Appendix F-1

Noise Background

Background

The unit of measurement used to describe a noise level is the decibel (dB). However, the human ear is not equally sensitive to all frequencies within the sound spectrum. Therefore, a method called "A weighting" is used to adjust actual sound pressure levels so that they are consistent with the human hearing response, which is most sensitive to frequencies around 4,000 Hertz (Hz) and less sensitive to frequencies around and below 100 Hz, thus filtering out noise frequencies that are not audible to the human ear. A weighting approximates the frequency response of the average young ear when listening to most ordinary everyday sounds. When people make relative judgments of the loudness or annoyance of a sound, their judgments correlate well with the "A-weighted" levels of those sounds. Therefore, the A-weighted noise scale is used for measurements and standards involving the human perception of noise. In this analysis, all noise levels are A-weighted, and "dBA" is understood to identify the A-weighted decibel.

Decibels are measured on a logarithmic scale that quantifies sound intensity in a manner similar to the Richter scale used for earthquake magnitudes. A doubling of the energy of a noise source, such as a doubling of traffic volume, would increase the noise level by 3 dB; similarly, dividing the energy in half would result in a decrease of 3 dB. Human perception of noise has no simple correlation with sound energy: the perception of sound is not linear in terms of dBA or in terms of sound energy. Two sources do not "sound twice as loud" as one source. It is widely accepted that the average healthy ear can barely perceive an increase (or decrease) of up to 3 dBA in noise levels (i.e., twice [or half] the sound energy); that an increase (or decrease) of 5 dBA (8 times [or one eighth] the sound energy) is readily perceptible; and that an increase (or decrease) of 10 dBA (10.5 times [or approximately one tenth] the sound energy) sounds twice (or half) as loud (Crocker 2007).[1]

Descriptors

The impact of noise is not a function of loudness alone. The time of day when noise occurs, and the duration of the noise are also important. In addition, most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors has been developed. The noise descriptors used for this analysis are the one-hour equivalent noise level (L_{eq}) and the community noise equivalent level (CNEL).

- The L_{eq} is defined as the single steady A-weighted level that is equivalent to the same amount of energy as that contained in the actual fluctuating levels over a period. Typically, L_{eq} is equivalent to a one-hour period, even when measured for shorter durations as the noise level of a 10- to 30-minute period would be the same as the hour if the noise source is relatively steady. L_{max} is the highest Root Mean Squared (RMS) sound pressure level within the sampling period, and L_{min} is the lowest RMS sound pressure level within the measuring period (Crocker 2007).
- The CNEL is a 24-hour equivalent sound level with an additional 5 dBA penalty to noise occurring during evening hours, between 7:00 PM and 10:00 PM, and an additional 10 dBA penalty to noise occurring during the night, between 10:00 PM and 7:00 AM, to account for the added sensitivity of humans to noise during these hours (California Department of Transportation [Caltrans] 2013).[2]

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[1] Crocker, Malcolm J. Crocker (Editor). 2007. Handbook of Noise and Vibration Control Book, ISBN: 978-0-471-39599-7, Wiley-VCH, October.

[2] Caltrans. 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. (CT-HWANP-RT-13-069.25.2). Accessed November 2022 at: https://www.dtsc-ssfl.com/files/lib_ceqa/ref_draft_peir/Chap4_10-Noise/Caltrans_2013a_Tech_Noise_Supplement.pdf.

Quiet suburban areas typically have a CNEL in the range of 40 to 50 dBA, while areas near arterial streets are in the 50 to 70+ CNEL range.

Propagation

Sound changes in both level and frequency spectrum as it travels from the source to the receiver. The most obvious change is the decrease in sound level as the distance from the source increases. The way sound reduces with distance depends on factors such as the type of source (e.g., point or line), the path the sound will travel, site conditions, and obstructions. Sound levels from a point source (e.g., construction, industrial machinery, ventilation units) typically attenuate, or drop off, at a rate of 6 dBA per doubling of distance. Sound from a line source (e.g., roadway, pipeline, railroad) typically attenuates at about 3 dBA per doubling of distance (Caltrans 2020).[3]

Fundamentals of Vibration

Groundborne vibration of concern in environmental analysis consists of the oscillatory waves that move from a source through the ground to adjacent structures. The number of cycles per second of oscillation makes up the vibration frequency, described in terms of Hz. The frequency of a vibrating object describes how rapidly it oscillates. The normal frequency range of most groundborne vibration that can be felt by the human body starts from a low frequency of less than 1 Hz and goes to a high of about 200 Hz (Crocker 2007).

While people have varying sensitivities to vibrations at different frequencies, in general people are most sensitive to low-frequency vibration. Vibration in buildings, such as from nearby construction activities, may cause windows, items on shelves, and pictures on walls to rattle. Vibration of building components can also take the form of an audible low-frequency rumbling noise, referred to as groundborne noise. Groundborne noise is usually only a problem when the originating vibration spectrum is dominated by frequencies in the upper end of the range (60 to 200 Hz), or when foundations or utilities, such as sewer and water pipes, physically connect the structure and the vibration source (Federal Transit Administration [FTA] 2018).[4] Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors. The primary concern of vibration is that it can be intrusive and annoying to building occupants and vibration-sensitive land uses.

Descriptors

The ground motion caused by vibration is measured as particle velocity in inches per second and is referenced as vibration decibels (VdB) in the U.S. The background vibration velocity level in residential areas is usually around 50 VdB. The vibration velocity level threshold of perception for humans is approximately 65 VdB. A vibration velocity of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. The range of interest is from approximately 50 VdB, which is the typical background vibration velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Most perceptible indoor vibration is caused by sources in buildings, such as operation of mechanical equipment, movement of people, or

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[3] Caltrans. 2020. Transportation and Construction Vibration Guidance Manual CT-HWANP-RT-20-365.01.01. Accessed November 2022 at: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tcvgm-apr2020-a11y.pdf.

[4] FTA. 2018. Transit Noise and Vibration Impact Assessment Manual. Accessed November 2022 at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf.

the slamming of doors. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel wheeled trains, and traffic on rough roads.

Propagation

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. High-frequency vibration diminishes much more rapidly than low frequency vibration, so low frequencies tend to dominate the spectrum at large distances from the source. Variability in the soil strata can also cause diffractions or channeling effects that affect the propagation of vibration over long distances (Caltrans 2020). When a building is exposed to vibration, a ground-to-foundation coupling loss (the loss that occurs when energy is transferred from one medium to another) will usually reduce the overall vibration level. However, under rare circumstances, the ground-to-foundation coupling may amplify the vibration level due to structural resonances of the floors and walls.

Project Site Noise Conditions

The project area consists of private residential roadways that do not experience substantial traffic volumes. Therefore, the primary off-site noise sources in the project area are overhead flights from passing aircraft. To determine ambient noise levels at the project site, one 15-minute sound measurement was taken using an Extech ANSI Type II Integrating sound level meter between 9:45 AM and 10:00 AM on January 9, 2018 (refer to Appendix F-2 for sound measurement data). See Figure F-1.1 for the location of the sound measurement. As shown in Table F-1.3 , the ambient noise level at the project site was recorded at 41.4 dBA L_{eq}.

Table F-1.3 Project Sound Level Monitoring Results

Measurement Location	Sample Time	L_{eq} [15] (dBA)[1]
SM1 - Southeastern boundary of the project site	9:45 AM – 10:00 AM	41.4

See Appendix F-2 for noise monitoring data. See Figure F-1.1 for a map of the sound measurement (SM) location.

[1] For this measurement, the L_{eq} was over a 15-minute period $L_{eq[}$ [15].

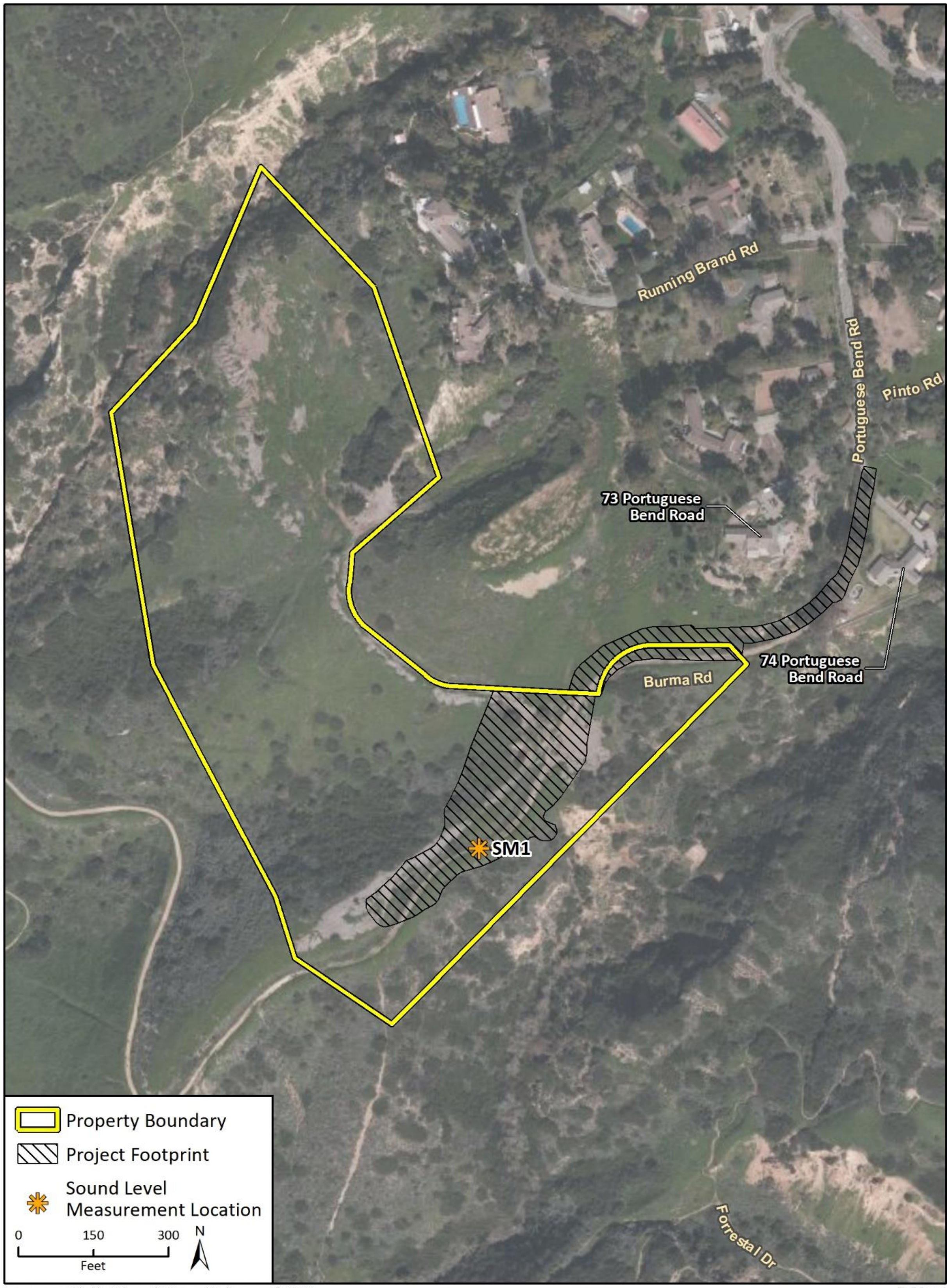
Source: Rincon Consultants, field measurements on January 9, 2018 using ANSI Type II Integrating sound level meter

Sensitive Receivers

Noise affects all types of land uses and activities although some land use types are more sensitive to high noise levels than other types. According to the City's General Plan Noise Element, land uses identified as noise-sensitive include residences of all types, hospitals, rest homes, convalescent hospitals, places of worship, and schools. As an entirely residential community, all of Rolling Hills is noise-sensitive, including the City's only public school, Rancho Del Mar High School (Rolling Hills 1990).[5] The nearest noise-sensitive receivers to the project site are existing single-family residences located at 73 Portuguese Bend Road and 74 Portuguese Bend Road located approximately 75 feet west and east, respectively, from the road easement leading to the project site. In addition, the proposed project would include a single-family residence, which would also be considered a new noise-sensitive receptor in the existing residential community.

[5] Rolling Hills. 1990. General Plan Noise Element. Accessed November 2022 at: https://cms5.revize.com/revize/rollinghillsca/Goverment/Planning%20And%20Community%20Services/General%20Plan/8%20-%20Noise%20Element.pdf.

Figure F-1.1 Sound Measurement Location



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Regulatory Setting

Rolling Hills General Plan

The City's General Plan Noise Element identifies noise sources and areas of noise impact to achieve and maintain noise control and land use compatibility in the City. Noise sources in the City are grouped into three categories: minor arterial and collector roadways, aircraft overflights, and stationary sources. According to the General Plan Noise Element, the noise environment for the City is described using noise contours based on the existing and future conditions of traffic volumes. Based on noise contour maps in the Noise Element, the 55-Ldn noise contour defines the City's Noise Referral Zone for which any proposed noise-sensitive land use should be evaluated on a project-specific basis.[6] The 55-Ldn noise contour also defines zones where residential development should be discouraged without proper mitigation to ensure a quiet living environment (Rolling Hills 1990).

Rolling Hills Municipal Code

Although the Rolling Hills Municipal Code (RHMC) does not define regulations for residential noise sources, the RHMC does include a restriction for construction activities. According to RHMC Section 15.36.020, construction activities, including the use of mechanical equipment, within City limits are prohibited except on Monday through Saturday between 7:00 AM and 6:00 PM.

California Code of Regulations

The California Code of Regulations (CCR), Title 24, Section 1207.4 requires interior noise levels attributable to exterior sources to be at or below 45 dBA in any habitable room of a development based on the noise metric used in the noise element in the local general plan. All residential windows, exterior doors, and exterior wall assemblies would be required to have sound transmission class ratings that would ensure the adequate attenuation of noise at a range of frequencies. The Noise Element of the Rolling Hills General Plan uses a noise metric of Ldn. Therefore, interior noise levels of development under the proposed project would need to be at or below 45 dBA Ldn to be compliant with CCR requirements.

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[6] Community noise is also measured using Day-Night Average Level (Ldn), which is the 24-hour average noise level with a 10-dBA penalty for noise occurring during nighttime hours (10:00 PM to 7:00 AM). Noise levels described by Ldn and CNEL typically do not differ by more than 1 dBA. In practice, CNEL and Ldn are often used interchangeably.