Appendix F

Smoke Tree Residential Project
Noise Impact Study

MD Acoustics

October 28, 2024

Smoke Tree Residential Project

Noise Impact Study

City of Hesperia, CA

Prepared for:

Ms. Julie Gilbert
ELMT Consulting, Inc.
2201 N Grand Ave, Ste #10098
Santa Ana, CA 92711

Prepared by:

MD Acoustics, LLC
Rachel Edelman, INCE-USA
Claire Pincock, INCE-USA
1197 Los Angeles Ave, Ste C-256
Simi Valley, CA 93065

Date: 10/28/2024

MD ACOUSTICS
Sound Solutions for Planning and Design

Noise Study Reports | Vibration Studies | Air Quality | Greenhouse Gas | Health Risk Assessments

P) AZ - 602.774.1950 P) CA - 805.426.4477
www.mdacoustics.com
info@mdacoustics.com

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF EXHIBITS

LIST OF TABLES

1.0 Introduction

1.1 Purpose of Analysis and Study Objectives

This noise assessment was prepared to evaluate the potential noise impacts for the project study area and to recommend noise mitigation measures, if necessary, to minimize the potential noise impacts. The assessment was conducted and compared to the noise standards set forth by the Federal, State, and Local agencies. Consistent with the City's Noise Guidelines, the project must demonstrate compliance to the applicable noise criterion as outlined within the City's Noise Element and Municipal Code.

The following is provided in this report:

- A description of the study area and the proposed project
- Information regarding the fundamentals of noise
- A description of the local noise guidelines and standards
- An analysis of traffic noise impacts to and from the project site
- An analysis of construction noise impacts

1.2 Site Location and Study Area

The Project site is located at 15639 Smoke Tree Street in the City of Hesperia, California, as shown in Exhibit A (APN: 0407-251-012). The site is located within the Main Street and Freeway Corridor Specific Plan. Land zoning surrounding the site includes residential in all cardinal directions. Smoke Tree Street is to the north, and 11th Avenue is to the west.

1.3 Proposed Project Description

The multi-family Project proposes the development of 86 new attached townhouse units comprising of nine (9) two-story buildings and a one-story clubhouse on approximately 4.36 acres. There will be a total of 190 parking spaces. The proposed site plan is illustrated in Exhibit B.

This study assesses the operational noise and traffic noise to and from the project site and compares the results to the applicable City noise standards. In addition, this study reviews noise generated by construction activities.

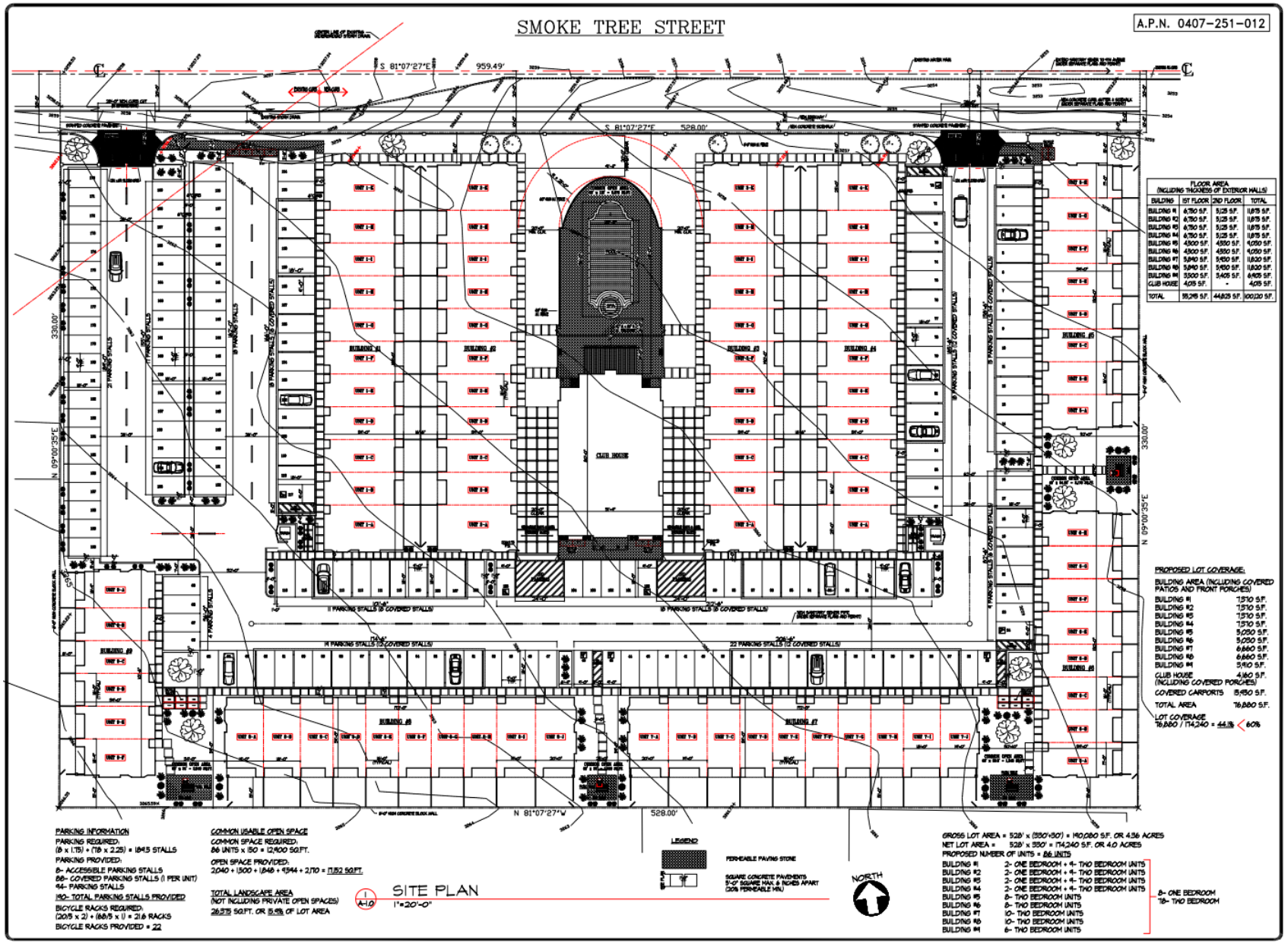
Construction activities within the Project area will consist of site preparation, grading, building, paving, and architectural coating.

Exhibit A

Location Map

Exhibit B

Site Plan



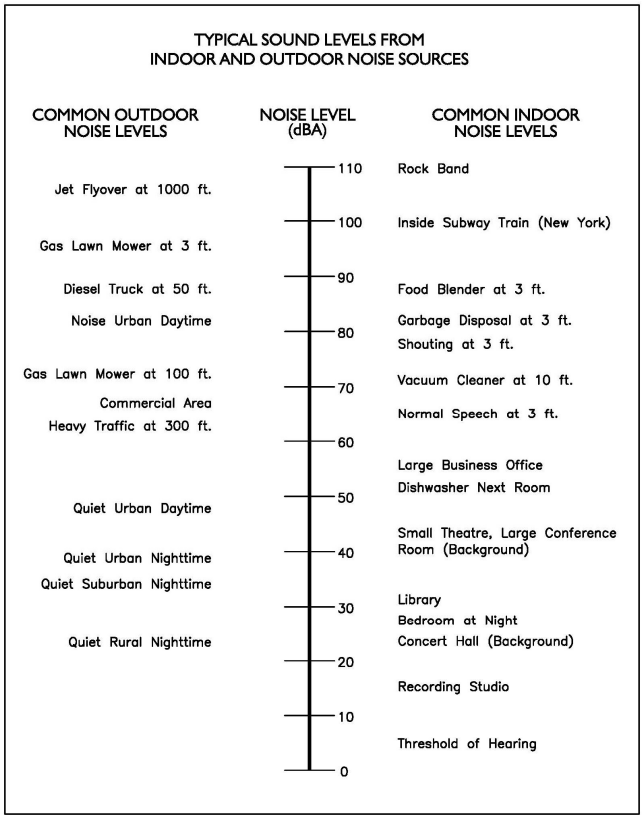
2.0 Fundamentals of Noise

This section of the report provides basic information about noise and presents some of the terms used within the report.

This section of the report provides basic information about noise and presents some of the terms used within the report.

2.1 Sound, Noise and Acoustics

Sound is a disturbance created by a moving or vibrating source and is capable of being detected by the hearing organs. Sound may be thought of as the mechanical energy of a moving object transmitted by pressure waves through a medium to a human ear. For traffic or stationary noise, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or unwanted.



2.2 Frequency and Hertz

A continuous sound is described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch (bass sounding), and high-frequency sounds are high in pitch (squeak). These oscillations per second (cycles) are commonly referred to as Hertz (Hz). The human ear can hear from the bass pitch starting at 20 Hz all the way to the high pitch of 20,000 Hz.

2.3 Sound Pressure Levels and Decibels

The *amplitude* of a sound determines its loudness. The loudness of sound increases or decreases as the amplitude increases or decreases. Sound pressure amplitude is measured in units of micro-Newton per square inch meter (N/m2), also called micro-Pascal (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. Sound pressure level (SPL or L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels, abbreviated dB. Exhibit C illustrates reference sound levels for different noise sources.

2.4 Addition of Decibels

Because decibels are on a logarithmic scale, sound pressure levels cannot be added or subtracted by simple plus or minus addition. When two sounds or equal SPL are combined, they will produce an SPL 3

dB greater than the original single SPL. In other words, sound energy must be doubled to produce a 3 dB increase. If two sounds differ by approximately 10 dB, the higher sound level is the predominant sound.

2.5 Sensitive Receptors

Noise-sensitive land uses include residential (single and multi-family dwellings, mobile home parks, dormitories, and similar uses); transient lodging (including hotels, motels, and similar uses); hospitals, nursing homes, convalescent hospitals, and other facilities for long-term medical care; public or private educational facilities, libraries, churches, and places of public assembly.

2.6 Human Response to Changes in Noise Levels

In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz (A-weighted scale), and it perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. For purposes of this report as well as with most environmental documents, the A-scale weighting is typically reported in terms of A-weighted decibel (dBA). Typically, the human ear can barely perceive the change in noise level of 3 dB. A change in 5 dB is readily perceptible, and a change in 10 dB is perceived as being twice or half as loud. As previously discussed, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g., doubling the traffic volume on a highway) would result in a barely perceptible change in sound level.

Table 1: Decibel Changes and Loudness

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud
Source: https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm	

2.7 Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels are constant, while others are sporadic. Noise descriptors were created to describe the different time-varying noise levels.

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted 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 response of the human ear. A numerical method of rating human judgment of loudness.

Ambient Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after adding five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after adding ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a 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, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time-varying noise level. The energy average noise level during the sample period.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking, or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms, and similar spaces.

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly, L50, L90 and L99, etc.

Noise: *A*ny unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Outdoor Living Area: Outdoor spaces that are associated with residential land uses typically used for passive recreational activities or other noise-sensitive uses. Such spaces include patio areas, barbecue areas, jacuzzi areas, etc., associated with residential uses; outdoor patient recovery or resting areas associated with hospitals, convalescent hospitals, or rest homes; outdoor areas associated with places of worship which have a significant role in services or other noise-sensitive activities; and outdoor school facilities routinely used for educational purposes which may be adversely impacted by noise. Outdoor areas usually not included in this definition are: front yard areas, driveways, greenbelts, maintenance areas, and storage areas associated with residential land uses; exterior areas at hospitals that are not used for patient activities; outdoor areas associated with places of worship and principally used for short-term social gatherings; and, outdoor areas associated with school facilities that are not typically associated with educational uses prone to adverse noise impacts (for example, school play yard areas).

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by the use of a sound level meter having a standard frequency filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level, which, if it lasted for one second, would produce the same A-weighted sound energy as the actual event.

2.8 Traffic Noise Prediction

Noise levels associated with traffic depend on a variety of factors: (1) volume of traffic, (2) speed of traffic, (3) auto, medium truck (2 axles), and heavy truck percentage (3 axles and greater), and sound propagation. The greater the volume of traffic, higher speeds, and larger truck percentages equate to a louder volume of noise. A doubling of the Average Daily Traffic (ADT) along a roadway will increase noise levels by approximately 3 dB; reasons for this are discussed in the sections above.

2.9 Sound Propagation

As sound propagates from a source, it spreads geometrically. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a rate of 6 dB per doubling of distance. The movement of vehicles down a roadway makes the source of the sound appear to propagate from a line (i.e., line source) rather than a point source. This line source results in the noise propagating from a roadway in a cylindrical spreading versus a spherical spreading that results from a point source. The sound level attenuates for a line source at a rate of 3 dB per doubling of distance.

As noise propagates from the source, it is affected by the ground and atmosphere. Noise models use hard site (reflective surfaces) and soft site (absorptive surfaces) to help calculate predicted noise levels. Hard site conditions assume no excessive ground absorption between the noise source and the receiver. Soft site conditions such as grass, soft dirt, or landscaping attenuate noise at a rate of 1.5 dB per doubling of distance. When added to the geometric spreading, the excess ground attenuation results in an overall noise attenuation of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.

Research has demonstrated that atmospheric conditions can have a significant effect on noise levels when noise receivers are located 200 feet from a noise source. Wind, temperature, air humidity, and turbulence can further impact how far sound can travel.

3.0 Ground-Bourne Vibration Fundamentals

3.1 Vibration Descriptors

Ground-borne vibrations consist of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically only cause a nuisance to people, but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically only an annoyance to people indoors where the associated effects of the shaking of a building can be notable. Ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls and floors of a room and may also consist of the rattling of windows or dishes on shelves.

Several different methods are used to quantify vibration amplitude.

PPV – Known as the peak particle velocity (PPV) which is the maximum instantaneous peak in vibration velocity, typically given in inches per second.

RMS – Known as root mean squared (RMS) can be used to denote vibration amplitude

VdB – A commonly used abbreviation to describe the vibration level (VdB) for a vibration source.

3.2 Vibration Perception

Typically, developed areas are continuously affected by vibration velocities of 50 VdB or lower. These continuous vibrations are not noticeable to humans whose threshold of perception is around 65 VdB. Outdoor sources that may produce perceptible vibrations are usually caused by construction equipment, steel-wheeled trains, and traffic on rough roads, while smooth roads rarely produce perceptible ground-borne noise or vibration. To counter the effects of ground-borne vibration, the Federal Transit Administration (FTA) has published guidance relative to vibration impacts. According to the FTA, fragile buildings can be exposed to ground-borne vibration levels of 0.3 inches per second without experiencing structural damage.

There are three main types of vibration propagation: surface, compression, and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water. P-waves, or compression waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. S-waves, or shear waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse, or side-to-side and perpendicular to the direction of propagation. As vibration waves propagate from a source, the vibration energy decreases in a logarithmic nature and the vibration levels typically decrease by 6 VdB per doubling of the distance from the vibration source. As stated above, this drop-off rate can vary greatly depending on the soil but has been shown to be effective enough for screening purposes, in order to identify potential vibration impacts that may need to be studied through actual field tests

4.0 Regulatory Setting

The proposed project is located in the City of Hesperia and noise regulations are addressed through the efforts of various federal, state and local government agencies. The agencies responsible for regulating noise are discussed below.

4.1 Federal Regulations

The adverse impact of noise was officially recognized by the federal government in the Noise Control Act of 1972, which serves three purposes:

- Publicize noise emission standards for interstate commerce
- Assist state and local abatement efforts
- Promote noise education and research

The Federal Office of Noise Abatement and Control (ONAC) originally was tasked with implementing the Noise Control Act. However, it was eventually eliminated leaving other federal agencies and committees to develop noise policies and programs. Some examples of these agencies are as follows: The Department of Transportation (DOT) assumed a significant role in noise control through its various agencies. The Federal Aviation Agency (FAA) is responsible to regulate noise from aircraft and airports. The Federal Highway Administration (FHWA) is responsible to regulate noise from the interstate highway system. The Occupational Safety and Health Administration (OSHA) is responsible for the prohibition of excessive noise exposure to workers.

The federal government advocates that local jurisdiction use their land use regulatory authority to arrange new development in such a way that “noise sensitive” uses are either prohibited from being constructed adjacent to a highway or, or alternatively that the developments are planned and constructed in such a manner that potential noise impacts are minimized.

Since the federal government has preempted the setting of standards for noise levels that can be emitted by the transportation source, the City is restricted to regulating the noise generated by the transportation system through nuisance abatement ordinances and land use planning.

4.2 State Regulations

Established in 1973, the California Department of Health Services Office of Noise Control (ONC) was instrumental in developing regularity tools to control and abate noise for use by local agencies. One significant model is the “Land Use Compatibility for Community Noise Environments Matrix.” The matrix allows the local jurisdiction to clearly delineate compatibility of sensitive uses with various incremental levels of noise.

The State of California has established noise insulation standards as outlined in Title 24, the California Building Code, which in some cases requires acoustical analyses to outline exterior noise levels and to ensure interior noise levels do not exceed the interior threshold. The State mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local

noise element usually recognizes the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable, as illustrated in Exhibit D.

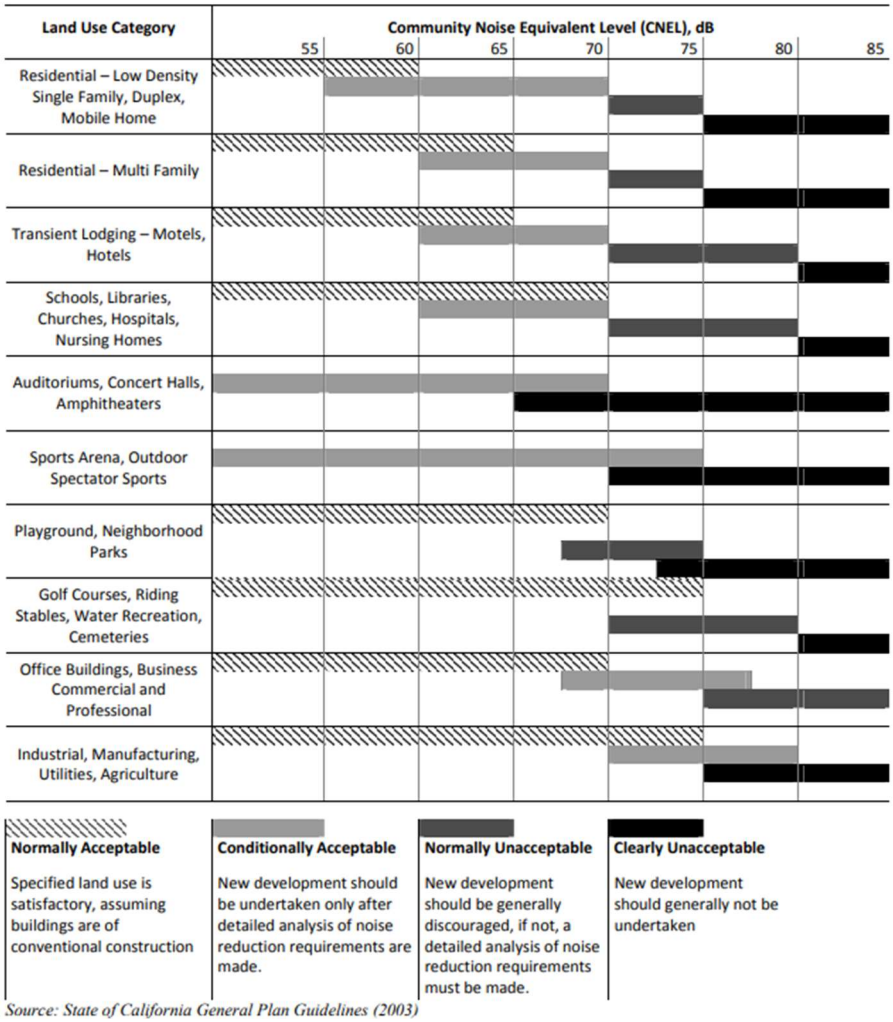
4.3 City of Hesperia Noise Regulations

The City of Hesperia outlines its noise regulations and standards within the Noise Element from the General Plan and the Noise Ordinance from the Municipal Code.

City of Hesperia General Plan

Applicable policies and standards governing environmental noise in the City are set forth in the General Plan's Noise Element. Exhibit NS-1 (Exhibit D of this report) of the City's Noise Element outlines the land use compatibility and Table NS-4 (Exhibit E of this report) outlines the City's interior and exterior noise levels for community noise environments.

Exhibit D: Noise/Land Use Compatibility Matrix



Source: State of California General Plan Guidelines (2003)

Exhibit E: Interior and Exterior Noise Standards

Land Use Categories		Community Noise Equivalent Level (CNEL)	
Categories	**Land Uses**	**Interior[1]**	**Exterior[2]**
Residential	Single Family, Duplex, Multiple Family	45[3]	65
	Mobile Homes	n/a	65[4]
Commercial Industrial Institutional	Hotel, Motel, Transient Lodging	45	65[5]
	Commercial Retail, Bank, Restaurant	55	n/a
	Office Building, Research and Development, Professional Offices, City Office Building	50	n/a
	Amphitheatre, Concert Hall, Meeting Hall	45	n/a
	Gymnasium (Multipurpose)	50	n/a
	Sports Club	55	n/a
	Manufacturing, Warehousing, Wholesale, Utilities	65	n/a
	Movie Theatres	45	n/a
Institutional	Hospitals, School Classrooms	45	65
	Church, Library	45	n/a
Open Space	Parks	n/a	65

Interpretation

1. Indoor environment excluding: Bathrooms, toilets, closets, corridors.
2. Outdoor environment limited to:
   Private yard of single family
   Multi-family private patio or balcony which is served by a means of exit from inside.
   Mobile home park
   Hospital patio
   Park picnic area
   School playground
   Hotel and motel recreation area
3. Noise level requirement with closed windows. Mechanical ventilation system or other means of natural ventilation shall be provided per Building Code.
4. Exterior noise level should be such that interior noise level will not exceed 45 dBA CNEL.
5. Except those areas affected by aircraft noise.

In addition to these noise standards, the City has outlined goals and implementation policies to reduce potential noise impacts, which are presented below:

Goals and Implementation Policies

Goals and implementation policies from the noise section that would mitigate potential impacts on noise include the following.

Goal NS - 1: To achieve and maintain an environment which is free from excessive or harmful noise through identification, control and abatement.

Implementation Policies

NS - 1.1: Incorporate noise reduction features during site planning and into land use planning decisions to mitigate anticipated noise impacts on affected residential and noise-sensitive land uses.

NS - 1.2: Control and abate undesirable sounds through the use of the land use compatibility criteria shown in Exhibit NS-1 (Exhibit D in this report), Table NS-4 (Exhibit E in this report) and the Municipal Code Section 16.20.125(B).

NS - 1.3: Enforce the California Noise Insulation Standards (California Code of Regulations, Title 24). Title 24 requires that an acoustical analysis be performed for all new multifamily residences in areas where the exterior sound level exceeds 60 dBA CNEL. The analysis shall ensure that the building design limits the interior noise environment to 45 dBA CNEL or below.

NS - 1.6. Provide developers and builders with development noise policy guidelines. The guidelines shall provide specific design criteria, minimum standards for submittal of acoustical studies and descriptions of acceptable noise mitigation measures.

NS - 1.7. Ensure that residential uses and areas intended for frequent outdoor use (See Table NS-3 footnote 2) are not subjected to inappropriate noise levels resulting from transportation systems.

NS - 1.10. Limit the hours of construction activity in, and around, residential areas in order to reduce the intrusion of noise in the early morning and late evening hours and on weekends and holidays.

NS - 1.13. Ensure adequate noise control measures at construction sites by requiring that construction equipment be fitted with manufacturer-recommended mufflers and ensuring physical separation of machinery maintenance and staging areas from adjacent residential uses.

Goal NS - 2: To achieve and maintain an environment which is free from excessive vibration.

Implementation Policies

NS - 2.1: Control exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels as set forth in Table NS-1 and Municipal Code Section 16.20.130.

City of Hesperia Municipal Code

The City's Municipal Code outlines the City's exterior noise limits as it relates to stationary noise sources in Section 16.20.125 – Noise.

Section 16.20.125 – Noise

A. Noise Measurement. Noise will be measured with a sound level meter, which meets the standards of the American National Standards Institute (ANSI Section S1.4-1979, Type 1 or Type2). Noise levels

shall be measured using the "A" weighted sound pressure level scale in decibels (ref. pressure = 20 micro-newtons per meter squared). The unit of measure shall be designated as dB(A). The building official shall be the noise control officer.

B. Noise Standards.

1. The following table describes the noise standard for emanations from any source, as it affects adjacent properties:

Table 2: Noise Standards

Affected Land Use (Receiving Noise)	Maximum Noise Level	Time Period
A-1, A-2, R-1, R-3 and RR Zone Districts	55 dB(A)	10:00 p.m. – 7:00 a.m.
A-1, A-2, R-1, R-3 and RR Zone Districts	60 dB(A)*	7:00 a.m. – 10:00 p.m.
C-1, C-2, C-3, C-4, C-R, AP, and P-I Zone Districts	65 dB(A)*	Anytime
I-1 and I-2 Zone Districts	70 dB(A)*	Anytime
*Due to wind noise, the maximum permissible noise level may be adjusted so that it is no greater than five dB(A) above the ambient noise level.		

2. No person shall operate or cause to be operated any source of sound at any location or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level, when measured on any other property, either incorporated or unincorporated, to exceed:

   a. The noise standard for that receiving land use (as specified in subsection (B)(1) of this section) for a cumulative period of more than thirty (30) minutes in any hour; or
   b. The noise standard plus five dB(A) for a cumulative period of more than fifteen (15) minutes in any hour; or
   c. The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour; or
   d. The noise standard plus fifteen (15) dB(A) for a cumulative period of more than one minute in any hour; or
   e. The noise standard plus twenty (20) dB(A) for any period of time.

C. If the measured ambient level exceeds any of the first four noise limit categories above, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.

D. If the alleged offense consists entirely of impact noise or simple tone noise, each of the noise levels in subsection (B)(1) of this section shall be reduced by five dB(A).

E. Exempt Noises. The following sources of noise are exempt:

1. Motor vehicles not under the control of the industrial use;
2. Emergency equipment, vehicles and devices;
3. Temporary construction, repair, or demolition activities between seven a.m. and seven p.m. except Sundays and federal holidays.

Section 16.20.1130 – Vibration

A. Vibration Standard. No ground vibration shall be allowed which can be felt without the aid of instruments at or beyond the lot line; nor will any vibration be permitted which produces a particle velocity greater than or equal to 0.2 inches per second measured at or beyond the lot line.

B. Vibration Measurement. Vibration velocity shall be measured with a seismograph or other instrument capable of measuring and recording displacement and frequency, particle velocity or acceleration. Readings are to be made at points of maximum vibration along any lot line next to a residential or commercial district or a community industrial lot.

C. Exempt Vibrations. The following sources of vibration are not regulated by this code:

1. Motor vehicles not under the control of the industrial use;
2. Temporary construction, maintenance or demolition activities between seven a.m. and seven p.m. except Sundays and federal holidays

4.4 CEQA Guidelines

According to CEQA guidelines, the project would have a potential impact if it resulted in:

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

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

c) For a project 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 public use airport, would the project expose people residing or working in the project area to excessive noise levels?

5.0 Study Method and Procedure

The following section describes the noise modeling procedures and assumptions used for this assessment.

5.1 Noise Measurement Procedure and Criteria

Noise measurements are taken to determine the existing noise levels. A noise receiver or receptor is any location in the noise analysis in which noise might produce an impact. The following criteria are used to select measurement locations and receptors:

- Locations expected to receive the highest noise impacts, such as the first row of houses
- Locations that are acoustically representative and equivalent of the area of concern
- Human land usage
- Sites clear of major obstruction and contamination

MD conducted the sound level measurements in accordance to the County's and Caltrans (TeNS) technical noise specifications. All measurement equipment meets American National Standards Institute (ANSI) specifications for sound level meters (S1.4-1983 identified in Chapter 19.68.020.AA). The following gives a brief description of the Caltrans Technical Noise Supplement procedures for sound level measurements:

- Microphones for sound level meters were placed 5-feet above the ground for all measurements
- Sound level meters were calibrated (Larson Davis CAL 200) before and after each measurement
- Following the calibration of equipment, a windscreen was placed over the microphone
- Frequency weighting was set on "A" and slow response
- Results of the long-term noise measurements were recorded on field data sheets
- During any short-term noise measurements, any noise contaminations such as barking dogs, local traffic, lawn mowers, or aircraft fly-overs were noted
- Temperature and sky conditions were observed and documented

5.2 Noise Measurement Location

The noise monitoring location was selected to obtain a baseline of the existing noise environment. One (1) short-term 15-minute noise measurement was conducted at the Project site. Appendix A includes photos, the field sheet, and measured noise data. Exhibit F illustrates the measurement location.

5.3 Interior Noise Modeling

The interior noise level is the difference between the projected exterior noise level at the structure's facade and the noise reduction provided by the structure itself. Typical building construction will provide a conservative 12 dBA noise level reduction with a "windows open" condition and a very conservative 20 dBA noise level reduction with "windows closed". MD estimated the interior noise level by subtracting the building shell design from the predicted exterior noise level.

For a "windows closed" condition, the project will require mechanical fresh air ventilation (e.g., air conditioning) to the habitable dwelling units.

5.4 FHWA Roadway Construction Noise Model

The construction noise analysis utilizes the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RNCM), together with several key construction parameters. Key inputs include distance to the sensitive receiver, equipment usage, % usage factor, and baseline parameters for the project site.

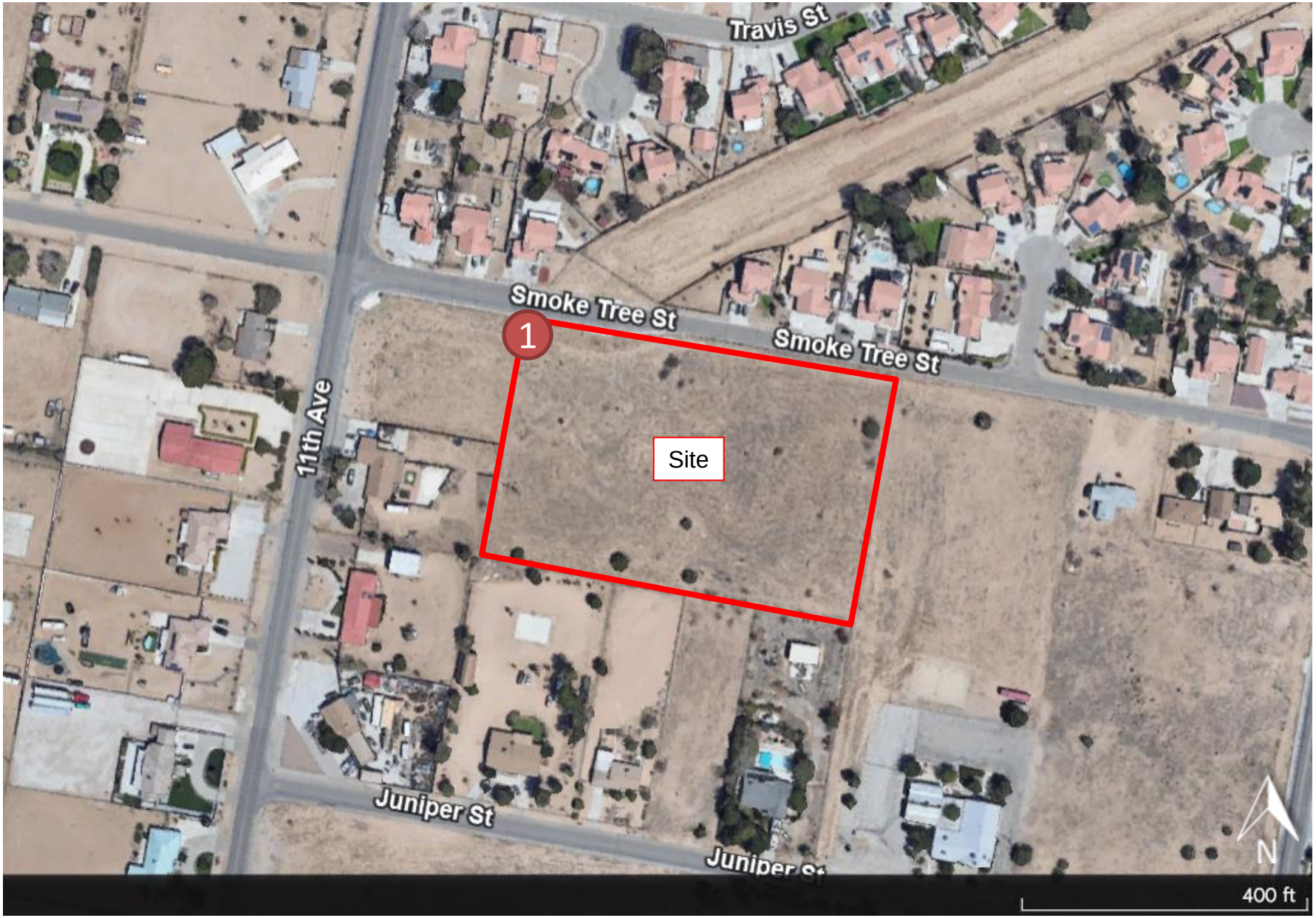
The project was analyzed based on the different construction phases. The construction noise calculation output worksheet is in Appendix C. The following assumptions relevant to short-term construction noise impacts were used:

- It is estimated that construction will occur over a 13-month time period.

Exhibit F

Measurement Location

= Short-Term Monitoring Location



6.0 Existing Noise Environment

One (1) 15-minute noise measurement was conducted at the project site to document the existing noise environment. During the site visit, MD observed that traffic is the primary source of noise impacting the site and surrounding area.

6.1 Short-Term Noise Measurement Results

The results of the short-term noise data are presented in Table 3.

Table 3: Short-Term Noise Measurement Data[1]

Location	Start Time	Stop Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)	L(90)	Estimated CNEL[2]
NM1	12:51 PM	1:06 PM	58.1	70.2	48.6	67.3	62.8	56.4	53.4	50.2	61.5

Notes:
1. Short-term noise monitoring locations are illustrated in Exhibit F.
2. 24-hour noise levels extrapolated based on typical traffic patterns.

Noise data indicates that the ambient noise level is 58 dBA Leq at and near the Project site. Additional field notes and photographs are provided in Appendix A.

24-hour noise data was extrapolated based on typical traffic patterns. The ambient noise level at the site is anticipated to be 62 dBA CNEL and meets the multi-family exterior noise standard of 65 dBA CNEL according to Table NS-4 of the City of Hesperia's Noise Element (Exhibit E of this report).

7.0 Future Noise Environment Impacts and Mitigation

This assessment analyzes future noise impacts to and from the Project and compares the results to the City's Noise Standards. The analysis details the estimated exterior noise levels associated with traffic from adjacent roadway sources and stationary operational noise. There are no airports within 2 miles of the Project site.

7.1 Future Exterior Noise Impact

The exterior noise level off-site of the Project will be impacted by transportation-related sources and other stationary sources. The following outlines the impacts associated with exterior noise levels.

7.1.1 Noise Impacts to On/Off-Site Receptors Due to Project Generated Traffic

It takes a change of 3 dB for the human ear to perceive a difference. Traffic along the subject roadways would need to double in average daily traffic volumes to see a 3 dBA increase in noise level. The proposed Project generates 44 peak hour trips and 580 daily trips and is not anticipated to double the existing traffic volumes. Additionally, the proposed Project will generate less than 50 peak hour trips and thus meets the project-type exemption, and an LOS analysis is not required. The Project is screened out from a VMT analysis and is presumed to have a less than significant transportation impact. (*Trip Generation Assessment and VMT Screening Analysis for Smoke Tree Residential Project, March 2024*).

7.1.2 Future Off-site Stationary Noise Impact

Off-site operational noise includes transformers and HVAC units. HVAC equipment is assumed to be located in the backyard of each unit. Equipment will be at least 20 feet away from the nearest residential uses to the south. The maximum sound power level from a single unit is 72 dBA. At 20 feet away, the sound pressure level is estimated to be 45 dBA. Assuming all units of Buildings 6, 7, 8, and 9 (34 units total) are located 20 feet away from the southern receptor and running simultaneously, the sound level is 61 dBA Leq. The project proposes a six-foot tall concrete property line wall around the project site. The wall will reduce the noise by a conservative 8 dB, resulting in a total noise level of 53 dBA Leq if all of the nearest units are running simultaneously. According to the City's Municipal Code, the noise at residential properties must not exceed 55 dBA Leq during nighttime hours. The worst-case noise due to the HVAC units operating simultaneously will be 53 dBA Leq, and thus meets the City's noise level limit for residential properties.

Per ANSI and NEPA requirements for transformer noise, transformers must be no louder than 65 dBA at 6 feet. Transformers should be placed at least 20 feet from the adjacent residential receptors or should be shielded to stay below the nighttime ambient level.

Operational noise complies with 16.20.125(B)(1) of the Hesperia Municipal Code. The impact is, therefore, less than significant.

7.2 Interior Noise Levels

The future interior noise level was calculated for the proposed residential units using a typical "windows open" and "windows closed" condition. A "windows open" condition assumes 12 dBA of noise attenuation from the exterior noise level. A "windows closed" condition" assumes 20 dBA of noise attenuation from the exterior noise level. Table 4 indicates the first and second-floor interior noise levels for the Project site.

Table 4: Future Interior Noise Levels (dBA CNEL)

Location	Roadway Noise Source	Exterior Facade Study Location	Noise Level at Building Facade[1]	Interior Noise Reduction Required to Meet Interior Noise Standard of 45 dBA CNEL	Interior Noise Level w/ Typical Residential Windows (STC≥ 25)		STC Rating for Windows Facing Subject Roadway[4]
					Window Open[2]	Windows Closed[3]	
1st Row Units Along Northern Property Line	Smoke Tree Street	1st Floor	62	17	50	42	25
		2nd Floor	62	17	50	42	25

Notes:
1. Noise level from Section 6.1 and Appendix A.
2. A minimum of 12 dBA noise reduction is assumed with a "windows open" condition.
3. A minimum of 20 dBA noise reduction is assumed with a "windows closed" condition.
4. Indicates the required STC rating to meet the interior noise standard.

As shown in Table 4, the interior noise level will be 50 dBA CNEL with the windows open and 42 dBA CNEL with the windows closed.

To meet the City's interior 45 dBA CNEL standard a "windows closed" condition is required. The windows and sliding glass doors will meet the requirement with the standard window STC rating of 25. A "windows closed" condition simply means that in order to achieve a 45 dBA CNEL interior noise level, the windows must be closed and does not mean the windows must be fixed.

8.0 Construction Noise Impact

The degree of construction noise may vary for different areas of the Project site and also vary depending on the construction activities. Noise levels associated with the construction will vary with the different phases of construction. The construction noise and vibration level projections are provided in the sections below.

8.1 Construction Noise

The Environmental Protection Agency (EPA) has compiled data regarding the noise generated characteristics of typical construction activities. The data is presented in Table 5.

Table 5: Typical Construction Noise Levels[1]

Equipment Powered by Internal Combustion Engines

Type	Noise Levels (dBA) at 50 Feet
Earth Moving	
Compactors (Rollers)	73 - 76
Front Loaders	73 - 84
Backhoes	73 - 92
Tractors	75 - 95
Scrapers, Graders	78 - 92
Pavers	85 - 87
Trucks	81 - 94
Materials Handling	
Concrete Mixers	72 - 87
Concrete Pumps	81 - 83
Cranes (Movable)	72 - 86
Cranes (Derrick)	85 - 87
Stationary	
Pumps	68 - 71
Generators	71 - 83
Compressors	75 - 86

Impact Equipment

Type	Noise Levels (dBA) at 50 Feet
Saws	71 - 82
Vibrators	68 - 82

Notes:
[1] Referenced Noise Levels from the Environmental Protection Agency (EPA)

Construction is anticipated to occur during the permissible hours as described in the City's Municipal Code Section 16.20.125(E)(3).

Construction noise is considered a short-term impact and would be considered significant if construction activity does not follow the above requirements or if construction occurs outside the allowable times as described in the City's Municipal Code. Construction noise will have a temporary or periodic increase in

the ambient noise level above the existing within the Project vicinity. The construction noise impact is considered less than significant; however, construction noise level projections are provided.

Sensitive land uses surrounding the site include residential uses to the north, south, east, and west. The closest sensitive land use to the Project is the residential use to the west of the site. The residential property is an average of 205 feet away from construction activities and as close as 10 feet from construction activities.

Construction equipment assumptions were taken from the Project's CalEEMod. Typical operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three to four minutes at lower power settings. Noise levels are in Table 6. A likely worst-case construction noise scenario assumes equipment operating as close as 10 feet and an average of 205 feet from the property line of the nearest sensitive receptor, the residential use to the west. The Lmax levels represent maximum levels when construction occurs adjacent to the residential receptors. Leq levels represent the average construction noise level during each phase.

Table 6: Construction Noise Levels East Property Line

Phase	dBA Lmax	dBA Leq
Site Prep	98	76
Grading	99	75
Build	98	74
Paving	104	76
Arch Coating	92	62
Notes: Const Equip from CalEEMod		

As shown in Table 6, project construction noise will range between 62 to 76 dBA Leq and 92 to 104 dBA Lmax at the nearest sensitive receptor (without the implementation of mufflers and other sound attenuating devices). Construction will occur within the permissible hours as described in the City's Municipal Code; thus, the impact is temporary and less than significant. Section 8.3 of this report lists best construction practices to reduce the construction noise levels at surrounding properties.

8.2 Construction Vibration

Construction activities can produce vibration that may be felt by adjacent land uses. The construction of the proposed Project would not require the use of equipment such as pile drivers, which are known to generate substantial construction vibration levels. The primary vibration source during construction may be from a vibratory roller. A vibratory has a vibration impact of 0.210 inches per second peak particle velocity (PPV) at 25 feet which is perceptible but below any risk to architectural damage.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref} (100/D_{rec})^n$$

Where: PPV_{ref} = reference PPV at 100ft.
D_{rec} = distance from equipment to receiver in ft.
n = 1.1 (the value related to the attenuation rate through ground)

The thresholds from the Caltrans Transportation and Construction Induced Vibration Guidance Manual in Table 7 (below) provides general thresholds and guidelines as to the vibration damage potential from vibratory impacts.

Table 7: Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Table 19, Transportation and Construction Vibration Guidance Manual, Caltrans, Sept. 2013.
Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 8 gives approximate vibration levels for particular construction activities. This data provides a reasonable estimate for a wide range of soil conditions.

Table 8: Vibration Source Levels for Construction Equipment[1]

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level LV (dVB) at 25 feet
Pile driver (impact)	1.518 (upper range)	112
	0.644 (typical)	104
Pile driver (sonic)	0.734 upper range	105
	0.170 typical	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill	0.008 in soil	66
(slurry wall)	0.017 in rock	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drill	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level LV (dVB) at 25 feet
Small bulldozer	0.003	58

[1] Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006.

The nearest residential façade is at least 75 feet north of the Project site. At a distance of 75 feet, a vibratory roller would yield a worst-case 0.063 PPV (in/sec) which may be perceptible but sustainably below any risk of damage (0.3 in/sec PPV is the threshold of old residential structures). The impact is less than significant, and no mitigation is required.

8.3 Construction Noise Reduction Policies

Construction operations must follow the City's Noise Ordinance, which states that construction, repair or excavation work performed must occur within the permissible hours. To further reduce the construction noise levels at surrounding properties, the following best construction practices will be implemented:

1. During construction, the contractor will ensure all construction equipment is equipped with appropriate noise attenuating devices.

2. The contractor will locate equipment staging areas as far as possible, away from the sensitive receptors.

3. Idling equipment will be turned off when not in use.

4. Equipment will be maintained so that vehicles and their loads are secured from rattling and banging.

9.0 CEQA Analysis

The California Environmental Quality Act Guidelines establishes thresholds for noise impact analysis as presented below:

(a) Would the project result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise Code, or applicable standards of other agencies?

Transportation Noise Impacts

The proposed Project will generate less than 50 peak hour trips and thus meets the project-type exemption, and an LOS analysis is not required. The Project is screened out from a VMT analysis and is presumed to have a less than significant transportation impact. Additionally, transportation noise impacts would be considered significant if the existing plus project levels are expected to increase by more than 3 dB. It takes a doubling of traffic to see a 3 dB increase in traffic, which is not expected for this Project. The impact is therefore less than significant.

Stationary Noise Sources

Stationary noise impacts would be considered significant if they result in exceedances of Section 16.20.125(B)(1) of the City of Hesperia's Municipal Code. Implementation of the proposed Project may result in stationary noise related to HVAC systems. Equipment will be at least 20 feet away from the nearest residential uses to the south. The maximum sound power level from a single unit is 72 dBA. At 20 feet away, the sound pressure level is estimated to be 45 dBA. Assuming all 34 units of Buildings 6, 7, 8, and 9 (the nearest buildings to the southern receptor) are located 20 feet away from the southern receptor and running simultaneously, the sound level is 61 dBA Leq. The proposed property line wall will reduce the noise by a conservative 8 dB, resulting in a total noise level of 53 dBA Leq. According to the City's Municipal Code, the noise at residential properties must not exceed 55 dBA Leq during nighttime hours. The worst-case noise due to the HVAC units operating simultaneously will be 46 dBA Leq, and thus meets the City's noise level limit for residential properties. Transformers are assumed to be at least 20 feet away from all residential property lines or are shielded to be below the 55 dBA nighttime limit. The stationary noise impact would therefore be less than significant.

Construction Noise and Vibration

Construction noise will be significant if construction activities occur outside of the permitted construction hours specified in Section 16.20.125(E)(3) of the City of Hesperia's Municipal Code.

Noise due to construction will result in short-term noise impacts associated with construction activities. However, construction will comply with the City's code, and the impact is less than significant.

b) Generate excessive ground-borne vibration or ground-borne noise levels?

Construction vibration will be significant if vibration exceeds levels that would result in structural damage to existing buildings. At a distance of 75 feet, the nearest building to the Project property line, a vibratory roller would yield a worst-case 0.063 PPV (in/sec), which may be perceptible but is below the threshold of any risk of damage. Therefore, the impact is less than significant.

c) For a project 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 public use airport, would the project expose people residing or working in the project area to excessive noise levels?

The project is located more than 2 miles away from the nearest airport. Thus, the impact due to airport/aircraft noise is less than significant.

10.0 References

State of California General Plan Guidelines: 1998. Governor's Office of Planning and Research

City of San Bernardino: General Plan Noise Element.

City of San Bernardino: Municipal Code Chapter 8.45.

City of Highland: Municipal Code Section 8.16.100.

ITE Trip Generation Manual

Konan Vibration Criteria

Federal Highway Administration. Noise Barrier Design Handbook. June 2017.

Federal Transit Administration. Transit Noise and Vibration Impact Assessment Manual. September 2018

Appendix A:

Photographs and Field Measurement Data

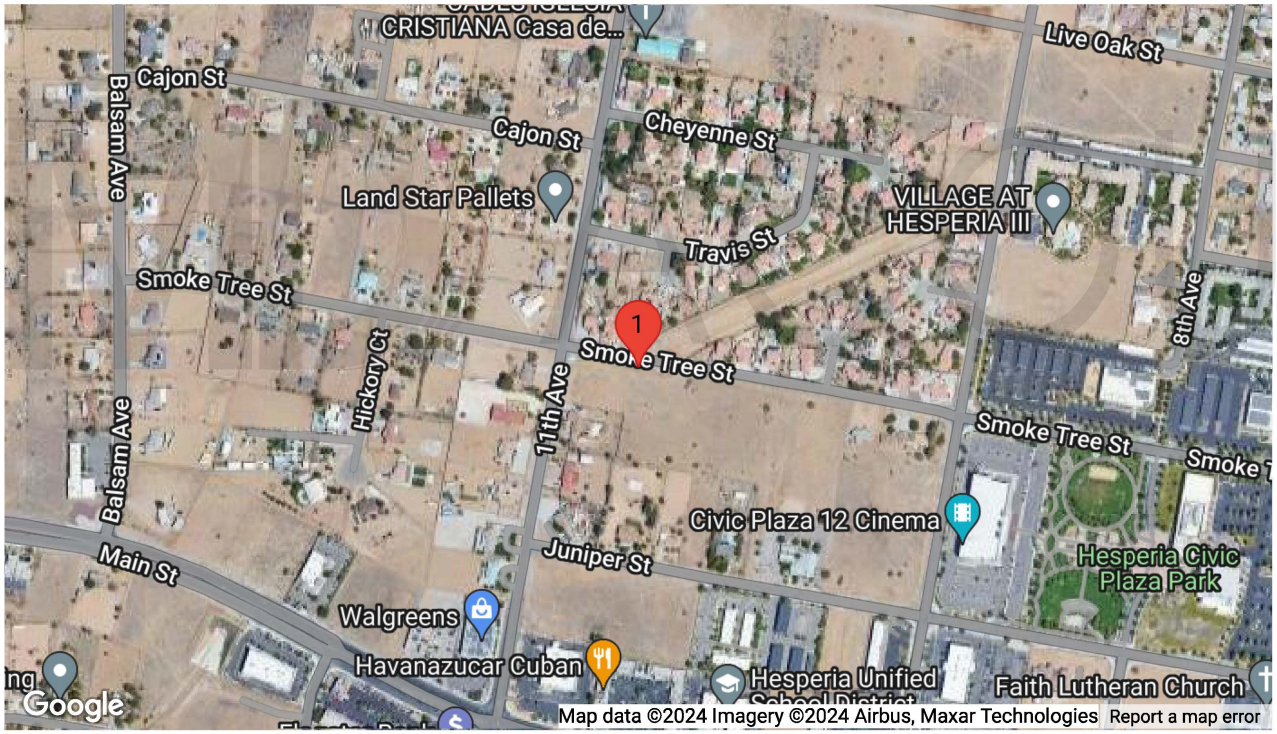
15-Minute Continuous Noise Measurement Datasheet

Project Name:	15639 Smoke Tree Street Noise
Project: #/Name:	0739-2023-031
Site Address/Location:	15369 Smoke Tree Steet
Date:	03/04/2024
Field Tech/Engineer:	Jason Schuyler / Samuel Hord

Site Observations:

Sunny temp 54F winds 10-15MPH. Constant wind from High Desert conditions, the primary noise source is the road.

Sound Meter:	XL2, NTI	**SN:**	A2A-08562-E0
Settings:	A-weighted, slow, 1-sec, 15-minute interval		
Site Id:	NM1		



MD ACOUSTICS

15-Minute Continuous Noise Measurement Datasheet - Cont.

Project Name: 15639 Smoke Tree Street Noise

Site Address/Location: 15369 Smoke Tree Steet

Site Id: NM1

Figure 1: NM1

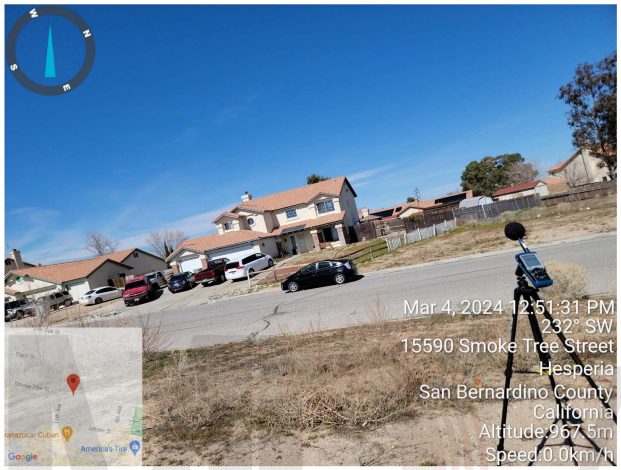


Figure 2: NM1

Figure 3: NM1

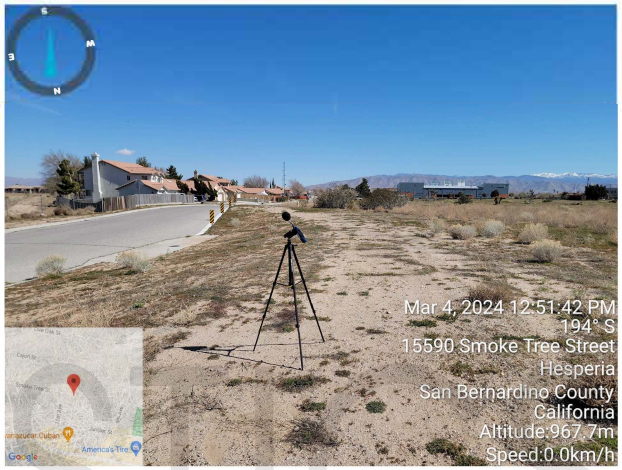
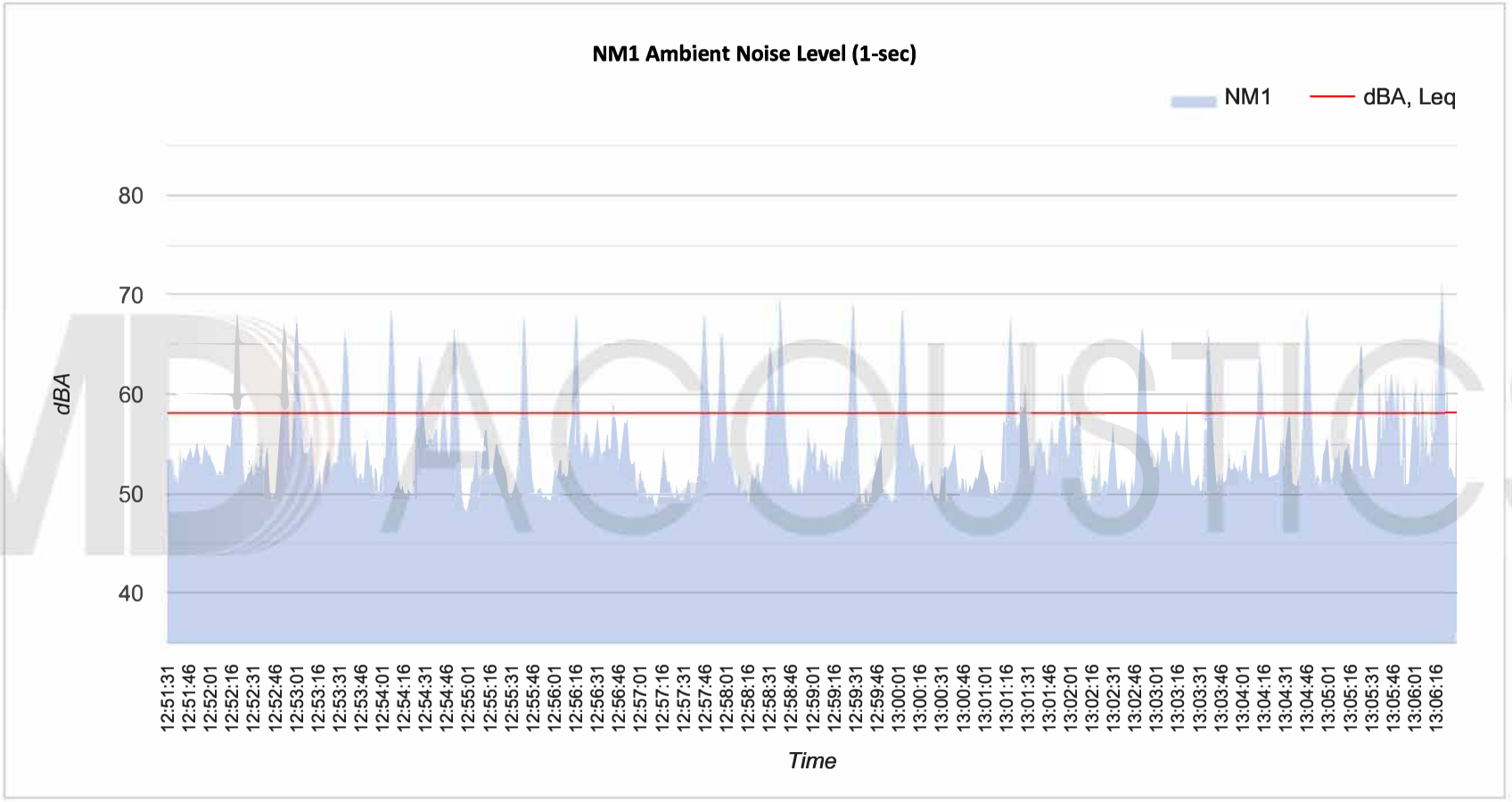


Table 1: Baseline Noise Measurement Summary

Location	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
NM1	12:51 PM	1:06 PM	58.1	70.2	48.6	67.3	62.8	56.4	53.4	50.2

15-Minute Continuous Noise Measurement Datasheet - Cont.

Project Name:	15639 Smoke Tree Street Noise	**Site Topo:**	Flat desert conditions with hous	**Noise Source(s) w/ Distance:**	
Site Address/Location:	15369 Smoke Tree Steet	**Meteorological Cond.:**	54F wind 10-15MPH	road noise and residential noise	
Site Id:	NM1	**Ground Type:**	Sandy soil and clay		



Appendix B:
Reference Data

50PG03–14
Ultra High Efficiency Single Package Electric Cooling with Optional Electric Heat Commercial Rooftop Units with Puron® (R–410A) Refrigerant, Optional EnergyX™ (Energy Recovery Ventilator)
2 to 12.5 Nominal Tons

Carrier
turn to the experts

Not equipment being used, but a similar assumption

Product Data

CENTURION

DEALER DESIGN AWARDS
the NEWS | GOLD

BUILDINGS magazine
Editors' Choice
TOP 100 PRODUCTS
2005

Puron
the environmentally sound refrigerant

AHRI* CAPACITY RATINGS

50PG03-14

UNIT 50PG	NOMINAL CAPACITY (Tons)	NET COOLING CAPACITY (Btuh)	TOTAL POWER (kW)	SEER	EER†	SOUND RATING (dB)	IEER
03	2.0	24,000	2.1	14.1	11.5	75	—
04	3.0	35,800	3.1	14.1	11.7	73	—
05	4.0	47,500	4.0	15.0	12.2	72	—
06	5.0	58,500	4.9	14.8	12.2	78	—
07	6.0	69,000	5.8	—	12.2	78	13.0
08	7.5	88,000	7.0	—	12.7	80	13.5
09	8.5	102,000	8.4	—	12.4	80	13.4
12	10.0	119,000	9.9	—	12.2	80	13.0
14	12.5	150,000	13.2	—	11.5	83	11.6

LEGEND
EER – Energy Efficiency Ratio
SEER – Seasonal Energy Efficiency Ratio

*Air Conditioning, Heating and Refrigeration Institute.
† AHRI does not require EER ratings for units with capacity below 65,000 Btuh.

Assuming 1 4-ton unit per condo unit

NOTES:
1. Tested in accordance with AHRI Standards 210–94 (sizes 03–12), 360–93 (size 14).
2. Ratings are net values, reflecting the effects of circulating fan heat.
3. Ratings are based on:
Cooling Standard: 80°F db, 67°F wb indoor entering–air temperature and 95°F db air entering outdoor unit.
IPLV Standard: 80°F db, 67°F wb indoor entering–air temperature and 80°F db outdoor entering–air temperature.
4. All 50PG units are in compliance with Energy Star® and ASHRAE 90.1 2010 Energy Standard for minimum SEER and EER requirements.
5. Units are rated in accordance with AHRI sound standards 270 or 370.
6. Per AHRI, Integrated Energy Efficiency Ratio (IEER) became effective beginning January 1, 2010. Integrated Part–Load Value (IPLV) was superseded by IEER on January 1, 2010. IEER is intended to be a measure of merit for the part load performance of the unit. Each building may have different part load performance due to local occupancy schedules, building construction, building location and ventilation requirements. For specific building energy analysis, an hour–by–hour analysis program should be used.

AHRI CERTIFIED™ www.ahridirectory.org

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program For verification of certification for individual products, go to www.ahridirectory.org.

Appendix C:

Construction Noise Modeling Output

Receptor - Residences to the West

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Edge of Site to Receptor, feet	Center of Site to Receptor, feet	Item Usage Percent[1]	Ground Factor[2]	Usage Factor	Receptor Item Lmax, dBA	Recptor. Item Leq, dBA
SITE PREP									
Tractor	4	84	10	205	40	0	0.40	98.0	67.8
Dozer	3	82	10	205	40	0	0.40	96.0	65.8
							Log Sum	98.0	75.5
GRADE									
Excavator	1	81	10	205	40	0	0.40	95.0	64.8
Grader	1	85	10	205	40	0	0.40	99.0	68.8
Dozer	1	82	10	205	40	0	0.40	96.0	65.8
Tractor	3	84	10	205	40	0	0.40	98.0	67.8
								99.0	75.1
BUILD									
Crane	1	81	10	205	16	0	0.16	95.0	60.8
Man lift	3	75	10	205	20	0	0.20	89.0	55.8
Generator	1	81	10	205	50	0	0.50	95.0	65.7
Tractor	3	84	10	205	40	0	0.40	98.0	67.8
Welder/Torch	1	74	10	205	40	0	0.40	88.0	57.8
								98.0	73.9
PAVE									
Concrete Mixer Truck	2	79	10	205	40	0	0.40	93.0	62.8
Paver	1	77	10	205	50	0	0.50	91.0	61.7
Pavement Scarifier	2	90	10	205	20	0	0.20	104.0	70.8
Roller	2	80	10	205	20	0	0.20	94.0	60.8
Tractor	1	84	10	205	40	0	0.40	98.0	67.8
								104.0	75.7
ARCH COAT									
Compressor (air)	1	78	10	205	40	0	0.40	92.0	61.8
								92.0	61.8

[1]FHWA Construction Noise Handbook: Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors

VIBRATION LEVEL IMPACT

Project:	Smoke Tree Residential Project	Date: 8/23/24
Source:	Roller	
Scenario:	Unmitigated	
Location:	Adjacent residences	
Address:	15639 Smoke Tree St, Hesperia, CA	

PPV = PPVref(25/D)^n (in/sec)

DATA INPUT

Equipment = Type	1	Vibratory Roller	INPUT SECTION IN BLUE
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.	
D =	75.00	Distance from Equipment to Receiver (ft)	
n =	1.10	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

DATA OUT RESULTS

PPV =	**0.063**	IN/SEC	OUTPUT IN RED