State Center Community College District
First Responders Campus Project
Draft Environmental Impact Report
(State Clearinghouse No. 2020039018)

Appendix D
Noise and Groundborne Vibration Impact Analysis

Noise & Groundborne Vibration Impact Assessment

For The Proposed

State Center Community College District First Responders Campus Project

County of Fresno, CA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

LIST OF COMMON TERMS & ACRONYMS

ANSI	Acoustical National Standards Institute
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	Decibels
dBA	A-Weighted Decibels
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
Hz	Hertz
in/sec	Inches per Second
L_{dn}	Day-Night Average Sound Level
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Sound Level
ppv	Peak Particle Velocity
SCCCD	State Center Community College District
SEL	Sound-Exposure Level
U.S. EPA	United States Environmental Protection Agency

INTRODUCTION

This report discusses the existing setting, identifies potential noise and groundborne vibration impacts associated with the implementation of the proposed First Responders Campus Project. Mitigation measures are recommended where the predicted noise and groundborne vibration levels would exceed applicable thresholds of significance.

PROPOSED PROJECT

The State Center Community College District (SCCCD) is proposing to undertake the First Responders Campus Project (project).

The SCCCD proposed campus for first responders is to be located on the western half of an approximately 40-acre site northwest of the intersection of Willow and North Avenues in Fresno County, California. The proposed campus will include a fire academy, police academy, and EMT training in numerous small cohorts moving through the academy programs. Approximately 270 students would be on the campus at any one time, staffed by up to 50 employees, including administrators, faculty, and support staff. Site access is expected to be from one or more driveways connecting to North Avenue, with left turns into the site allowed from eastbound North Avenue.

The facilities will include a total of approximately 62,000 square feet of building area with a spot tower, a scenario village, and a virtual-reality/simulation laboratory, which may include joint use with the City of Fresno and other agencies. The police and fire academies are expected to begin daily operations at 7:00 a.m. and finish at approximately 5:00 p.m., although night classes until 10:00 p.m. are possible. Day courses for EMT training are likely to begin at 8:00 a.m. and end at 5:00 p.m. on Tuesdays, Wednesdays, and Thursdays. Evening courses for EMT training are likely to start at 6:00 p.m. and end by 10:00 p.m. on Tuesdays and Thursdays.

Construction is planned to occur from late 2021 to the middle of 2023.

A site vicinity map is presented in Figure 1, Site Vicinity Map, and a site plan is presented in Figure 2, Site Plan.

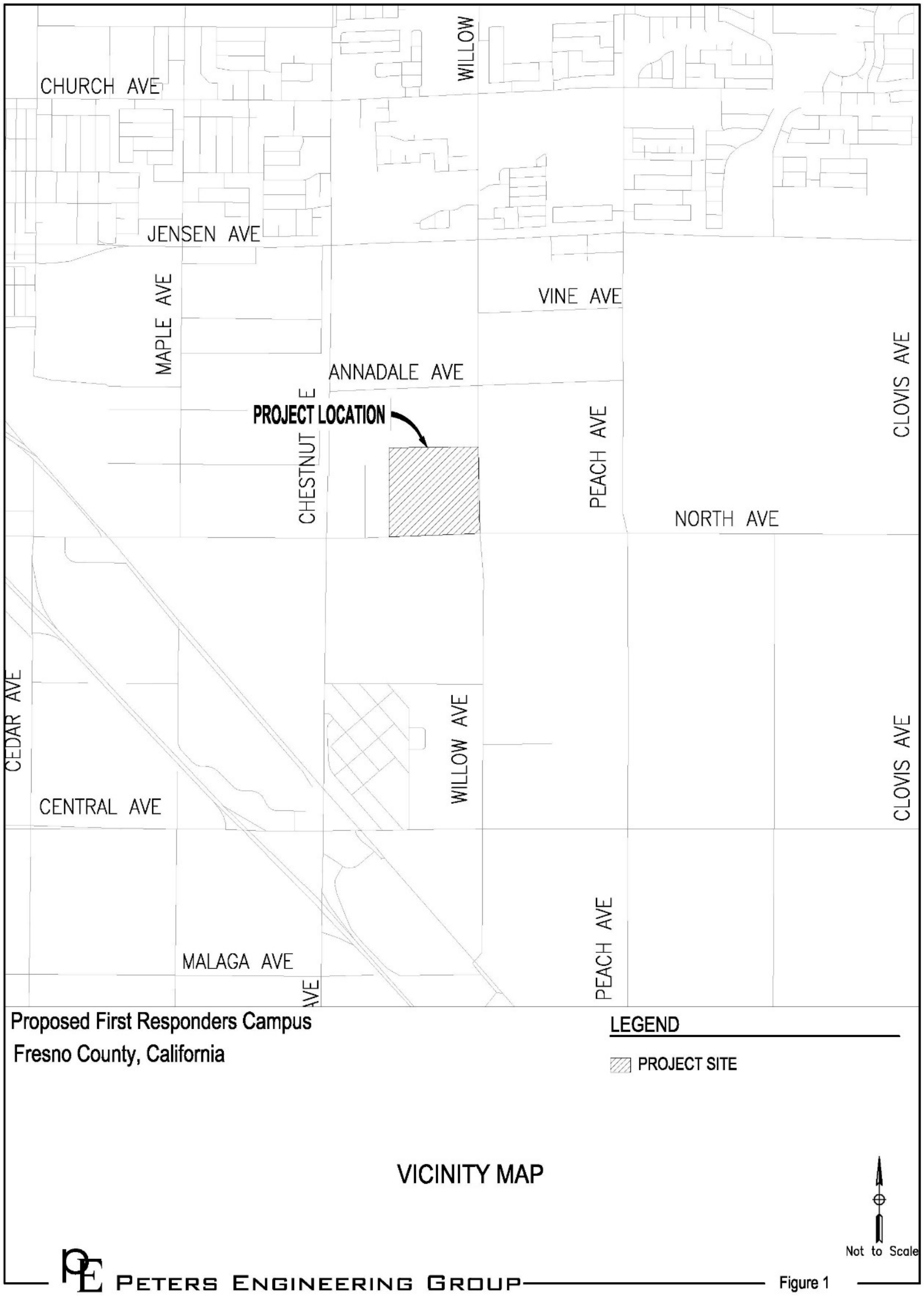
ACOUSTIC FUNDAMENTALS

Noise is generally defined as a sound that is loud, disagreeable, or unexpected. Sound is mechanical energy transmitted in the form of a wave because of a disturbance or vibration. Sound levels are described in terms of both amplitude and frequency.

Amplitude

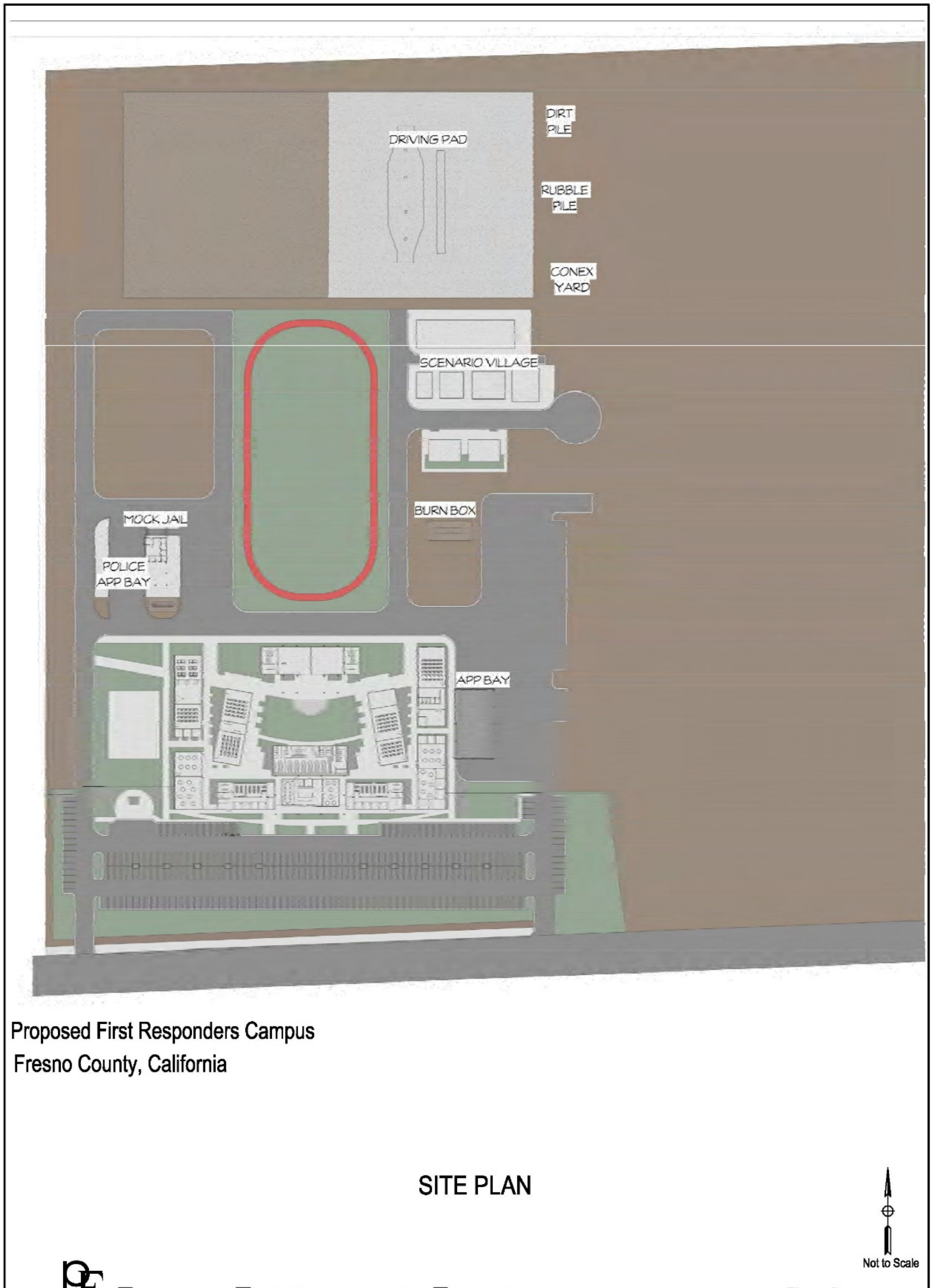
Amplitude is defined as the difference between ambient air pressure and the peak pressure of the sound wave. Amplitude is measured in decibels (dB) on a logarithmic scale. For example, a sound source of 65 dB, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). Amplitude is interpreted by the ear as corresponding to different degrees of loudness. Laboratory measurements correlate a 10 dB increase in amplitude with a perceived doubling of loudness and establish a 3 dB change in amplitude as the minimum audible difference perceptible to the average person.

Figure 1. Site Vicinity Map



Source: PEG 2021

Figure 2. Site Plan



Source: PEG 2021

Frequency

The frequency of a sound is defined as the number of fluctuations of the pressure wave per second. The unit of frequency is the Hertz (Hz). One Hz equals one cycle per second. The human ear is not equally sensitive to the sound of different frequencies. For instance, the human ear is more sensitive to sound in the higher portion of this range than in the lower, and sound waves below 16 Hz or above 20,000 Hz cannot be heard at all. To approximate the sensitivity of the human ear to changes in frequency, the environmental sound is usually measured in what is referred to as "A-weighted decibels" (dBA). On this scale, the normal range of human hearing extends from about 10 dBA to about 140 dBA (U.S. EPA 1971). Common community noise sources and associated noise levels, in dBA, are depicted in Figure 3.

Addition of Decibels

Because dBs are logarithmic units, sound levels cannot be added or subtracted through ordinary arithmetic. Under the dB scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces a sound level of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the dB scale, three sources of equal loudness together would produce an increase of 5 dB.

Sound Propagation & Attenuation

Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level decreases (attenuates) at a rate of approximately 6 dBs for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path, and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of approximately 3 dBs for each doubling of distance from a line source, depending on ground surface characteristics. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water,), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 decibels per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation for soft surfaces results in an overall attenuation rate of 4.5 dBs per doubling of distance from the source.

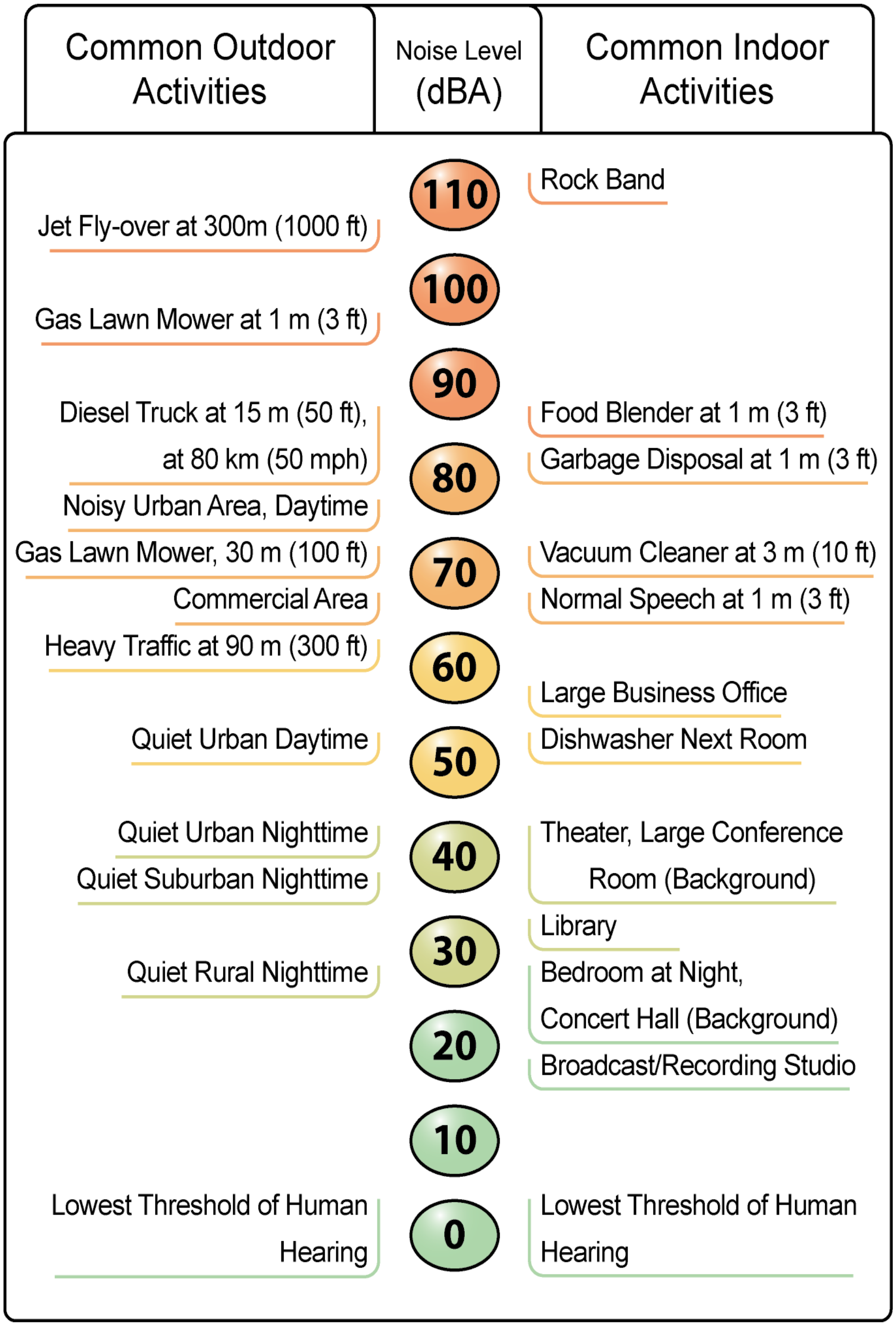
Atmospheric Effects

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) from the highway due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects.

Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in a minimum of 5 dB noise reduction. Taller barriers provide increased noise reduction.

Figure 3. Common Noise Levels



Source: Caltrans 2018

Noise reductions afforded by building construction can vary depending on construction materials and techniques. Standard construction practices typically provide approximately 15 dBA exterior-to-interior noise reductions for building facades, with windows open, and approximately 20-30 dBA with windows closed. The absorptive characteristics of interior rooms, such as carpeted floors, draperies, and furniture, can result in further reductions in interior noise.

Noise Descriptors

The dB scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the sound-pressure level in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude with higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies, which is referred to as the "A-weighted" sound level (expressed in units of dBA). The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with environmental noise.

The intensity of environmental noise fluctuates over time, and several descriptors of time-averaged noise levels are typically used. For the evaluation of environmental noise, the most commonly used descriptors are equivalent sound level (L_{eq}), day-night average sound level (L_{dn}), community noise equivalent level (CNEL), and sound-exposure level (SEL). The energy-equivalent sound level, L_{eq}, is a measure of the average energy content (intensity) of noise over any given period. Many communities use 24-hour descriptors of noise levels to regulate noise. The day-night average sound level, L_{dn}, is the 24-hour average of the noise intensity, with a 10-dBA "penalty" added for nighttime noise (10 p.m. to 7 a.m.) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to L_{dn} but adds a 5-dBA penalty for evening noise (7 p.m. to 10 p.m.) Another descriptor that is commonly discussed is the sound-exposure level, expressed as SEL. The SEL describes a receiver's cumulative noise exposure from a single noise event, which is defined as an acoustical event of short duration (0.5 seconds), such as a backup beeper, the sound of an airplane traveling overhead, or a train whistle. The percentile noise level (L_n) descriptor represents the percent exceeded over a period of time. For instance, L_{50} represents a noise level exceeding 50 percent of the time. Common noise level descriptors are summarized in Table 1.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases. The acceptability of noise and the threat to public well-being is the basis for land use planning policies preventing exposure to excessive community noise levels.

Unfortunately, there is no completely satisfactory way to measure the subjective effects of noise or 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 differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted: the so-called "ambient" environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged.

Table 1. Common Acoustical Descriptors

Descriptor	Definition
Energy Equivalent Noise Level (L_{eq})	The mean (average) energy noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value (in dBA) is calculated.
Minimum Noise Level (L_{min})	The minimum instantaneous noise level during a specific period of time.
Maximum Noise Level (L_{max})	The maximum instantaneous noise level during a specific period of time.
Percentile Noise Level (L_n)	The percent exceeded over a period of time. For instance, L_{50} represents a noise level exceeding 50 percent of the time.
Day-Night Average Noise Level (DNL or L_{dn})	The DNL was first recommended by the United States Environmental Protection Agency (U.S. EPA) in 1974 as a "simple, uniform and appropriate way" of measuring long-term environmental noise. DNL takes into account both the frequency of occurrence and duration of all noise events during a 24-hour period with a 10 dBA "penalty" for noise events that occur between the more noise-sensitive hours of 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours to account for increased sensitivity to noise during these hours.
Community Noise Equivalent Level (CNEL)	The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA "penalty" added to noise events that occur between the hours of 7:00 p.m. to 10:00 p.m. The calculated CNEL is typically approximately 0.5 dBA higher than the calculated L_{dn}.
Sound Exposure Level (SEL)	The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second.

Regarding increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this analysis:

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

Effects of Noise on Human Activities

The extent to which environmental noise is deemed to result in increased levels of annoyance, activity interference, and sleep disruption varies greatly from individual to individual depending on various factors, including the loudness or suddenness of the noise, the information value of the noise (e.g., aircraft overflights, a child crying, fire alarm), and an individual's sleep state and sleep habits. Over time, adaptation to noise events and increased levels of noise may also occur. In terms of land use compatibility, environmental noise is often evaluated in terms of the potential for noise events to result in increased levels of annoyance, sleep disruption, or interference with speech communication, activities, and learning. Noise-related effects on human activities are discussed in more detail, as follows:

Speech Communication

For most noise-sensitive land uses, an interior noise level of 45 dB L_{eq} is typically identified for the protection of speech communication to provide for 100-percent intelligibility of speech sounds. Assuming a minimum 20-

dB reduction in sound level between outdoors and indoors, with windows closed, this interior noise level of 45 dB L_{eq} would equate to an exterior noise level of 65 dBA L_{eq}. For outdoor voice communication, exterior noise levels of 60 dBA L_{eq} allow normal conversation at distances up to 2 meters with 95 percent sentence intelligibility (U.S. EPA 1974.) Based on this information, speech interference begins to become a problem when steady noise levels reach approximately 60 to 65 dBA.

Annoyance & Sleep Disruption

With regard to potential increases in annoyance, activity interference, and sleep disruption, land use compatibility determinations are typically based on the use of the cumulative noise exposure metrics (i.e., CNEL or L_{dn}). Perhaps the most comprehensive and widely accepted evaluation of the relationship between noise exposure and the extent of annoyance was originally developed by Theodore J. Schultz in 1978. In 1978 the research findings of Theodore J. Schultz provided support for L_{dn} as the descriptor for environmental noise. Research conducted by Schultz identified a correlation between the cumulative noise exposure metric and individuals who were highly annoyed by transportation noise. The Schultz curve, expressing this correlation, became a basis for noise standards. When expressed graphically, this relationship is typically referred to as the Schultz curve. The Schultz curve indicates that approximately 13 percent of the population is highly annoyed at a noise level of 65 dBA L_{dn}. It also indicates that the percentage of people describing themselves as being highly annoyed accelerates smoothly between 55 and 70 dBA L_{dn}. A noise level of 65 dBA L_{dn} is a commonly referenced dividing point between lower and higher rates of people describing themselves as being highly annoyed.

The Schultz curve and associated research became the basis for many of the noise criteria subsequently established for federal, state, and local entities. Most federal and state California regulations and policies related to transportation noise sources establish a noise level of 65 dBA CNEL/L_{dn} as the basic limit of acceptable noise exposure for residential and other noise-sensitive land uses. For instance, with respect to aircraft noise, both the Federal Aviation Administration (FAA) and the State of California have identified a noise level of 65 dBA L_{dn} as the dividing point between normally compatible and normally incompatible residential land use generally applied for the determination of land use compatibility. For noise-sensitive land uses exposed to aircraft noise, noise levels in excess of 65 dBA CNEL/L_{dn} are typically considered to result in a potentially significant increase in levels of annoyance.

Allowing for an average exterior-to-interior noise reduction of 20 dB, an exterior noise level of 65 dBA CNEL/L_{dn} would equate to an interior noise level of 45 dBA CNEL/L_{dn}. An interior noise level of 45 dB CNEL/L_{dn} is generally considered sufficient to protect against activity interference at most noise-sensitive land uses, including residential dwellings, and would also be sufficient to protect against sleep interference (U.S. EPA 1974.)

The cumulative noise exposure metric is currently the only noise metric for which there is a substantial body of research data and regulatory guidance defining the relationship between noise exposure, people's reactions, and land use compatibility. However, when evaluating environmental noise impacts involving intermittent noise events, such as aircraft overflights and train pass byes, the use of cumulative noise metrics may not provide a thorough understanding of the resultant impact. The general public often finds it difficult to understand the relationship between intermittent noise events and cumulative noise exposure metrics. In such instances, supplemental use of other noise metrics, such as the L_{eq} or maximum sound level (L_{max}) descriptor, may be helpful as a means of increasing public understanding regarding the relationship between these metrics and the extent of the resultant noise impact.

AFFECTED ENVIRONMENT

Noise-Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

Nearby existing land uses consist predominantly of residential, agriculture, industrial, commercial, and utility. The nearest noise-sensitive land uses located in the vicinity of the proposed project site include residential dwellings, which are located approximately 35 feet west of the western property boundary and 100 feet east of the eastern project boundary along Willow Avenue. The nearest non-noise-sensitive land uses include industrial and commercial business uses, located approximately 100 feet south of the southern property boundary along North Avenue; and utility uses, located approximately 100 feet east of the eastern property boundary along Willow Avenue.

Ambient Noise Environment

To document existing ambient noise levels in the project area, short-term ambient noise measurements were conducted on April 1, 2021, using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter. The meter was calibrated before use and is certified to comply with Acoustical National Standards Institute (ANSI) specifications. Measured ambient daytime noise levels are summarized in Table 2 and detailed in Appendix A, Noise Measurement Survey.

Table 2. Summary of Measured Ambient Noise Levels

Location	Monitoring Period (24-hour time)	Measured Daytime Noise Levels (dBA)				
		L_{50}/L_{eq}	L_{25}	L_8	L_2	L_0/L_{max}
ST1: Project site along Willow Avenue.	14:19-14:29	49.3	51.4	53.5	56.6	66.7
ST2: Edge of the roadway of Willow Avenue.	14:30-14:40	52.9	54.8	56.7	59.6	69.5
ST3: Edge of the roadway of Willow Avenue.	14:43-14:53	48.8	50.7	52.6	55.5	65.4
ST4: Edge of the roadway of North Avenue.	14:57-15:07	59.1	62.2	64.3	67.4	77.5
ST5: Edge of the roadway of North Avenue.	15:11-15:21	59.6	62.5	64.4	67.3	77.2

dBA = A-weighted decibel; Leq = Equivalent sound level; ST = Short-term noise measurement
Ambient noise measurements were conducted on April 1, 2021, using a Larson Davis Laboratories, Type I, Model 820 integrating sound level meter placed at a height of 5 feet.

Based on the measurements conducted, daytime average-hourly noise levels in the project vicinity ranged from the upper-40s to upper-50s (in dBA L_{eq}). Ambient noise levels within the project area are predominantly influenced by vehicle traffic on area roadways.

REGULATORY FRAMEWORK

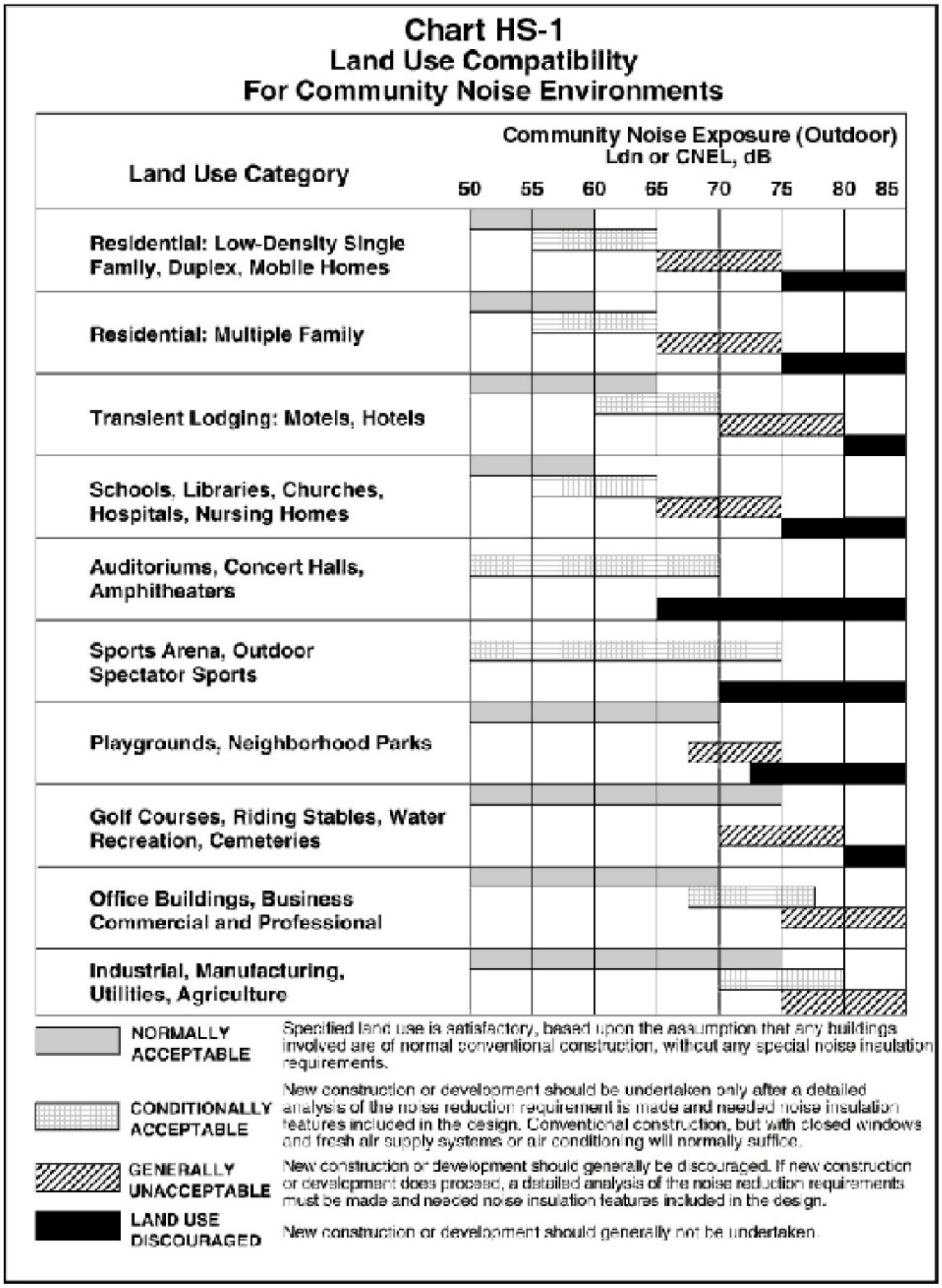
Noise

Fresno County General Plan

The Fresno County General Plan is a comprehensive, long-term framework for the protection of the county's agricultural, natural, and cultural resources and development in the county (County of Fresno 2000). Designed to meet State general plan requirements, it outlines policies, standards, and programs and sets out plan proposals to guide day-to-day decisions concerning Fresno County's future. In regard to noise, the County's goal is to protect residential and other noise-sensitive uses from exposure to harmful or annoying noise levels; to identify maximum acceptable noise levels compatible with various land use designations, and to develop a policy framework necessary to achieve and maintain a healthful noise environment.

Fresno County's noise standards for the determination of land use compatibility are shown in Figure 4. As shown, educational land uses, are considered "normally acceptable" within exterior noise environments up to 60 dBA CNEL/L_{dn}, "conditionally acceptable" up to 65 dBA CNEL/L_{dn}, and "generally unacceptable" at noise levels exceeding 75 dBA CNEL/L_{dn}.

Figure 4. Fresno County Land Use Compatibility for Community Noise Environments



Source: County of Fresno 2000

Fresno County Noise Control Ordinance

The intent of the Fresno County Noise Control Ordinance is "…to protect persons from excessive levels of noise within or near a residence, school, church, hospital or public library and to warn persons of the hazards of excessive noise in places of public entertainment." Applicable noise standards are identified below (County of Fresno 2021):

Exterior Noise Standards

A. It is unlawful for any person, including an owner, whether through the owner or the owner's agent, lessee, sublessor, sublessee, or occupant, at any location within the unincorporated area of the county, to create any noise, or to allow the creation of any noise, on property owned, leased, occupied or otherwise controlled by such person which causes the exterior noise level when measured at any affected single- or multiple-family residence, school, hospital, church or public library situation in either the incorporated or unincorporated area to exceed the noise level standards as set forth in the following table:

Table 3. Exterior Noise Standards

Category	Cumulative Number of Minutes in any One-Hour Time Period	Noise Level Standards, dBA	
		Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
1	30 (L_{50})	50	45
2	15 (L_{25})	55	50
3	5 (L_8)	60	55
4	1 (L_2)	65	60
5	0 (L_0/L_{max})	70	65

B. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted to equal the ambient noise level.
C. Each of the noise level standards specified above shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.
D. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards.

Interior Noise Standards

A. It is unlawful for any person, at any location within the unincorporated area of the county to operate or cause to be operated within a dwelling unit, any source of sound or to allow the creation of any noise which causes the noise level when measured inside a receiving dwelling unit situated in either the incorporated or unincorporated are to exceed the noise level standards as set forth in the following table:

Table 4. Interior Noise Standards

Category	Cumulative Number of Minutes in any One-Hour Time Period	Noise Level Standards, dBA	
		Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
1	5 (L_8)	45	35
2	1 (L_2)	50	40
3	0 (L_0/L_{max})	55	45

B. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted to equal the ambient noise level.

C. Each of the noise level standards specified above shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulse noises.

D. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards.

The County's noise ordinance limits are stated in terms of the cumulative number of minutes in any one-hour time period that the noise level is allowed to exceed. These standards are typically referred to as the n-percent exceeded level (L_n). The L_n is the sound pressure level exceeded for n percent of the time. For instance, the "L_{50}" represents the sound level not to be exceeded 50 percent of the time or 30 minutes within a one-hour time period. Likewise, a fifteen-minute limitation is expressed as the L_{25}, a five-minute limitation is expressed as the L_8, and a one-minute limitation is expressed as the L_2. The L_0 represents the noise level not to be exceeded at any time, which is also often referred to as the L_{max}. For most sources, the L_{50} is also representative of the energy-equivalent sound level, represented as "L_{eq}".

Construction noise levels that occur between 6:00 a.m. and 9:00 p.m. on weekdays, and between 7:00 a.m. and 5:00 p.m. on Saturday or Sunday, are exempt from the County's noise regulations. Operational activities conducted on public or private school grounds are exempt from the County's noise regulations.

Groundborne Vibration

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of amplitude and frequency. A person's perception of the vibration will depend on their sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating. Vibration can be measured in terms of acceleration, velocity, or displacement. Measurements in terms of velocity are expressed as peak particle velocity (ppv) with units of inches per second (in/sec).

There are no federal, state, or local regulatory standards for groundborne vibration. However, the California Department of Transportation (Caltrans) has developed vibration criteria based on potential structural damage risks and human annoyance. Caltrans-recommended criteria for the evaluation of groundborne vibration levels, with regard to structural damage and human annoyance, are summarized in Table 5. The criteria apply to continuous vibration sources, which include vehicle traffic and most construction activities. All damage criteria for buildings are in terms of ground motion at the buildings' foundations. No allowance is included for the amplifying effects of structural components (Caltrans 2020).

As indicated in Table 5, the threshold at which there is a risk to normal structures from continuous events is 0.3 in/sec ppv for older residential structures and 0.5 in/sec ppv for newer building construction. With regard to human perception, vibration levels would begin to become distinctly perceptible at levels of 0.04 in/sec ppv for continuous events. Continuous vibration levels are considered potentially annoying for people in buildings at levels of 0.2 in/sec ppv. Fresno County does not have an adopted criterion pertaining to construction-generated groundborne vibration.

Table 5. Summary of Groundborne Vibration Levels and Potential Effects

Vibration Level (in/sec ppv)	Human Reaction	Effect on Buildings
0.006 - 0.019	Threshold of perception; possibility of intrusion.	Vibrations are unlikely to cause damage of any type.
0.08	Vibrations are readily perceptible.	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected.
0.1	The level at which continuous vibrations begin to annoy people.	Virtually no risk of "architectural" damage to normal buildings.
0.2	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relatively short periods of vibrations).	The threshold at which there is a risk of "architectural" damage to fragile buildings.
0.3 - 0.6	Vibrations become distinctly perceptible at 0.04 in/sec ppv and considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges.	The potential risk of "architectural" damage may occur at levels above 0.3 in/sec ppv for older residential structures and above 0.5 in/sec ppv for newer structures.

in/sec = Inch per second; ppv = Peak particle velocity

The vibration levels are based on ppv in the vertical direction for continuous vibration sources, which includes most construction activities.

Source: Caltrans 2020

Impact Analysis

Thresholds of Significance

Criteria for determining the significance of air quality impacts were developed based on information contained in the California Environmental Quality Act (CEQA) Guidelines (Appendix G). According to those guidelines, a project may have a significant effect on the environment if it would result in the following conditions:

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the project vicinity in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies; or

b) Generation of excessive groundborne vibration or groundborne noise levels; or

c) 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 private-use airport, that exposes people residing or working in the project area to excessive noise levels.

The CEQA Guidelines do not define the levels at which temporary and permanent increases in ambient noise are considered "substantial." As discussed previously in this section, a noise level increase of 3 dBA is barely perceptible to most people, an increase of 5 dBA is readily noticeable, and a difference of 10 dBA would be perceived as a doubling of loudness. For purposes of this analysis, a substantial increase in ambient noise levels would be defined as an increase of 5 dBA, or greater, and considered a significant increase if it would exceed the County's normally acceptable noise standards for land use compatibility or noise control ordinance.

The CEQA Guidelines also do not define the levels at which groundborne vibration levels would be considered excessive. For this reason, Caltrans recommended groundborne vibration thresholds were used for the evaluation of impacts based on increased potential for structural damage and human annoyance, as identified in Table 5. For purposes of this analysis, risks of architectural damage (i.e., minor cracking of plaster walls and ceilings) would be considered potentially significant if construction-generated ground vibration levels at nearby structures would exceed 0.5 in/sec ppv. Ground vibration in excess of 0.2 in/sec ppv would be expected to result in a potential for significant short-term increases in levels of annoyance for occupants of nearby buildings.

Methodology

Construction Impacts

Short-term noise impacts associated with construction activities were analyzed based on typical construction equipment noise levels and distances to the nearest noise-sensitive land use. Noise levels were predicted based on representative off-road equipment noise levels derived from the Federal Highway Administration's (FHWA) Roadway Construction Noise Model based on average equipment usage rates and assuming a noise-attenuation rate of 6 dB per doubling of distance from the source.

Operational Impacts

Roadway Traffic Noise

Traffic noise levels were calculated using the FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108) based on California vehicle reference noise levels and traffic data obtained from the traffic analysis prepared for this project. Additional input data included day/night percentages of autos, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. The project's contribution to traffic noise levels along area roadways was determined by comparing the predicted noise levels with and without project-generated traffic. Predicted noise levels were compared to Fresno County's noise standards for the determination of impact significance.

Non-Transportation Noise

Noise levels associated with vehicle parking areas were calculated in accordance with FHWA's Transit Noise and Vibration Impact Assessment Guidelines assuming a reference noise level of 92 dBA SEL. Average-hourly noise levels associated with vehicle parking-related activities were calculated based on the conservative assumption that all parking spaces would be accessed over a one-hour period. Noise levels generated by other on-site noise sources, including on-site building mechanical equipment, were assessed based on the representative manufacturer and measured data obtained from similar sources. Physical training activities would occur during the weekday between 6:00 a.m. and 8:00 a.m. for the Fire Academy, and between 4:00 a.m. and 5:00 a.m. for the Police Academy. The use of sirens and an emergency public address (PA) system would occur infrequently. Training simulations for the Fire Academy and Police Academy would occur during the weekday.

Non-transportation noise sources were evaluated in comparison to the County's L_{50} noise standard. For most sources, the L_{50} noise metric is also representative of the energy-equivalent sound level, represented as "L_{eq}". The L_{50}/L_{eq} noise metrics are, therefore, used interchangeably in this report for comparison to the County's L_{50} noise standard. Instantaneous noise sources were also evaluated in comparison to the County's L_0/L_{max} noise standard. Operational noise levels were calculated at the exterior and interior of the nearest noise-sensitive land use. Interior noise levels were calculated based on the predicted exterior noise level and assuming an average exterior-to-interior noise reduction of 15 dB.

Project Impacts and Mitigation Measures

Impact N-A. Would the project result in a substantial temporary or permanent increase in ambient noise levels in the project vicinity in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Construction-Related Noise Levels

Construction noise typically occurs intermittently and varies depending upon the phase (e.g., land clearing, grading, excavation, and erection). Noise generated by construction equipment, including earthmovers, material handlers, and portable generators, can reach high levels. Noise levels commonly associated with off-road equipment anticipated to be used during project construction are summarized in Table 6.

As noted in Table 6, instantaneous noise levels generated by individual pieces of off-road equipment typically range from approximately 77 to 90 dBA L_{max} at 50 feet. Typical operating cycles may involve 2 minutes of full power, followed by 3 or 4 minutes at lower settings. Based on typical off-road equipment usage rates, average hourly noise levels for individual equipment would be approximately 83 dBA L_{eq}, or less, at 50 feet. Assuming that multiple pieces of equipment could be operating simultaneously, predicted average-hourly noise levels could reach levels of approximately 85 dBA at 50 feet.

Table 6. Typical Construction Equipment Noise Levels

Equipment	Typical Noise Level (dBA) at 50 Feet from Source	
	L_{max}	L_{eq}
Air Compressor	78	74
Backhoe	78	74
Concrete Mixer	79	75
Crane, Mobile	81	73
Dozer	82	78
Grader	85	81
Loader	79	71
Paver	77	74
Roller	80	73
Saw	90	83

dBA = A-weighted decibels; L_{max} = Maximum sound level; L_{eq} = Equivalent sound level

Source: FHWA Roadway Construction Noise Model

The nearest noise-sensitive land uses located in the vicinity of the proposed project site include residential dwellings, which are located approximately 35 feet west of the western property boundary. Assuming an average-hourly construction noise level of 85 dBA L_{eq} at 50 feet and that construction activities were to occur at the property boundary, predicted exterior noise levels would be approximately 88 dBA L_{eq} at the nearest residential dwelling. Based on the exterior noise level and assuming an average exterior-to-interior noise reduction of 15 dB, with windows partially open, predicted interior noise levels at the residential dwelling would be approximately 73 dBA L_{eq}. As previously noted, construction noise levels that occur between 6:00 a.m. and 9:00 p.m. on weekdays, and between 7:00 a.m. and 5:00 p.m. on Saturday or Sunday, are exempt from the County's noise regulations. With regards to residential land uses, activities occurring during the more noise-sensitive nighttime hours are of particular concern given the potential for sleep disruption and increased levels of annoyance for building occupants. For these reasons, this impact would be considered **potentially significant**.

Mitigation Measures

N-1: The following measures shall be implemented to reduce construction-generated noise levels:

a) Noise-generating construction activities, including equipment maintenance, shall be limited to the hours between 6:00 a.m. and 9:00 p.m. on weekdays, and between 7:00 a.m. and 5:00 p.m. on Saturday or Sunday.
b) Stationary construction equipment that generates noise that exceeds 65 dBA at the project boundaries shall be shielded with a barrier that meets a sound transmission class rating of 25.
c) All diesel equipment shall be operated with closed engine doors and shall be equipped with factory-recommended mufflers.
d) Whenever feasible, electrical power shall be used to run air compressors and similar power tools.
e) Construction staging areas shall be located at the furthest distance possible from nearby residential land uses.

Significance After Mitigation

Implementation of the above mitigation measures would limit construction activities to less noise-sensitive periods of the day. The use of mufflers would reduce construction equipment noise levels by approximately 10 dBA. With the implementation of the above mitigation measures and given that construction activities would be short-term and intermittent, this impact would be considered **less than significant**.

Operational Noise Levels

Long-term, permanent increases in ambient noise levels would be primarily associated with potential increases in vehicle traffic on nearby roadways; as well as on-site activities. Noise levels commonly associated with these sources and potential impacts to nearby noise-sensitive land uses are discussed as follows:

Vehicular Roadway Traffic

Predicted existing traffic noise levels, with and without the implementation of the proposed project, are summarized in Table 7. In comparison to existing without project traffic noise levels, the proposed project would result in a predicted increase in traffic noise levels of 1.7 to 3.0 dBA along nearby roadways.

Predicted future cumulative traffic noise levels, with and without the implementation of the proposed project, are summarized in Table 8. In comparison to future cumulative without project traffic noise levels, the proposed project would result in a predicted increase in traffic noise levels of 0.3 to 0.8 dBA along nearby roadways.

As noted earlier in this report, a change in sound level of at least 5 dB is required before any noticeable change in community response would be expected. Implementation of the proposed project would not result in substantial increases (i.e., 5 dBA or greater) in existing and future cumulative conditions along nearby roadways. Predicted traffic noise levels are not projected to exceed the County's noise control ordinance exterior and interior standards at the nearby residential land use (refer to Appendix B). As a result, this impact would be considered **less than significant.**

Table 7. Predicted Increase in Existing Traffic Noise Levels

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1]			Substantial Increase?[3]	Exceeds County's Noise Standard?[4]	Significant Impact?[5]
	Existing without Project	Existing with Project	Difference[2]			
North Avenue, East of Chestnut Avenue	52.0	55.0	3.0	No	No	No
North Avenue, West of Willow Avenue	51.0	53.8	2.9	No	No	No
Willow Avenue, North of Chestnut Avenue	46.9	48.5	1.7	No	No	No

dBA = A-weighted decibels; CNEL = Community noise equivalent level; L_{dn} = Day-night average sound level
1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.
2. Differences in noise levels reflect the incremental increase attributable to the proposed project.
3. Substantial increase defined as an increase of 5 dB, or greater.
4. Noise-sensitive land uses along evaluated roadway segments would not exceed the Fresno County noise control ordinance standards.
5. A significant increase is defined as a substantial increase in noise levels that would exceed the County's applicable noise standards at nearby land uses.

Table 8. Predicted Increase in Future Traffic Noise Levels

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1]			Substantial Increase?[3]	Exceeds County's Noise Standard?[4]	Significant Impact?[5]
	Future without Project	Future with Project	Difference[2]			
North Avenue, East of Chestnut Avenue	57.0	57.8	0.8	No	No	No
North Avenue, West of Willow Avenue	56.9	57.3	0.4	No	No	No
Willow Avenue, North of Chestnut Avenue	52.4	52.7	0.3	No	No	No

dBA = A-weighted decibels; CNEL = Community noise equivalent level; L_{dn} = Day-night average sound level
1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.
2. Differences in noise levels reflect the incremental increase attributable to the proposed project.
3. Substantial increase defined as an increase of 5 dB, or greater.
4. Noise-sensitive land uses along evaluated roadway segments would not exceed the Fresno County noise control ordinance standards.
5. A significant increase is defined as a substantial increase in noise levels that would exceed the County's applicable noise standards at nearby land uses.

Building Maintenance & Mechanical Equipment

Proposed structures would be anticipated to include the use of building mechanical equipment, such as air conditioning units and exhaust fans. The specific building mechanical equipment to be installed and the locations of such equipment have not yet been identified. Building mechanical equipment (e.g., air conditioning units, exhaust fans) would typically be located within the structures, enclosed, or placed on rooftop areas away from direct public exposure. Exterior air conditioning units and exhaust fans can generate noise levels up to approximately 65 dBA L_{eq} at 10 feet. Based on these assumptions, predicted exterior noise levels at the nearest residential dwelling (270 feet from the nearest proposed building) would be approximately 36 dBA L_{eq}. Assuming an average exterior-to-interior noise reduction of 15 dBA, predicted interior noise levels would be approximately 21 dBA L_{eq}. Predicted noise levels associated with building mechanical equipment would not exceed the County's noise control ordinance exterior and interior noise standards at the residential dwelling. As a result, this impact would be considered **less than significant**.

Vehicle Parking Lot

The proposed project may include the construction of a 320-space parking lot (i.e., 270 students and 50 employees). Based on a conservative assumption that all parking spaces would be accessed over a one-hour period, predicted exterior noise levels at the nearest residential dwelling (120 feet from the proposed parking lot) would be approximately 46 dBA L_{eq}. Predicted interior noise levels at the residential dwelling would be approximately 31 dBA L_{eq}. Predicted noise levels associated with on-site parking lot activities would not exceed the County's noise control ordinance exterior and interior noise standards at the residential dwelling. As a result, this impact would be considered **less than significant**.

Physical Training

The proposed project would include physical training activities during the weekday between 6:00 a.m. and 8:00 a.m. for the Fire Academy, and between 4:00 a.m. and 5:00 a.m. for the Police Academy. Associated noise from physical training includes chanting and counting. Elevated human voices typically generate noise levels of approximately 70 to 88 dBA L_{eq} at one foot (Engineering ToolBox 2005). Assuming a very loud voice noise level of 82 dBA L_{eq} at one foot and a maximum of 90 students between the Fire Academy and Police Academy training simultaneously, combined noise levels at 50 feet would be approximately 65 dBA L_{eq}. Based on this noise level, predicted exterior noise levels at the nearest residential dwelling (650 feet from the proposed track field) would be approximately 42 dBA L_{eq}. Predicted interior noise levels at the residential dwelling would be approximately 27 dBA L_{eq}. Predicted noise levels associated with physical training activities would not exceed the County's noise control ordinance exterior and interior noise standards at the residential dwelling. As a result, this impact would be considered **less than significant**.

Public Address Systems

The proposed project would include an emergency PA system. Noise from the emergency PA system would occur temporarily and infrequently. Based on representative noise levels from similar sources, the use of PA systems can generate noise levels of approximately 75 to 80 dBA L_{eq} at 45 feet. Based on these noise levels, predicted noise levels at the nearest residential dwelling (400 feet from the center of campus) would be approximately 61 dBA L_{eq} at the exterior of the nearest residential dwelling. Predicted interior noise levels at the residential dwelling would be approximately 46 dBA L_{eq}. Predicted noise levels associated with the use of an emergency PA system would exceed Fresno County's noise control ordinance standards at the nearest residential land use. However, emergency PA systems are exempt from the County's noise control ordinance. As noted in the County's Code of Ordinances Chapter 8.40 – Noise Control, noise source exemptions include any mechanical device, apparatus, or equipment used, related to, or connected with emergency activities or emergency work. As a result, this impact would be considered **less than significant**.

Sirens

The proposed project would include noise from sirens. Noise from the sirens would occur very infrequently with no set times. Based on representative noise levels from similar sources, the sounding of sirens can generate instantaneous noise levels of 124 dBA L_{max} at 10 feet (Fire Apparatus 2017). Based on these noise levels, predicted noise levels at the nearest residential dwelling (900 feet from the driving pad) would be approximately 85 dBA L_{max} at the exterior of the nearest residential dwelling. Predicted interior noise levels at the residential dwelling would be approximately 70 dBA L_{max}. Predicted noise levels associated with the use of sirens would exceed Fresno County's noise control ordinance standards at the nearest residential land use. However, noise from sirens would be exempt from the Count's noise control ordinance. As previously noted, noise source exemptions also include operational activities conducted on public or private school grounds. As a result, this impact would be considered **less than significant**.

Training Simulation

The proposed project would utilize training simulation structures. The use of these structures would produce noise during training. The proposed locations of the structures would be setback away from nearby noise-sensitive land uses (700 feet from the nearest residential dwelling). Noise generated during the use of training structures would be primarily associated with occasional conversations and yelling among students. Firearms or simulated weapons fire would not be used. As previously discussed, physical training would not exceed the County's noise control ordinance at 650 feet from the nearest residential dwelling. Therefore, the training simulation 700 feet from the nearest residential dwelling would also not exceed the noise ordinance. As a result, this impact would be considered **less than significant**.

Land Use Compatibility

Based on the traffic noise modeling conducted for this project, predicted onsite exterior noise levels at the nearest proposed buildings would range from approximately 36 dBA CNEL/L_{dn} to 48 dBA CNEL/L_{dn} for future project conditions (refer to Appendix B). Predicted onsite noise levels would not exceed the County's General Plan "normally acceptable" noise standards for land use compatibility of 60 dBA CNEL/L_{dn} at the First Responders Campus. As a result, this impact would be considered **less than significant**.

Impact N-B. Would the project result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Increases in groundborne vibration levels attributable to the proposed project would be primarily associated with short-term construction activities. Groundborne vibration levels associated with representative construction equipment likely to be required during project construction are summarized in Table 9. As depicted, construction-generated vibration levels would range from approximately 0.003 to 0.210 in/sec ppv at 25 feet. The highest vibration levels would be associated with the use of vibratory rollers.

Table 9. Representative Vibration Levels for Construction Equipment

Equipment	Vibration Level at 25 Feet (in/sec, ppv)
Vibratory Roller	0.210
Large Bulldozer	0.089
Loaded Trucks	0.076
Small Bulldozers/Tractors	0.003

in/sec = Inch per second; ppv = Peak particle velocity
Source: FTA 2018

The nearest existing structures include residential dwellings, which are located approximately 35 feet west of the western property boundary; industrial and commercial business structures, approximately 100 feet south of the southern property boundary along North Avenue. Predicted groundborne vibration levels at these nearby structures are summarized in Table 10. As shown in Table 10, predicted construction vibration levels at nearby structures would not exceed the minimum recommended criteria for structural damage or human annoyance (0.5 in/sec ppv and 0.2 in/sec ppv, respectively). Predicted groundborne vibration levels at the nearest off-site structures associated with construction activities would not exceed commonly applied thresholds for potential structural damage or human annoyance. As a result, this impact would be considered **less than significant**.

Table 10. Predicted Groundborne Vibration Levels at Nearby Structures

Nearby Land Use Structures	Distance from Project Boundary (feet)	Vibration Level (in/sec, ppv)
Residential	35	0.145
Industrial	100	0.046
Commercial Business	100	0.046

in/sec = Inch per second; ppv = Peak particle velocity

Impact N-C. For a project located within 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? and for a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

The nearest airport is the Fresno Yosemite International Airport, which is located approximately 5.2 miles north of the project site. The proposed project is not located within the predicted noise contour zones of the airport. As a result, the proposed project would not subject on-site employees or students to potentially hazardous noise conditions associated with aircraft operations nor would the implementation of the proposed project affect airport operations. As a result, this impact would be considered **less than significant.**

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APPENDIX A

NOISE MEASUREMENT SURVEY

NOISE MEASUREMENT SURVEY FORM

SHEET 1 **OF** 3

DATE:	4/1/2021
PROJECT:	Fresno City College New First Responders Center
LOCATION:	County of Fresno, CA
MONITORING STAFF:	Danny L

LOCATION MAP: *(Attached on the following sheet.)*

NOISE MEASUREMENT CONDITIONS & EQUIPMENT

MET CONDITIONS & MONITORING EQUIPMENT:

TEMP: 83 - 85 F | HUMIDITY: 15% | WIND SPEED: 4 MPH | GROUND: DRY

CLOUD COVER BY CLASS (OC=OVERCAST): 3 (1. HEAVY OC, 2. LIGHT OC, 3. SUNNY, 4. CLEAR NIGHT, 5. OC NIGHT)

MET. METER: Kestrel Model 5500

NOISE MONITORING EQUIPMENT:

SOUND LEVEL METER: Larson Davis Model 820 Type 1 S/N: S

CALIBRATOR: Larson Davis Model CAL 200 S/N: S

NOISE MONITORING SETUP:

WITHIN 10 FT OF REFLECTIVE SURFACE?: NO | MICROPHONE HEIGHT AGL (FT): 5

CALIBRATED PRIOR TO AND UPON COMPLETION OF MEASUREMENTS: YES | METER SETTINGS: A-WHT SLOW

NOISE & TRAFFIC MEASUREMENTS

MEASUREMENT			DURATION (Minutes)	MEASUREMENT LOCATION	PRIMARY NOISE SOURCES NOTED	MEASURED NOISE LEVELS
LOCATION	DATE	TIME (24 Hour)				L_{EQ}
1	4/1/2021	14:19	10	Project Site	Traffic	49.3
2	4/1/2021	14:30	10	Edge of Roadway	Traffic	52.9
3	4/1/2021	14:43	10	Edge of Roadway	Traffic	48.8
4	4/1/2021	14:57	10	Edge of Roadway	Traffic	59.1
5	4/1/2021	15:11	10	Edge of Roadway	Traffic	59.6

TRAFFIC COUNTS			DURATION (Minutes)	TRAFFIC DIRECTION	VEHICLE CLASSIFICATION			AVG. VEHICLE SPEEDS (mph)
LOCATION	DATE	TIME (24 Hour)			LDV	MDV	HDV	
1	4/1/2021	14:19	10	-	-	-	-	-
2	4/1/2021	14:30	10	Northbound/Southbound Willow Avenue	7/6	0/1	1/0	45/45
3	4/1/2021	14:43	10	Northbound/Southbound Willow Avenue	6/10	0/0	0/2	45/45
4	4/1/2021	14:57	10	Eastbound/Westbound North Avenue	32/17	3/2	6/6	45/45
5	4/1/2021	15:11	10	Eastbound/Westbound North Avenue	23/26	5/6	7/0	50/50

VEHICLE COUNTS: ☒ MANUALLY ☐ VIDEO

VEHICLE SPEEDS: ☐ IN TRAFFIC ☒ RADAR

AMBIENT
AIR QUALITY & NOISE CONSULTING

NOISE MEASUREMENT SURVEY FORM

		SHEET	***2***	***OF***	***3***

DATE:	4/1/2021
PROJECT:	Fresno City College New First Responders Center
LOCATION:	County of Fresno, CA
MONITORING STAFF:	Danny L

LOCATION MAP:

Project Site Figure 2

First Responders Campus Project
State Center Community College District

Project Site

N

ODELL Planning & Research, Inc.
Environmental Planning • School Facility Planning • Demographics

0 125 250 500
Feet

NOISE MEASUREMENT SURVEY FORM

	SHEET	**3**	**OF**	**3**

DATE:	4/1/2021
PROJECT:	Fresno City College New First Responders Center
LOCATION:	County of Fresno, CA
MONITORING STAFF:	Danny L

SITE PHOTO(S): (Refer to data sheets for noise measurement locations)

MEASUREMENT LOCATION 1

MEASUREMENT LOCATION 2

MEASUREMENT LOCATION 3

MEASUREMENT LOCATION 4

MEASUREMENT LOCATION 5

APPENDIX B

OPERATIONAL NOISE AND CONSTRUCTION VIBRATION MODELING

Operational Vehicular Traffic

Roadway Segment	ADT			Speed (mph)	AHW
	Without Project	With Project	Difference		
Existing Conditions					
North Avenue, East of Chestnut Avenue	323	651	328	45	6
North Avenue, West of Willow Avenue	256	494	238	45	6
Willow Avenue, North of Chestnut Avenue	100	146	46	45	6
Cumulative (Year 2040) Conditions					
North Avenue, East of Chestnut Avenue	1028	1222	194	45	6
North Avenue, West of Willow Avenue	1002	1102	100	45	6
Willow Avenue, North of Chestnut Avenue	352	381	29	45	6

ADT = Average daily traffic; mph = Miles per hour; AHW = Active half-width

Existing without Project Traffic Noise Level and Distance

ROADWAY SEGMENT	NOISE LEVEL	DISTANCE (FEET)			
	CNEL AT 50' FROM NEAR TRAVEL LANE CENTERLINE	70 CNEL	65 CNEL	60 CNEL	55 CNEL
North Avenue, East of Chestnut Avenue	52.0	WR	WR	WR	WR
North Avenue, West of Willow Avenue	51.0	WR	WR	WR	WR
Willow Avenue, North of Chestnut Avenue	46.9	WR	WR	WR	WR

CNEL = Community noise equivalent level

Existing with Project Traffic Noise Level and Distance

ROADWAY SEGMENT	NOISE LEVEL	DISTANCE (FEET)			
	CNEL AT 50' FROM NEAR TRAVEL LANE CENTERLINE	70 CNEL	65 CNEL	60 CNEL	55 CNEL
North Avenue, East of Chestnut Avenue	55.0	WR	WR	WR	56
North Avenue, West of Willow Avenue	53.8	WR	WR	WR	WR
Willow Avenue, North of Chestnut Avenue	48.5	WR	WR	WR	WR

CNEL = Community noise equivalent level

Cumulative (Year 2040) without Project Traffic Noise Level and Distance

ROADWAY SEGMENT	NOISE LEVEL	DISTANCE (FEET)			
	CNEL AT 50' FROM NEAR TRAVEL LANE CENTERLINE	70 CNEL	65 CNEL	60 CNEL	55 CNEL
North Avenue, East of Chestnut Avenue	57.0	WR	WR	WR	76
North Avenue, West of Willow Avenue	56.9	WR	WR	WR	75
Willow Avenue, North of Chestnut Avenue	52.4	WR	WR	WR	WR

CNEL = Community noise equivalent level

Cumulative (Year 2040) with Project Traffic Noise Level and Distance

ROADWAY SEGMENT	NOISE LEVEL	DISTANCE (FEET)			
	CNEL AT 50' FROM NEAR TRAVEL LANE CENTERLINE	70 CNEL	65 CNEL	60 CNEL	55 CNEL
North Avenue, East of Chestnut Avenue	57.8	WR	WR	WR	85
North Avenue, West of Willow Avenue	57.3	WR	WR	WR	80
Willow Avenue, North of Chestnut Avenue	52.7	WR	WR	WR	WR

CNEL = Community noise equivalent level

Predicted Existing Traffic Noise Levels at Residences

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1]		Distance from Nearest Residential Dwelling (feet)	Predicted Noise Level at Exterior of Residence (dBA L_{eq})	Predicted Noise Level at Interior of Residence (dBA L_{eq})[2]
	Existing without Project	Existing with Project			
North Avenue, East of Chestnut Avenue	52.0	55.0	175	46.8	31.8
North Avenue, West of Willow Avenue	51.0	53.8	175	45.6	30.6
Willow Avenue, North of Chestnut Avenue	46.9	48.5	105	43.7	28.7

dBA = A-weighted decibels; CNEL = Community noise equivalent level; L_{dn} = Day-night average sound level

1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.

2. Assumes an average exterior-to-interior noise reduction of 15 dB, with windows partially open.

Predicted Future Traffic Noise Levels at Residences

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1]		Distance from Nearest Residential Dwelling (feet)	Predicted Noise Level at Exterior of Residence (dBA L_{eq})	Predicted Noise Level at Interior of Residence (dBA L_{eq})[2]
	Future without Project	Future with Project			
North Avenue, East of Chestnut Avenue	57.0	57.8	175	49.6	34.6
North Avenue, West of Willow Avenue	56.9	57.3	175	49.1	34.1
Willow Avenue, North of Chestnut Avenue	52.4	52.7	105	47.9	32.9

dBA = A-weighted decibels; CNEL = Community noise equivalent level; L_{dn} = Day-night average sound level

1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.

2. Assumes an average exterior-to-interior noise reduction of 15 dB, with windows partially open.

Predicted Future Traffic Noise Levels at Project Site

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1]		Distance from Nearest Proposed Building (feet)	Predicted Noise Level at Exterior of Building (dBA L_{eq})
	Future without Project	Future with Project		
North Avenue, East of Chestnut Avenue	57.0	57.8	225	48.0
North Avenue, West of Willow Avenue	56.9	57.3	225	47.5
Willow Avenue, North of Chestnut Avenue	52.4	52.7	630	36.2

dBA = A-weighted decibels; CNEL = Community noise equivalent level; L_{dn} = Day-night average sound level

1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 1/29/2019

Project:	Fresno City College First Responders Center Project

Project Results Summary

Existing Ldn:	dBA
Total Project Ldn:	46 dBA
Total Noise Exposure:	46 dBA
Increase:	46 dB
Impact?:	Severe

Receiver Parameters	
Receiver:	Residenctial
Land Use Category:	2. Residential
Existing Noise (Measured or Generic Value):	dBA

Distance to Impact Contours

Dist to Mod. Impact Contour (Source 1):	31 ft
Dist to Sev. Impact Contour (Source 1):	18 ft

Noise Source Parameters	
Number of Noise Sources:	1

Noise Source Parameters		Source 1
	Source Type:	Stationary Source
	Specific Source:	Park & Ride Lot
Daytime hrs	Avg. Number of Autos/hr	320
	Avg. Number of Buses/hr	0
Nighttime hrs	Avg. Number of Autos/hr	0
	Avg. Number of Buses/hr	0
Distance	Distance from Source to Receiver (ft)	120
	Number of Intervening Rows of Buildings	0
Adjustments	Noise Barrier?	

Source 1 Results

Leq(day):	47.9 dBA
Leq(night):	0.0 dBA
Ldn:	45.9 dBA

Construction Vibrations at Residential Structure

Equipment	Distance from Source	Refrence in/sec ppv at 25 feet	in/sec ppv at Structure
Roller	35	0.210	0.145
Large Buldozer	35	0.089	0.061
Small Bulldozer/Tractor	35	0.003	0.002
Loaded Truck	35	0.076	0.052

ppv = Peak particle velocity

Construction Vibrations at Industrial Structure

Equipment	Distance from Source	Refrence in/sec ppv at 25 feet	in/sec ppv at Structure
Roller	100	0.210	0.046
Large Buldozer	100	0.089	0.019
Small Bulldozer/Tractor	100	0.003	0.001
Loaded Truck	100	0.076	0.017

ppv = Peak particle velocity

Construction Vibrations at Commercial Business Structure

Equipment	Distance from Source	Refrence in/sec ppv at 25 feet	in/sec ppv at Structure
Roller	100	0.210	0.046
Large Buldozer	100	0.089	0.019
Small Bulldozer/Tractor	100	0.003	0.001
Loaded Truck	100	0.076	0.017

ppv = Peak particle velocity