAY AREA RAPID TRANSIT
TRAIN PASSBY (10')
OFF HIGHWAY VEHICLE (50')
PNEUMATIC DRILL (50')
BOILER ROOM
PRINTING PRESS PLANT
GARBAGE DISPOSAL IN THE HOME
SF MUNI LIGHT-RAIL VEHICLE (35')
FREIGHT CARS (100')
INSIDE SPORTS CAR, 50 MPH
VACUUM CLEANER (10')
SPEECH (1')
DATA PROCESSING CENTER
DEPARTMENT STORE
PRIVATE BUSINESS OFFICE
LARGE TRANSFORMER (200')
AVERAGE RESIDENCE
LIGHT TRAFFIC (100')
TYPICAL MINIMUM NIGHTTIME
LEVELS–RESIDENTIAL AREAS
SOFT WHISPER (5')
RUSTLING LEAVES
RECORDING STUDIO
THRESHOLD OF HEARING
MOSQUITO (3')
(100') = DISTANCE IN FEET
BETWEEN SOURCE
AND LISTENER
© 2004
CHARLES M. SALTER ASSOCIATES, INC.
FOR ACOUSTICAL DESIGN INFORMATION ONLY
TYPICAL SOUND LEVELS
MEASURED IN THE
ENVIRONMENT AND INDUSTRY
FIGURE
1107
C
11.25.03