

Acoustics
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12 June 2017

John Lucchesi AIA
John Matthews Architects
335A East 4th Avenue
San Mateo CA 94401
Via email: john@matthewsarchitects.com

Subject: 4 West Santa Inez, San Mateo, CA
Preliminary Environmental Noise Study
CSA Project No. 17-0348

Dear John:

As requested, we have conducted a preliminary environmental noise study for the project. The purpose of the study is to determine the noise environment at the proposed site, compare the noise environment with applicable standards, and propose schematic mitigation measures as necessary. For those readers unfamiliar with environmental acoustics, please see appendix I at the end of this report. Our environmental noise study follows below.

SUMMARY

The project will comply with local and state noise standards provided it incorporates sound rated windows at the exterior facades and follows a construction noise plan limiting construction hours within the city guidelines and incorporating the noise reducing measures outlined in this report.

PROJECT CRITERIA

This project applies the following applicable criteria:

California Building Code 1207.4 – Allowable interior noise levels. Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric shall be either the day-night average sound level (Ldn) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.

San Mateo Noise Element – POLICIES:

N 1.1: Interior Noise Level Standard. Require submittal of an acoustical analysis and interior noise insulation for all “noise sensitive” land uses listed in Table N-1 that have an exterior noise level of 60 dB Ldn) or above, as shown on Figure N-1. The maximum interior noise level shall not exceed 45 dB (Ldn) in any habitable rooms.

N 1.2: Exterior Noise Level Standard. Require an acoustical analysis for new parks, play areas, and multi-family common open space (intended for the use and the enjoyment of residents) that have an exterior noise level of 60 dB (Ldn) or above, as shown on Figure N-1. Require an acoustical analysis that uses peak hour Leq for new parks and play areas. Require a feasibility analysis of noise reduction measures for public parks and play areas. Incorporate necessary mitigation measures into residential

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project design to minimize common open space noise levels. Maximum exterior noise should not exceed 67 dB (Ldn) for residential uses and should not exceed 65 dB (Leq) during the noisiest hour for public park uses.

N 2.2: Minimize Noise Impact. Protect all “noise-sensitive” land uses listed in Tables N-1 and N-2 from adverse impacts caused by the noise generated on-site by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit long-term exposure increases of 3dB (Ln) or greater at the common property line, or new uses which generate noise levels of 60 dB (Ldn) or greater at the property line, excluding existing ambient noise levels.

San Mateo Noise Ordinance – 7.30.060 SPECIAL PROVISIONS

(e) Construction

Construction, alteration, repair or land development activities which are authorized by a valid city permit shall be allowed on weekdays between the hours of seven a.m. and seven p.m., on Saturdays between the hours of eight a.m. and five p.m., and on Sundays and holidays between the hours of noon and four p.m., or at such other hours as may be authorized or restricted by the permit, if they meet at least one of the following noise limitations:

(1) No individual piece of equipment shall produce a noise level exceeding ninety dB at a distance of twenty-five feet. If the device is housed within a structure or trailer on the property, the measurement shall be made outside the structure at a distance as close to twenty-five feet from the equipment as possible.

(2) The noise level at any point outside of the property plane of the project shall not exceed ninety dB.

NOISE ENVIRONMENT

The project site is on El Camino Real between Engle Street and W Santa Inez Street. The major noise source in the area is traffic on El Camino Real. The project is set back approximately 56 feet from the centerline of El Camino Real

Between 7 and 8 June 2017, we conducted one continuous 24-hour noise measurement at the project site. The monitor was located along El Camino Real, 28 feet from the centerline of the roadway (LT-1 on the included site layout, Figure 1).

On 8 June 2006, we performed one short-term measurement at the project site along Engle Street. The monitor was approximately 80 feet from the centerline of El Camino Real. (ST-1 on the included site layout, Figure 1).

We measured Ldn 76 dB along El Camino. The project is set back 56 feet from El Camino Real. Therefore, we calculate that the units facing El Camino Real would be exposed to Ldn 73 dB due to traffic noise. Units facing Engle Street or W Santa Inez would be exposed to Ldn 68 dB. For our analysis, we added one dB to these noise levels to account for future traffic noise increases.

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Figure 1: Noise Measurement Locations

RECOMMENDATIONS

Interior – To meet the CBC and San Mateo Noise Element Ldn 45 dB requirement, it will be necessary for the facades to be sound rated. For our calculations, we used a generalized site map showing the building massing. We assumed typical bedroom and living room volumes and room treatments (carpeted bedroom, hard floor living), standard 3-coat stucco exterior wall construction and 40% glazing. The minimum STC ratings needed at exterior windows and doors are summarized in Table 1. As the project develops, an acoustical consultant should analyze the STC requirements in detail.

Table 1: Minimum STC ratings for exterior windows and doors

Façade	Minimum STC Rating	Minimum Corner Unit STC
North (facing El Camino Real)	35	37
West (facing Engles Road)	30	32
East (facing W Santa Inez Avenue)	30	32
South (away from El Camino Real)	No minimum rating required	No minimum rating required

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Typical construction-grade dual-pane thermal windows achieve an STC rating of 28. It is important to note that the STC ratings are for full window assemblies (glass and frame) rather than just the glass

itself. Tested sound-rated assemblies should be used. If non-tested assemblies were to be used, the STC rating of the glass may need to be increased.

The Building Code requires that where windows need to be closed to achieve DNL 45 dB indoors, an alternative method of supplying fresh air (e.g., mechanical ventilation) must be provided. This applies to all units in the project. This issue should be discussed with the project mechanical engineer.

Exterior – Outdoor patios facing El Camino Real, Engle Road or W. Santa Inez would be exposed to noise levels that exceed Leq 65 dB. In general, noise reduction at outdoor spaces is achieved by shielding the area from the noise source with a solid barrier. At some locations (Engle Road and W. Santa Inez Avenue), noise barriers could be used to meet the Leq 65 dB noise goal. At other locations (facing El Camino), meeting the Leq 65 dB noise goal could only be met by completely enclosing the patios. The project may choose to incorporate interior courtyards for common outdoor space using the building as a significant noise barrier.

Construction Noise – Typical construction noise phases include demolition, grading, foundation, framing, then construction of the building. Typical noise levels from these activities are summarized in the following table.

Typical Noise Levels of Construction Equipment at 50 feet¹	
Equipment Type	Sound Level (dB)
Backhoe	85
Excavator	84
10 Wheel Dump Truck	85
Loader	78
Concrete Truck	82
Concrete Pump	82
Conventional Crane	85
Air Compressor	81
Welding Machine	73
Concrete Saw	83
Truck Back-up Beeper	76

Noise levels from construction could reach levels between 79 to 91 dB on the site. Unmitigated construction noise levels could temporarily exceed the levels set forth in the San Mateo Noise Ordinance. To address potential noise disturbances, we recommend the following measures.

An owner or contractor Noise Disturbance Coordinator should be appointed to act as a liaison between the condominium development and adjacent neighbors. The Disturbance Coordinator responsibilities and authority should be as follows:

¹ CSA Projects 98-0352 and 01-0109, and Page 58 in "Acoustics", Charles M Salter Associates, 1998

1. Familiarity with the project and construction schedule, including attending weekly construction meetings.
2. An active role in monitoring project compliance with respect to noise.
3. Consider rescheduling noisy construction activities to minimize effects on surrounding noise sensitive receivers.
4. Site supervision of all potential sources of noise (e.g., material delivery, shouting, debris box pick-up and delivery) for all trades.
5. Intervene or discuss mitigation options with contractor.

The General Contractor should implement the following construction noise mitigation measures:

1. All internal combustion engine-driven construction equipment should be equipped with the best available mufflers and kept in good condition.
2. When feasible, "quiet" gasoline or electric-powered compressors should be used.
3. When feasible electric rather than gasoline or diesel-powered forklifts should be used. However, we understand that the load demands cannot be handled by electric lifts.
4. Where feasible, welded rather than bolted steel connections should be used when possible to minimize the use of impact wrenches.
5. Where possible, barriers should be erected around stationary noise generating operations.
6. Construction vehicles should be required to turn off engines and compressors when not in operation.
7. Define truck routes to confine noisy trucks to streets that currently have the heaviest traffic. We understand that these routes will be determined by the City's Planning Department
8. Where feasible, develop a truck staging area away from acoustically sensitive areas.
9. Where feasible, use an electric-powered tower crane instead of a diesel-powered truck crane. However, we understand that the load demands of this project require diesel-powered equipment.
10. Use structural steel frames in lieu of concrete structural frames to yield a much shorter assembly time.
11. If feasible, pre-cut metal decks and, to the extent possible, metal studs off-site to minimize on-site sawing.
12. For excavation, use drilled soldier piles with wood lagging instead of sheet pile driving techniques.
13. Avoid impact pile driving.
14. Retain an acoustical consultant to periodically measure noise levels and provide assistance with developing additional noise attenuation techniques where needed.
15. Where reasonable, avoid hammer drilling; use core bits, instead.
16. Where possible, avoid using powder-actuated fasteners; use concrete screws, instead.
17. Avoid sheet metal debris chutes; use plastic chutes, instead.
18. The General Contractor should maintain awareness among all trades of the noise sensitivity of project.
19. Where possible, avoid sand blasting.

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This concludes our environmental noise study for the West Santa Inez project. Should you have any questions, please give us a call.

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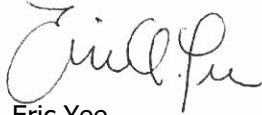
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This concludes our current comments on the subject project. Please contact us if you have any questions.

Sincerely,

CHARLES M. SALTER ASSOCIATES



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Vice President

2017-06-10 W Santa Inez Condo ENS

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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:

- a) The intensity or level of the sound;
- b) The frequency spectrum of the sound;
- c) 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 "dBA." 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 in Figure A-1.

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 passbys, 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 exceeded 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 Ldn.

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

- a) Subjective effects of annoyance, nuisance, dissatisfaction;
- b) Interference with activities such as speech, sleep, and learning;
- c) 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:

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

FNDA2LDN

A-WEIGHTED
SOUND PRESSURE LEVEL,
IN DECIBELS



(100') = DISTANCE IN FEET
BETWEEN SOURCE
AND LISTENER

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TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

FIGURE A1

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