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August 16, 2018

425 1st Los Altos, LLC
PO Box 1001
Los Altos, CA 94023

VIA E-MAIL: jeff.warmoth@gmail.com

SUBJECT: Multi-family Residential Project at 425 1st Street, Los Altos, CA -- Environmental Noise Assessment

Dear Mr. Warmoth:

This letter presents the results of the environmental noise assessment prepared for the multi-family residential project proposed at 425 1st Street in Los Altos, California. This assessment evaluates the compatibility of the project with respect to the noise environment at the project site. The regulatory criteria used in the noise assessment are presented first and then the results of on-site noise monitoring are discussed. The report concludes with our evaluation of the compatibility of the proposed project with the noise environment at the project site. Preliminary noise reduction measures are presented to provide an acceptable interior noise environment per applicable guidelines. Appendix A contains background information on environmental noise and definitions of technical terms used in the assessment.

Regulatory Background

California Building Code, Title 24, Part 2.
Section 1207.4 of the current (2016) California Building Code (CBC) states that interior noise levels attributable to exterior sources shall not exceed 45 dB(A) L_{dn} or CNEL (consistent with the noise element of the local general plan) in any habitable room of a residential dwelling. Though this section does to not explicitly apply this interior limit to multi-family residential buildings, in keeping with the requirements of prior editions of the CBC this limit is applied to any habitable room for new dwellings other than detached single-family dwellings.

City of Los Altos General Plan.
The Natural Environment & Hazards Element of the City of Los Altos' 2002 General Plan contains Noise and Land Use Compatibility Standards policies. These standards are used to assess the compatibility of a particular land use with the noise environment at the site where it would be

located. A project site, depending on its noise exposure, could be considered "Normally Acceptable", "Conditionally Acceptable", "Normally Unacceptable", or "Clearly Unacceptable" for a particular land use. “Normally Acceptable” noise levels assume that buildings are of normal conventional construction. “Conditionally Acceptable” noise levels require a detailed analysis of the noise reduction requirements be performed and needed noise insulation features included in the design of the project. New construction or development should generally be discouraged under “Normally Unacceptable” noise levels, however, if new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. New construction or development should generally not be undertaken under “Clearly Unacceptable” noise levels. Residential land uses are considered "Normally Acceptable" when sites are exposed to noise levels below 60 dBA L_{dn}, "Conditionally Acceptable" when exposed to noise levels between 60 and 70 dBA L_{dn}, "Normally Unacceptable"" when exposed to noise levels of between 70 and 75 dBA L_{dn} and "Clearly Unacceptable"" when exposed to noise levels above 75 dBA L_{dn}. These guidelines are typical of the standards adopted by other cities and counties in the State of California and are based on the assumption that providing for an L_{dn} of 60 dBA in outdoor use areas allows for an acceptable outdoor noise environment and provide an indoor noise environment of 45 dBA L_{dn} or less with the windows open.

Existing Noise Environment

Figure 1 shows the proposed project on an aerial image of the site vicinity and the locations of noise measurements made to document existing conditions. The primary ambient source of noise affecting the project site is traffic along 1st Street, which is at the western edge of the site. More distant sounds from Foothill Expressway and San Antonio Road traffic, as well as operational noise from area commercial businesses, were also found to contribute to background noise levels in the area. The site is bordered by commercial uses to the north and south, and parking lots on the east. A three-story multi-family apartment building is located west of the site across 1st Street.

To evaluate the existing noise environment at the project site, one long-term noise measurement was made along the western side of 1st Street between Tuesday, July 31, 2018 and Thursday, August 2, 2018. The long-term measurement was made on a utility pole directly across 1st Street from the project site, approximately 17 feet from the centerline of the roadway at a height of 12 feet above the existing ground level. The daily trends in noise levels measured at the long-term measurement site, including the energy equivalent noise level (L_{eq}), and the noise levels exceeded 1, 10, 50 and 90 percent of the time (indicated as $L_{(1)}$, $L_{(10)}$, $L_{(50)}$ and $L_{(90)}$) are shown on Figure 2. The L_{eq} noise level is typically considered the average noise level, while the L_1 is considered the intrusive level, the L_{50} is considered the median noise level, and the L_{90} is considered the ambient noise level. Daytime hourly average noise levels generated by vehicular traffic typically ranged from 60 to 66 dBA L_{eq}. Nighttime noise levels typically ranged from 44 to 62 dBA L_{eq}. The calculated day-night average noise level at this location was 65 dBA L_{dn}. Figure 2 summarizes the noise data collected at Site LT-1.

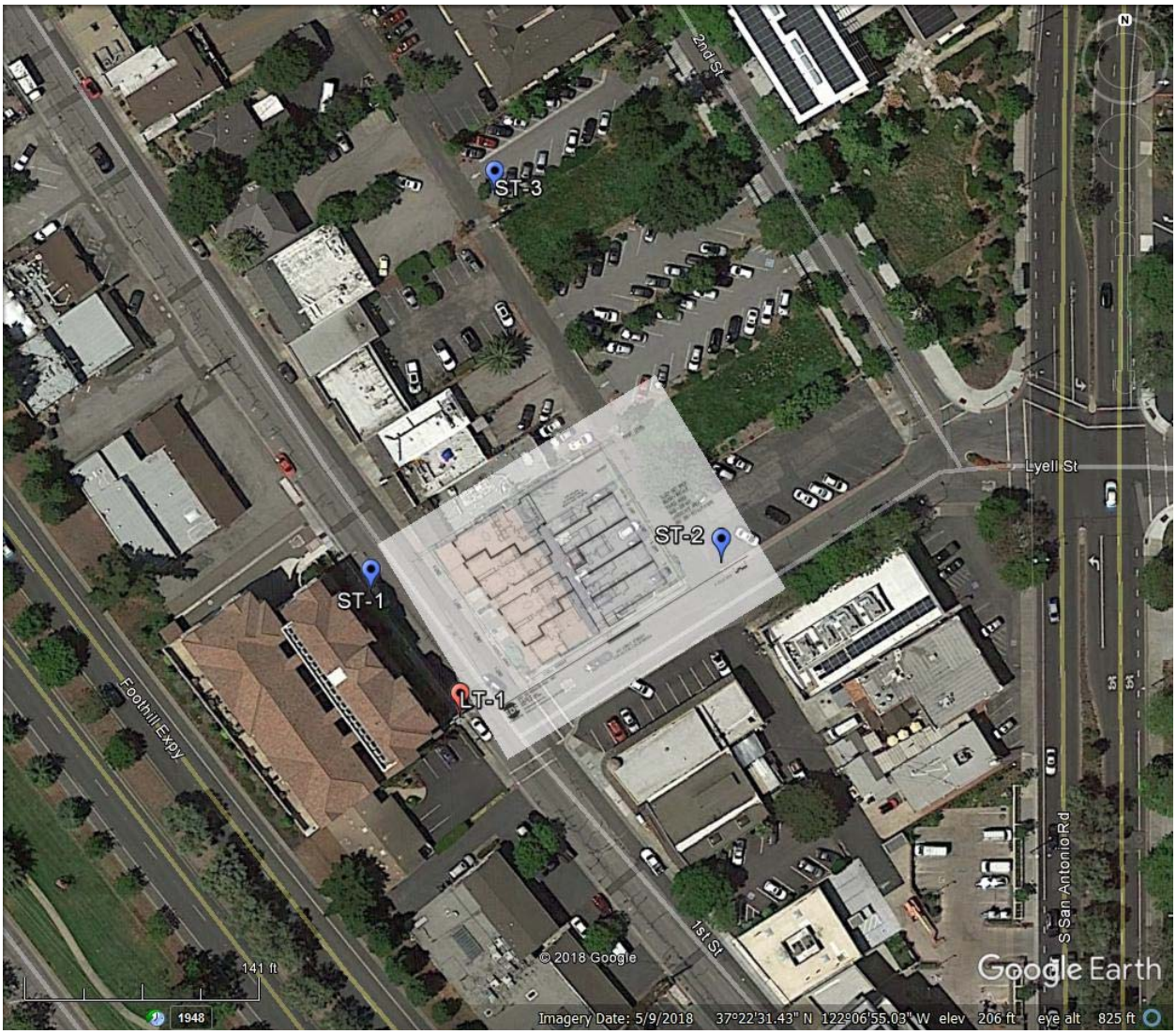
The long-term noise data were supplemented by three observed, short-term noise measurements made on the afternoon of Tuesday, July 31, 2018. Noise levels were measured at location ST-1, which was representative of the setback of proposed apartments near 1st Street, location ST-2,

which was representative of the noise environment at the easternmost portion of the site near San Antonio Road, and location ST-3, in the parking lot north of the site. The average noise level measured at site ST-1 was 67 dBA L_{eq}. The maximum instantaneous noise level measured at ST-1 was 84 dBA L_{max} and was produced by a heavy-duty truck passing the site along 1st Street. Noise levels measured at Site ST-2 were primarily the result of local and distant traffic, averaging 60 dBA L_{eq}. Noise levels at ST-3 were fairly low for the area, resulting from mechanical equipment and intermittent automobile passby. The average noise level measured at ST-3 was 51 dBA L_{eq}. Table 1 summarizes the results of the short-term noise measurements.

TABLE 1 Summary of Short-Term Noise Measurements

Noise Measurement Location (Date, Time)	Measured Noise Level, dBA					
	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10\text{-}min)}$
ST-1: 1st Street frontage. 37°22'31.0" N, 122°06'56.7" W (7/31/2018, 12:00-12:10 p.m.)	84	78	70	59	52	67
ST-2: Lyell Street frontage. 37°22'31.2" N, 122°06'54.0" W (7/31/2018, 12:20-12:30 p.m.)	78	74	61	54	50	60
ST-3: Alley frontage. 37°22'33.4" N, 122°06'55.7" W (7/31/2018, 12:40-12:50 p.m.)	63	59	54	50	48	51

Figure 1 Aerial Image Showing Site Plan and Noise Monitoring Locations



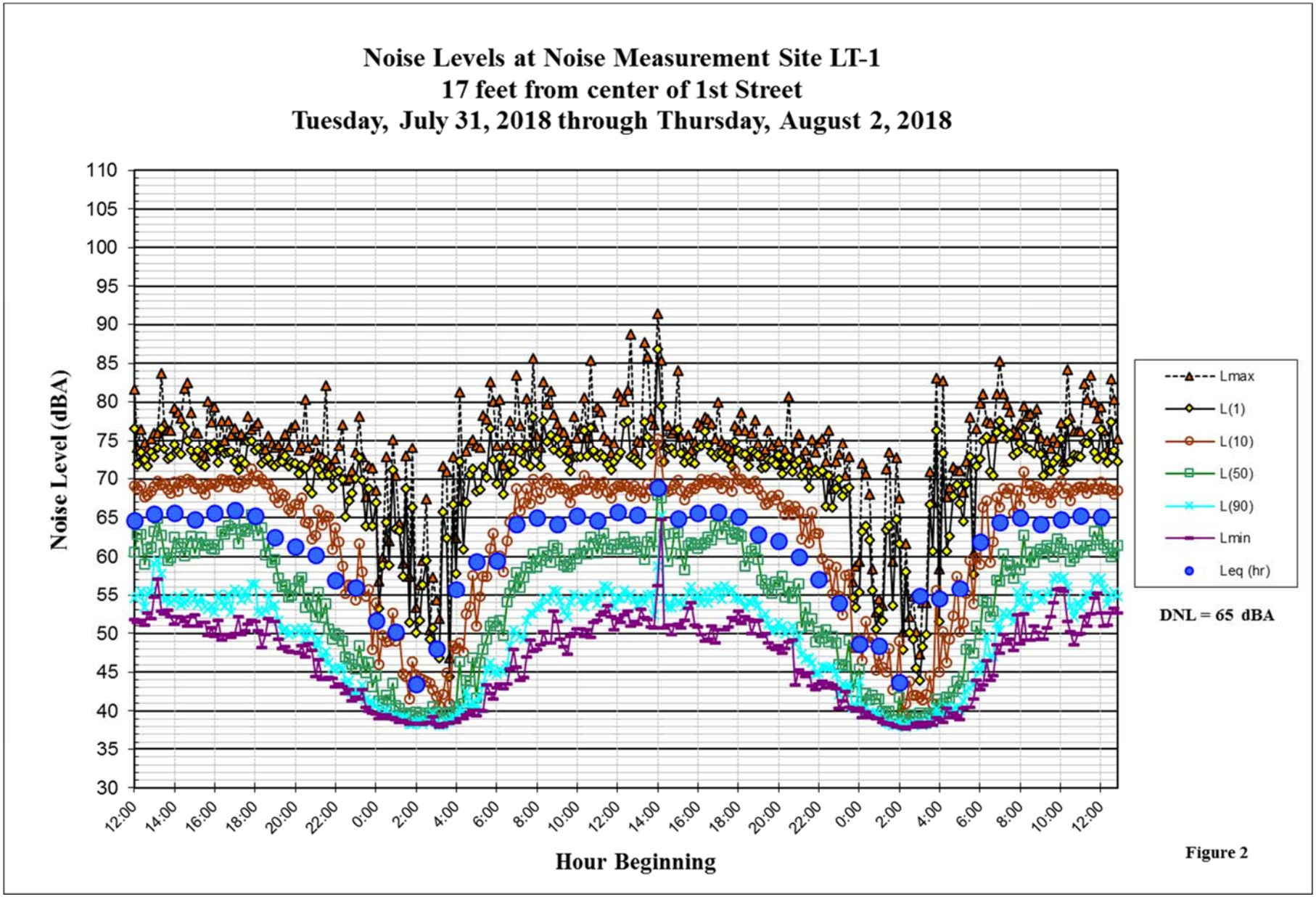

Noise Levels at Noise Measurement Site LT-1
17 feet from center of 1st Street
Tuesday, July 31, 2018 through Thursday, August 2, 2018
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 65 dBA

Figure 2

Noise and Land Use Compatibility Assessment

Future Exterior Noise Environment

The City's General Plan does not contain future traffic projections for 1st Street but does contain future traffic projections for nearby roadways including Foothill Expressway and San Antonio Road. Based on a comparison the General Plan traffic volumes for existing and future traffic conditions, future traffic noise levels (2025) along Foothill Expressway and San Antonio Road were projected to increase by less than 1 decibel over existing noise levels (2001). For the purposes of this assessment, a credible worst-case scenario would assume that general growth throughout the City and surrounding region would follow previous growth patterns and result in an increase of 1-2% in traffic volumes per year. Considering this incremental increase, the future noise environment on the project site adjacent to 1st Street is expected to increase by up to 1 decibel over existing noise levels. Such an increase would result in an L_{dn} level of 66 dBA at the building facades closest to and facing 1st Street.

The City's exterior noise level goal of 60 dBA L_{dn} is normally applied where outdoor use is a major consideration (e.g., backyards in single family developments and recreation areas in multi-family projects). Common industry practice regarding the exterior noise assessment of small private outdoor use areas (e.g., balconies, patios, etc.) or pathways in multi-family residential land uses is to apply the exterior noise threshold established by the City to common outdoor use areas only.

A review of the project plans indicates that no common outdoor use areas are proposed by the project. A small, private balcony is proposed for Unit 16, which would overlook 1st Street. A seated receptor located at the center of the balcony would be shielded from direct line-of-sight to traffic along the roadway by the solid wall proposed along the west side of the balcony. Exterior noise levels at this seated receptor would be reduced by 5 dBA by the solid wall and would be 61 dBA L_{dn}, which would exceed the normally acceptable noise level of 60 dBA L_{dn} by 1 decibel. However, mitigation is not recommended to reduce exterior noise levels at the small balcony proposed for Unit 16 given the slight exceedance and applicability of the normally acceptable exterior noise threshold at the small balcony proposed by the project.

Future Interior Noise Environment

Considering the preceding discussion, the western residential facades facing 1st Street would be exposed to an L_{dn} of 66 dBA under future conditions. Noise levels at other project facades would be lower due to distance attenuation and building shielding, such that future exterior noise levels on the southern facade are expected to be 63 dBA L_{dn} or less, and the eastern facade is expected to be exposed to an L_{dn} of 60 dBA or less. In view of these levels, the western, northern, and southern facades would be considered "Conditionally Acceptable" for residential use. In these areas, the City's General Plan standards require new construction or development to be undertaken only after a detailed noise analysis is made and noise reduction measures are identified and included in the project design.

To quantify interior noise levels resulting from traffic, calculations were made to estimate the transmission loss provided by the proposed building elements. Interior noise levels were calculated based on a review of the project's site plan, conceptual exterior building elevations, and floor plans. The relative areas of walls, windows, and doors were input into an acoustical model to calculate noise levels within individual units. The exterior walls of the proposed units were assumed to be a stucco sided exterior finish, ½" plywood sheathing, 2x4 or 2x6 wood studs, R-19 batt insulation, and ½" gypsum board interior finish. These exterior walls have a minimum Sound Transmission Class rating of STC 46. Windows (vinyl – dual glazed) and doors were then tested to determine the necessary sound transmission class ratings for these building elements to reduce interior average noise levels to 45 dBA L_{dn} or less, as required by the State Building Code and City of Los Altos.

The results of this analysis finds that the following window and exterior door sound isolation ratings will be needed at the project:

1. Residential windows and doors on the western façade (facing 1st Street) and exposed to an L_{dn} of 66 dBA will require a minimum STC rating of 28,
2. Residential windows and doors on the southern facade (facing Lyell Street) and exposed to an L_{dn} of between 60 and 65 dBA will require a minimum STC rating of 26, and
3. Residential windows and doors on the western facade and exposed to an L_{dn} of 60 dBA or less will not require specific STC ratings.

Additionally, all residences with windows or doors on the western, southern, and eastern building facades will require mechanical ventilation to provide a habitable interior environment with windows closed for noise control. In our experience a standard central air conditioning system or a central heating system equipped with a 'summer switch', which allows the fan to circulate air without furnace operation in each residence will provide such a habitable interior environment.

The implementation of the above noise insulation features in the project design will allow interior noise levels within the project residences to meet the City and State 45 dBA L_{dn} interior noise level criterion.

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This concludes our environmental noise assessment. If you have any questions, or if we can be of further assistance, please do not hesitate to call.

Sincerely yours,

Michael S. Thill
Principal Consultant
ILLINGWORTH & RODKIN, INC.

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APPENDIX A

Fundamentals of Environmental Noise

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

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table A1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table A2. Because sound levels can vary markedly over a brief period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

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

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

exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

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

Annoyance

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

TABLE A1 Definition of Acoustical Terms Used in this Report

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

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

TABLE A2 Typical Noise Levels in the Environment

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

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