Muranaka Warehouse

NOISE IMPACT ANALYSIS

COUNTY OF RIVERSIDE

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LIST OF ABBREVIATED TERMS

(1)	Reference
ANSI	American National Standards Institute
Calveno	California Vehicle Noise
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dBA	A-weighted decibels
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
INCE	Institute of Noise Control Engineering
L_{eq}	Equivalent continuous (average) sound level
L_{max}	Maximum level measured over the time interval
mph	Miles per hour
PPV	Peak Particle Velocity
Project	Muranaka Warehouse
REMEL	Reference Energy Mean Emission Level
RMS	Root-mean-square
VdB	Vibration Decibels

EXECUTIVE SUMMARY

Urban Crossroads, Inc. has prepared this noise study to determine the noise exposure and the necessary noise mitigation measures for the proposed Muranaka Warehouse development ("Project"). The Project site is located on the east side of Decker Road and south of Harley Knox Boulevard in the Mead Valley area of unincorporated County of Riverside. The project proposes to construct a new 239,308 square-foot High Cube Fulfillment Center Building. This noise study has been prepared to satisfy applicable County of Riverside noise standards and significance criteria based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (1)

The results of this Noise Impact Analysis are summarized below based on the significance criteria in Section 4 of this report consistent with Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (1) Table ES-1 shows the findings of significance for each potential noise and/or vibration impact under CEQA before and after any required mitigation measures.

TABLE ES-1: SUMMARY OF CEQA SIGNIFICANCE FINDINGS

Analysis	Report Section	Significance Findings	
		Unmitigated	Mitigated
Off-Site Traffic Noise	7	*Less Than Significant*	-
Operational Noise	9	*Less Than Significant*	-
Construction Noise	10	*Less Than Significant*	-
Construction Vibration		*Less Than Significant*	-

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1 INTRODUCTION

This noise analysis has been completed to determine the noise impacts associated with the development of the proposed Muranaka Warehouse ("Project"). This noise study briefly describes the proposed Project, provides information regarding noise fundamentals, sets out the local regulatory setting, presents the study methods and procedures for transportation related CNEL traffic noise analysis, and evaluates the future exterior noise environment. In addition, this study includes an analysis of the potential Project-related long-term stationary-source operational noise and short-term construction noise and vibration impacts.

1.1 SITE LOCATION

The proposed Project is located on a 12-acre currently vacant site on the east side of Decker Road and south of Harley Knox Boulevard in the Mead Valley area of unincorporated County of Riverside, as shown on Exhibit 1-A. Industrial uses are located to the north and east of the Project site with vacant land to the south and west. The nearest noise sensitive residential homes are located southeast, south, and west of the project site.

1.2 PROJECT DESCRIPTION

The project proposes to construct a new 239,308 square-foot High Cube Fulfillment Center Building that would operate seven days a week 24 hours a day. The site plan for the proposed Project is shown on Exhibit 1-B.

The on-site Project-related noise sources are expected to include: loading dock activity, roof-top air conditioning units, trash enclosure activity, parking lot vehicle movements, and truck movements. This noise analysis is intended to describe the noise level impacts associated with the expected typical operational activities at the Project site.

EXHIBIT 1-A: LOCATION MAP

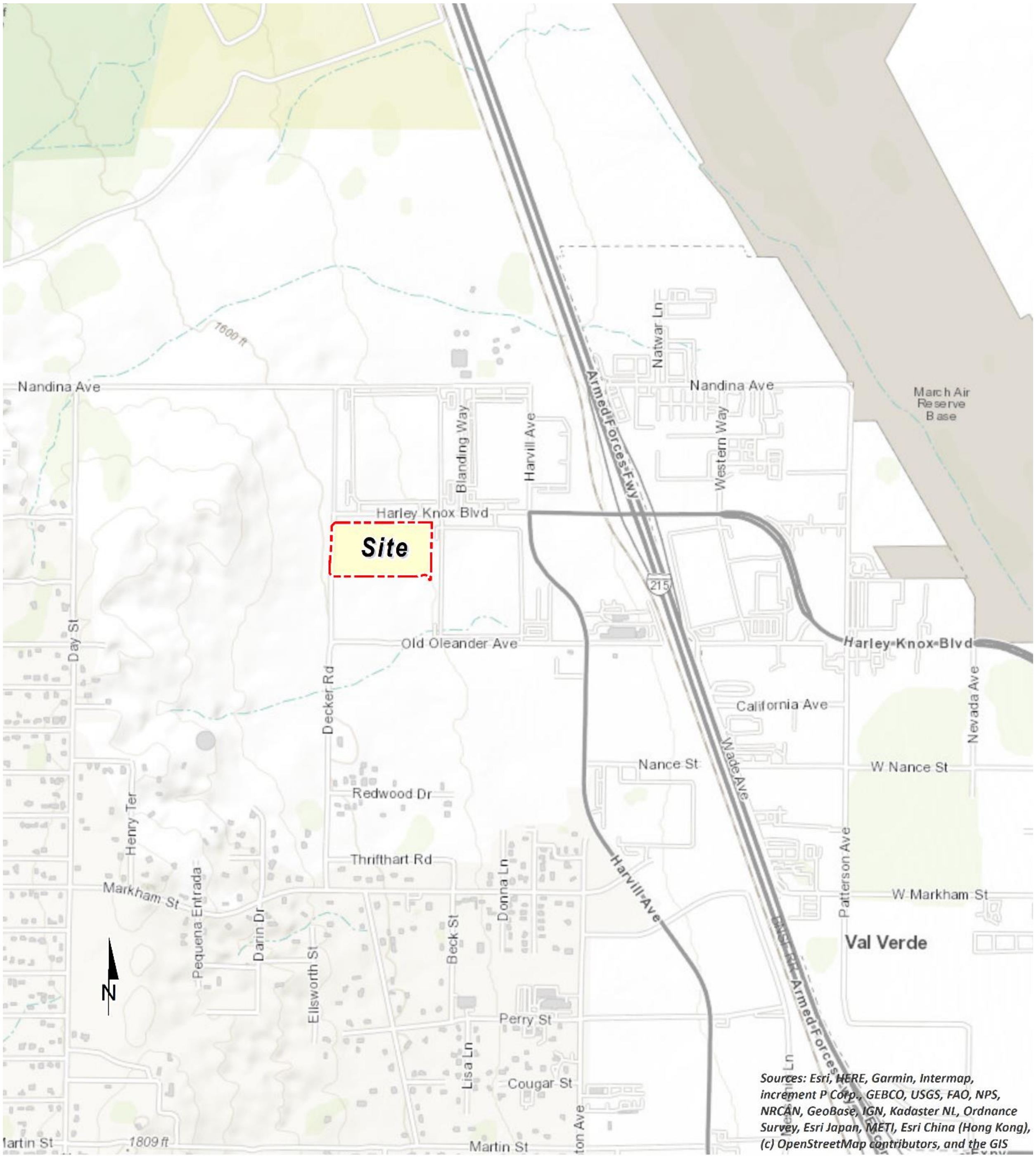
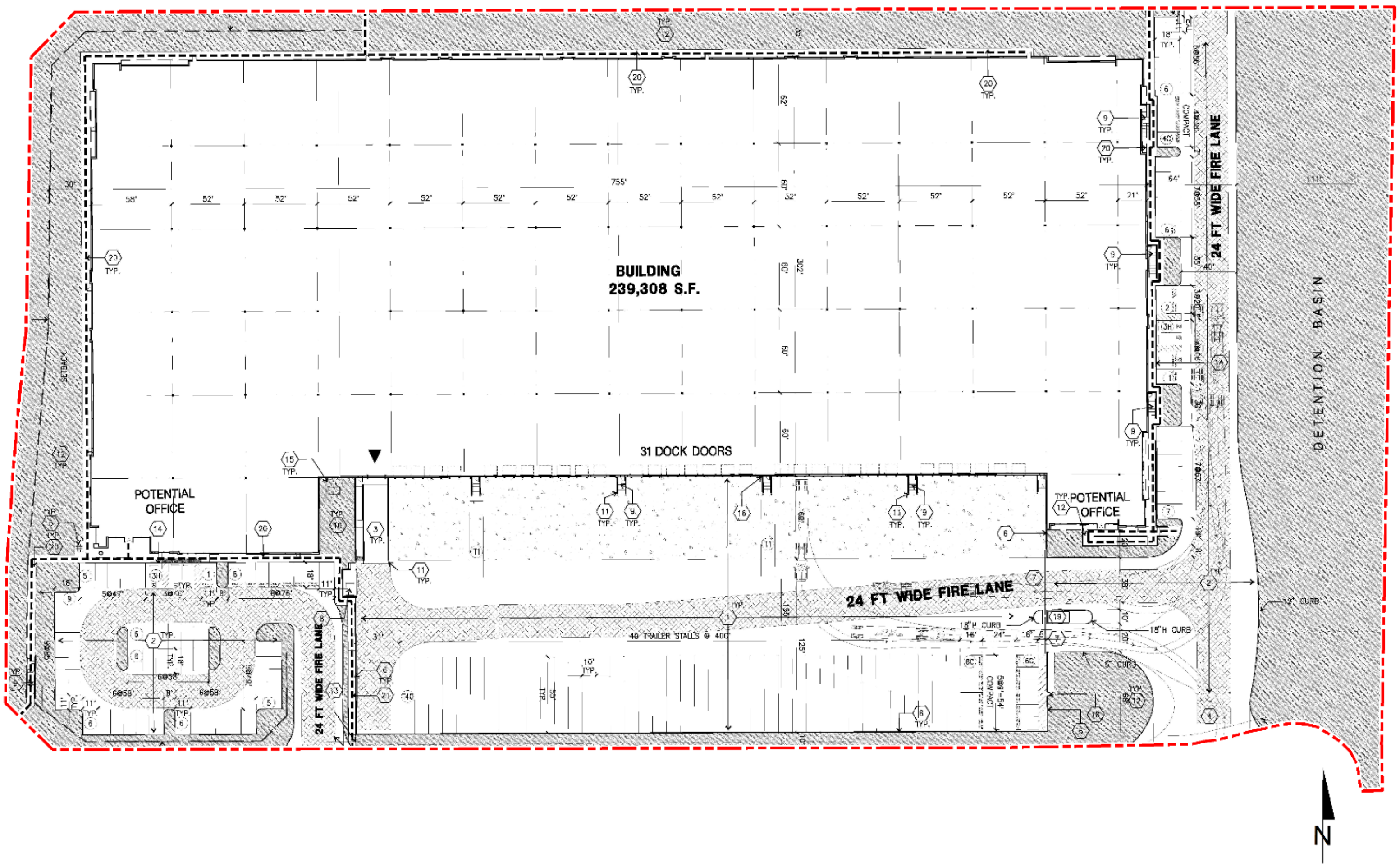


EXHIBIT 1-B: SITE PLAN



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2 FUNDAMENTALS

Noise is simply defined as "unwanted sound." Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm or when it has adverse effects on health. Noise is measured on a logarithmic scale of sound pressure level known as a decibel (dB). A-weighted decibels (dBA) approximate the subjective response of the human ear to broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies which are audible to the human ear. Exhibit 2-A presents a summary of the typical noise levels and their subjective loudness and effects that are described in more detail below.

EXHIBIT 2-A: TYPICAL NOISE LEVELS

<table>
<tr><th>COMMON OUTDOOR ACTIVITIES</th><th>COMMON INDOOR ACTIVITIES</th><th>A - WEIGHTED SOUND LEVEL dBA</th><th>SUBJECTIVE LOUDNESS</th><th>EFFECTS OF NOISE</th></tr>
<tr><td>THRESHOLD OF PAIN</td><td></td><td>140</td><td rowspan="4">INTOLERABLE OR DEAFENING</td><td rowspan="6">HEARING LOSS</td></tr>
<tr><td>NEAR JET ENGINE</td><td></td><td>130</td></tr>
<tr><td></td><td></td><td>120</td></tr>
<tr><td>JET FLY-OVER AT 300m (1000 ft)</td><td>ROCK BAND</td><td>110</td></tr>
<tr><td>LOUD AUTO HORN</td><td></td><td>100</td><td rowspan="3">VERY NOISY</td></tr>
<tr><td>GAS LAWN MOWER AT 1m (3 ft)</td><td></td><td>90</td></tr>
<tr><td>DIESEL TRUCK AT 15m (50 ft), at 80 km/hr (50 mph)</td><td>FOOD BLENDER AT 1m (3 ft)</td><td>80</td><td rowspan="3">SPEECH INTERFERENCE</td></tr>
<tr><td>NOISY URBAN AREA, DAYTIME</td><td>VACUUM CLEANER AT 3m (10 ft)</td><td>70</td><td rowspan="2">LOUD</td></tr>
<tr><td>HEAVY TRAFFIC AT 90m (300 ft)</td><td>NORMAL SPEECH AT 1m (3 ft)</td><td>60</td></tr>
<tr><td>QUIET URBAN DAYTIME</td><td>LARGE BUSINESS OFFICE</td><td>50</td><td rowspan="2">MODERATE</td><td rowspan="2">SLEEP DISTURBANCE</td></tr>
<tr><td>QUIET URBAN NIGHTTIME</td><td>THEATER, LARGE CONFERENCE ROOM (BACKGROUND)</td><td>40</td></tr>
<tr><td>QUIET SUBURBAN NIGHTTIME</td><td>LIBRARY</td><td>30</td><td rowspan="2">FAINT</td><td rowspan="4">NO EFFECT</td></tr>
<tr><td>QUIET RURAL NIGHTTIME</td><td>BEDROOM AT NIGHT, CONCERT HALL (BACKGROUND)</td><td>20</td></tr>
<tr><td></td><td>BROADCAST/RECORDING STUDIO</td><td>10</td><td rowspan="2">VERY FAINT</td></tr>
<tr><td>LOWEST THRESHOLD OF HUMAN HEARING</td><td>LOWEST THRESHOLD OF HUMAN HEARING</td><td>0</td></tr>
</table>

Source: Environmental Protection Agency Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA/ONAC 550/9-74-004) March 1974.

2.1 RANGE OF NOISE

Since the range of intensities that the human ear can detect is so large, the scale frequently used to measure intensity is a scale based on multiples of 10, the logarithmic scale. The scale for measuring intensity is the decibel scale. Each interval of 10 decibels indicates a sound energy ten times greater than before, which is perceived by the human ear as being roughly twice as loud. (2) The most common sounds vary between 40 dBA (very quiet) to 100 dBA (very loud). Normal conversation at three feet is roughly at 60 dBA, while loud jet engine noises equate to 110 dBA at approximately 1,000 feet, which can cause serious discomfort. (3) Another important aspect of noise is the duration of the sound and the way it is described and distributed in time.

2.2 NOISE DESCRIPTORS

Environmental noise descriptors are generally based on averages, rather than instantaneous, noise levels. The most used metric is the equivalent level (L_{eq}). Equivalent sound levels are not measured directly but are calculated from sound pressure levels typically measured in A-weighted decibels (dBA). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period and is commonly used to describe the "average" noise levels within the environment.

Peak hour or average noise levels, while useful, do not completely describe a given noise environment. Noise levels lower than peak hour may be disturbing if they occur during times when quiet is most desirable, namely evening and nighttime (sleeping) hours. To account for this, the Community Noise Equivalent Level (CNEL), representing a composite 24-hour noise level is utilized. The CNEL is the weighted average of the intensity of a sound, with corrections for time of day, and averaged over 24 hours. The time-of-day corrections require the addition of 5 decibels to dBA L_{eq} sound levels in the evening from 7:00 p.m. to 10:00 p.m., and the addition of 10 decibels to dBA L_{eq} sound levels at night between 10:00 p.m. and 7:00 a.m. These additions are made to account for the noise sensitive time periods during the evening and night hours when noise can become more intrusive. CNEL does not represent the actual sound level heard at any time, but rather represents the total sound exposure. The County of Riverside relies on the 24-hour CNEL level to assess land use compatibility with transportation related noise sources.

2.3 SOUND PROPAGATION

When sound propagates over a distance, it changes in level and frequency content. The way noise reduces with distance depends on the following factors.

2.3.1 GEOMETRIC SPREADING

Sound from a localized source (i.e., a stationary point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB 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 3 dB for each doubling of distance from a line source. (2)

2.3.2 GROUND ABSORPTION

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 ft. 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 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance from a line source. (4)

2.3.3 ATMOSPHERIC EFFECTS

Receivers 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) 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. (2)

2.3.4 SHIELDING

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. Shielding by trees and other such vegetation typically only has an “out of sight, out of mind” effect. That is, the perception of noise impact tends to decrease when vegetation blocks the line-of-sight to nearby residents. However, for vegetation to provide a substantial, or even noticeable, noise reduction, the vegetation area must be at least 15 feet in height, 100 feet wide and dense enough to completely obstruct the line-of-sight between the source and the receiver. This size of vegetation may provide up to 5 dBA of noise reduction. The Federal Highway Administration (FHWA) does not consider the planting of vegetation to be a noise abatement measure. (5)

2.4 NOISE CONTROL

Noise control is the process of obtaining an acceptable noise environment for an observation point or receiver by controlling the noise source, transmission path, receiver, or all three. This concept is known as the source-path-receiver concept. In general, noise control measures can be applied to these three elements.

2.5 NOISE BARRIER ATTENUATION

Effective noise barriers can reduce noise levels by 10 to 15 dBA, cutting the loudness of traffic noise in half. A noise barrier is most effective when placed close to the noise source or receiver. Noise barriers, however, do have limitations. For a noise barrier to work, it must block the line-of-sight path of sound from the noise source.

2.6 LAND USE COMPATIBILITY WITH NOISE

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches, and residences are more sensitive to noise intrusion than are commercial or industrial developments and related activities. As ambient noise levels affect the perceived amenity or livability of a development, so too can the mismanagement of noise impacts impair the economic health and growth potential of a community by reducing the area's desirability as a place to live, shop and work. For this reason, land use compatibility with the noise environment is an important consideration in the planning and design process. The FHWA encourages State and Local government to regulate land development in such a way that noise-sensitive land uses are either prohibited from being located adjacent to a highway, or that the developments are planned, designed, and constructed in such a way that noise impacts are minimized. (6)

2.7 COMMUNITY RESPONSE TO NOISE

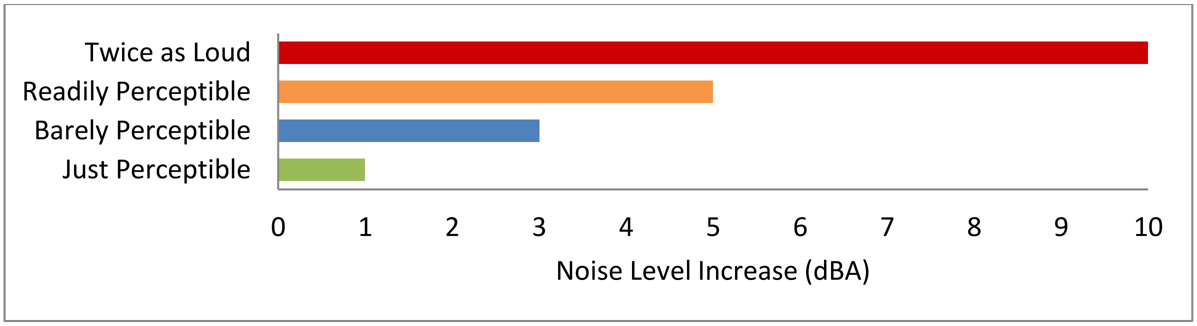
Community responses to noise may range from registering a complaint by telephone or letter, to initiating court action, depending upon everyone's susceptibility to noise and personal attitudes about noise. Several factors are related to the level of community annoyance including:

- Fear associated with noise producing activities;
- Socio-economic status and educational level;
- Perception that those affected are being unfairly treated;
- Attitudes regarding the usefulness of the noise-producing activity;
- Belief that the noise source can be controlled.

Approximately sixteen percent of the population has a very low tolerance for noise and will object to any noise not of their making. Consequently, even in the quietest environment, some complaints may occur. Twenty to thirty percent of the population will not complain even in very severe noise environments. (7 pp. 8-6) Thus, a variety of reactions can be expected from people exposed to any given noise environment.

Surveys have shown that community response to noise varies from no reaction to vigorous action for newly introduced noises averaging from 10 dB below existing to 25 dB above existing. (8) According to research originally published in the Noise Effects Handbook (7), the percentage of high annoyance ranges from approximately 0 percent at 45 dB or less, 10 percent are highly annoyed around 60 dB, and increases rapidly to approximately 70 percent being highly annoyed at approximately 85 dB or greater. Despite this variability in behavior on an individual level, the population can be expected to exhibit the following responses to changes in noise levels as shown on Exhibit 2-B. A change of 3 dBA is considered barely perceptible, and changes of 5 dBA are considered readily perceptible. (4)

EXHIBIT 2-B: NOISE LEVEL INCREASE PERCEPTION



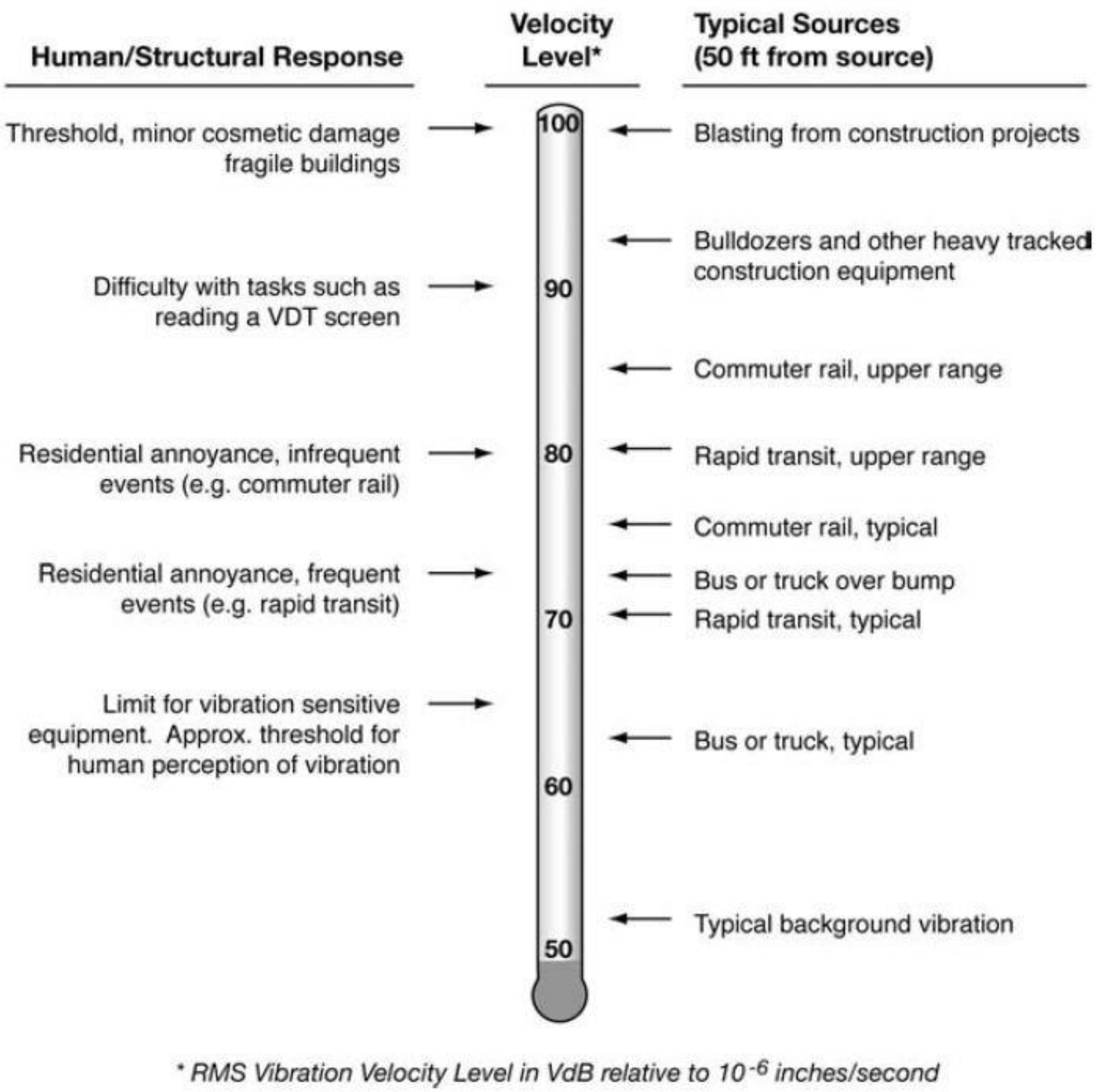
2.8 VIBRATION

Per the Federal Transit Administration (FTA) *Transit Noise Impact and Vibration Impact Assessment Manual* (8) , vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called structure-borne noise. Sources of ground-borne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions. As is the case with airborne sound, ground-borne vibrations may be described by amplitude and frequency.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings but is not always suitable for evaluating human response (annoyance) because it takes some time for the human body to respond to vibration signals. Instead, the human body responds to average vibration amplitude often described as the root mean square (RMS). The RMS amplitude is defined as the average of the squared amplitude of the signal and is most frequently used to describe the effect of vibration on the human body. Decibel notation (VdB) is commonly used to measure RMS. Decibel notation (VdB) serves to reduce the range of numbers used to describe human response to vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receivers for vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration-sensitive equipment and/or activities.

The background vibration-velocity level in residential areas is generally 50 VdB. Ground-borne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground-borne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Exhibit 2-C illustrates common vibration sources and the human and structural response to ground-borne vibration.

EXHIBIT 2-C: TYPICAL LEVELS OF GROUND-BORNE VIBRATION



Source: Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual.

2.9 BLASTING

The intensity of the noise and vibration impacts associated with rock blasting depends on location, size, material, shape of the rock, and the methods used to crack it. While a blasting contractor can design the blasts to stay below a given vibration level that could cause damage to nearby structures, it is difficult to design blasts that produce noise levels which are not perceptible to receivers near the blast site. (9) The noise produced by blasting activities is referred to as air overpressure, or an "airblast," which is generated when explosive energy in the form of gases escape from the detonating blast holes. Much like a point source, airblasts radiate outward in a spherical pattern and attenuate with each doubling of distance from the blast location, depending on the design of the blast and amount of containment.

Blasting activities generally include: the pre-drilling of holes in the hard rock area; preparation and placement of the charges in the drilled holes; a pre-blast horn signal; additional pre-blast horn signals immediately prior to the blast; and the blast itself. An additional horn signal is sounded to indicate the "all clear" after the blast and the blasting contractor has inspected the blasting area. The noise from the blast itself starts with a cracking sound from the detonator, located at a distance from the charges, and ends with the low crackling sound from each charge as they are subsequently set off. Blasts typically occur for only a few seconds, depending on their design. It is important to note that no other construction equipment will be operating during each blast in the blast area but will commence operation once the blasting contractor indicates it is safe to do so. The following calculations, analyses, and findings provided in this report is based on the 18th Edition of the *International Society of Explosives Engineer's (ISEE's) Blasters' Handbook*.

2.9.1 BLASTING NOISE LEVELS

Air overpressure, or "airblast," levels generated by blasting can travel up to 1,100 feet per second, depending on the size of the blast, distance from the blast, and amount of charge confinement. (10) To determine potential airblast levels (dB) from a blast, the cubed-root scaled distance (SD_3) is used based on the planned maximum charge weight of the blast, and distance to the receiver location being analyzed. The following equation is provided in the Blasters' Handbook to calculate the cubed root scaled distance:

$$SD_3 = R / W^{1/3}$$

Where "R" is equal to the distance to the receiver location (e.g., residential homes), and "W" is equal to the maximum charge weight detonated within any 8-millisecond period per Blasters' Handbook guidelines. With known cubed root scaled distances for each blast, the anticipated airblast levels can be calculated at the receiver location. The following equation is provided in the Blaster's Handbook for calculating airblast levels in "P," which represents air pressure in pounds per inch squared (lbs/in^2):

$$P = A \times (SD_3)^{-B}$$

Where "A" is equal to the intercept of a reference line with the calculated SD_3 value. The "A" values are based on the Blasters' Handbook for a given reference industry blast (e.g., construction, mining, etc.), and vary depending on the amount of confinement of each blast. "B" is equal to the slope of the line per Blasters' Handbook reference data. It is important to note that airblast levels are calculated in terms of pressure in the air, and do not represent perceptible noise levels typically described using A-weighted decibels (dBA). Alternatively, airblast pressure levels can be converted to linear decibels (dB) using the following equation per the Blasters' Handbook:

$$P_s = 20 \times \log(P / P_0)$$

Where "P" equals the measured or calculated overpressure, and P_0 represents the reference ambient air pressure (2.9×10^{-9} pounds/inch^2) per the Blasters' Handbook.

2.9.2 BLASTING VIBRATION LEVELS

Vibration levels generated by a blast can travel up to 20,000 feet per second, depending on the size of the blast, travel pathways (e.g., ground discontinuities), and site characteristics. (10) To determine potential vibration levels (PPV) from a blast, the square-root scaled distance (SD_2) is used based on the planned maximum charge weight of the blast, and distance to the receiver location being analyzed. The following equation is provided in the Blasters' Handbook to calculate the square-root scaled distance:

$$SD_2 = R / W^{1/2}$$

Where "R" is equal to the distance to the receiver location (e.g., residential homes), and "W" is equal to the maximum charge weight detonated within any 8-millisecond period per Blasters' Handbook guidelines. With known square-root scaled distances for each blast, the anticipated PPV levels can be calculated at the receiver location. The following equation is provided in the Blaster's Handbook for calculating vibration levels:

$$PPV = A \times (SD_2)^{-B}$$

Where "A" is equal to the intercept of a reference line with the calculated SD_2 value. The "A" values are based on the lower, best fit, or upper bound lines (provided in the Blasters' Handbook) for a given reference industry blast (e.g., construction, mining, etc.), and "B" is equal to the slope of the line.

3 REGULATORY SETTING

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, various county governments, and most municipalities in the state have established standards and ordinances to control noise. In most areas, automobile and truck traffic is the major source of environmental noise. Traffic activity generally produces an average sound level that remains constant with time. Air and rail traffic, and commercial and industrial activities are also major sources of noise in some areas. Federal, state, and local agencies regulate different aspects of environmental noise. Federal and state agencies generally set noise standards for mobile sources such as aircraft and motor vehicles, while regulation of stationary sources is left to local agencies.

3.1 STATE OF CALIFORNIA NOISE REQUIREMENTS

The State of California regulates freeway noise, sets standards for sound transmission, provides occupational noise control criteria, identifies noise standards, and provides guidance for local land use compatibility. State law requires that each county and city adopt a General Plan that includes a Noise Element which is to be prepared per guidelines adopted by the Governor's Office of Planning and Research (OPR). (11) The purpose of the Noise Element is to *limit the exposure of the community to excessive noise levels*. In addition, the California Environmental Quality Act (CEQA) requires that all known environmental effects of a project be analyzed, including environmental noise impacts.

3.2 COUNTY OF RIVERSIDE GENERAL PLAN NOISE ELEMENT

The County of Riverside has adopted a Noise Element of the General Plan to control and abate environmental noise, and to protect the citizens of the County of Riverside from excessive exposure to noise. (12) The Noise Element specifies the maximum allowable exterior noise levels for new developments impacted by transportation noise sources such as arterial roads, freeways, airports and railroads. In addition, the Noise Element identifies several polices to minimize the impacts of excessive noise levels throughout the community and establishes noise level requirements for all land uses. To protect County of Riverside residents from excessive noise, the Noise Element contains the following policies related to the Project:

N 1.1 *Protect noise-sensitive land uses from high levels of noise by restricting noise-producing land uses from these areas. If the noise-producing land use cannot be relocated, then noise buffers such as setbacks, landscaping, or block walls shall be used.*

N 1.3 *Consider the following uses noise-sensitive and discourage these uses in areas in excess of 65 CNEL:*

- *Schools*
- *Hospitals*
- *Rest Homes*
- *Long Term Care Facilities*
- *Mental Care Facilities*
- *Residential Uses*
- *Libraries*

- *Passive Recreation Uses*
- *Places of Worship*

N 1.5 Prevent and mitigate the adverse impacts of excessive noise exposure on the residents, employees, visitors, and noise-sensitive uses of Riverside County.

N 4.1 Prohibit facility-related noise, received by any sensitive use, from exceeding the following worst-case noise levels:

a. 45 dBA 9-minute L_{eq} between 10:00 p.m. and 7:00 a.m.;

b. 65 dBA 9-minute L_{eq} between 7:00 a.m. and 10:00 p.m.

N 13.1 Minimize the impacts of construction noise on adjacent uses within acceptable standards.

N 13.2 Ensure that construction activities are regulated to establish hours of operation in order to prevent and/or mitigate the generation of excessive or adverse impacts on surrounding areas.

N 13.3 Condition subdivision approval adjacent to developed/occupied noise-sensitive land uses (see policy N 1.3) by requiring the developer to submit a construction-related noise mitigation plan to the [County] for review and approval prior to issuance of a grading permit. The plan must depict the location of construction equipment and how the noise from this equipment will be mitigated during construction of this project, through the use of such methods as:

i. Temporary noise attenuation fences;

ii. Preferential location and equipment; and

iii. Use of current noise suppression technology and equipment.

N 14.1 Enforce the California Building Standards that sets standards for building construction to mitigate interior noise levels to the tolerable 45 CNEL limit. These standards are utilized in conjunction with the Uniform Building Code by the County's Building Department to ensure that noise protection is provided to the public. Some design features may include extra-dense insulation, double-paned windows, and dense construction materials.

N 16.3 Prohibit exposure of residential dwellings to perceptible ground vibration from passing trains as perceived at the ground or second floor. Perceptible motion shall be presumed to be a motion velocity of 0.01 inches/second over a range of 1 to 100 Hz.

To ensure noise-sensitive land uses are protected from high levels of noise (N 1.1), Table N-1 of the Noise Element identifies guidelines to evaluate proposed developments based on exterior and interior noise level limits for land uses and requires a noise analysis to determine needed mitigation measures if necessary. The Noise Element identifies residential use as a noise-sensitive land use (N 1.3) and discourages new development in areas with transportation related levels of 65 dBA CNEL or greater existing ambient noise levels. To prevent and mitigate noise impacts for its residents (N 1.5), County of Riverside requires exterior noise attenuation measures for sensitive land use exposed to transportation related noise levels higher than 65 dBA CNEL. In addition, the County of Riverside had adopted an interior noise level limit of 45 dBA CNEL (N 14.1).

Policy N 4.1 of the Noise Element sets a stationary-source exterior noise limit to not to be exceeded for a cumulative period of more than ten minutes in any hour of 65 dBA L_{eq} for daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. To prevent high levels of construction noise from impacting noise-sensitive land uses, policies N 13.1 through 13.3 identify construction noise mitigation requirements for new development located near existing noise-sensitive land uses. Policy 16.3 establishes the vibration perception threshold for rail-related vibration levels, used in this analysis as a threshold for determining potential vibration impacts due to Project construction. (12)

3.2.1 LAND USE COMPATIBILITY GUIDELINES

The noise criteria identified in the County of Riverside Noise Element (Table N-1) are guidelines to evaluate the land use compatibility of transportation related noise. The compatibility criteria, shown on Exhibit 3-A, provides the County with a planning tool to gauge the compatibility of land uses relative to existing and future exterior noise levels.

The *Land Use Compatibility for Community Noise Exposure* matrix describes categories of compatibility and not specific noise standards. The warehouse/industrial use of the Project is considered *normally acceptable* with unmitigated exterior noise levels of less than 70 dBA CNEL based on the *Industrial, Manufacturing, Utilities, Agriculture* land use compatibility criteria shown on Exhibit 3-A. Residential designated land uses in the Project study area are considered *normally acceptable* with exterior noise levels below 60 dBA CNEL, and *conditionally acceptable* with exterior noise levels of up to 70 dBA CNEL. For *conditionally acceptable* exterior noise levels, of up to 80 dBA CNEL for Project land uses, *new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and the needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice*. (12)

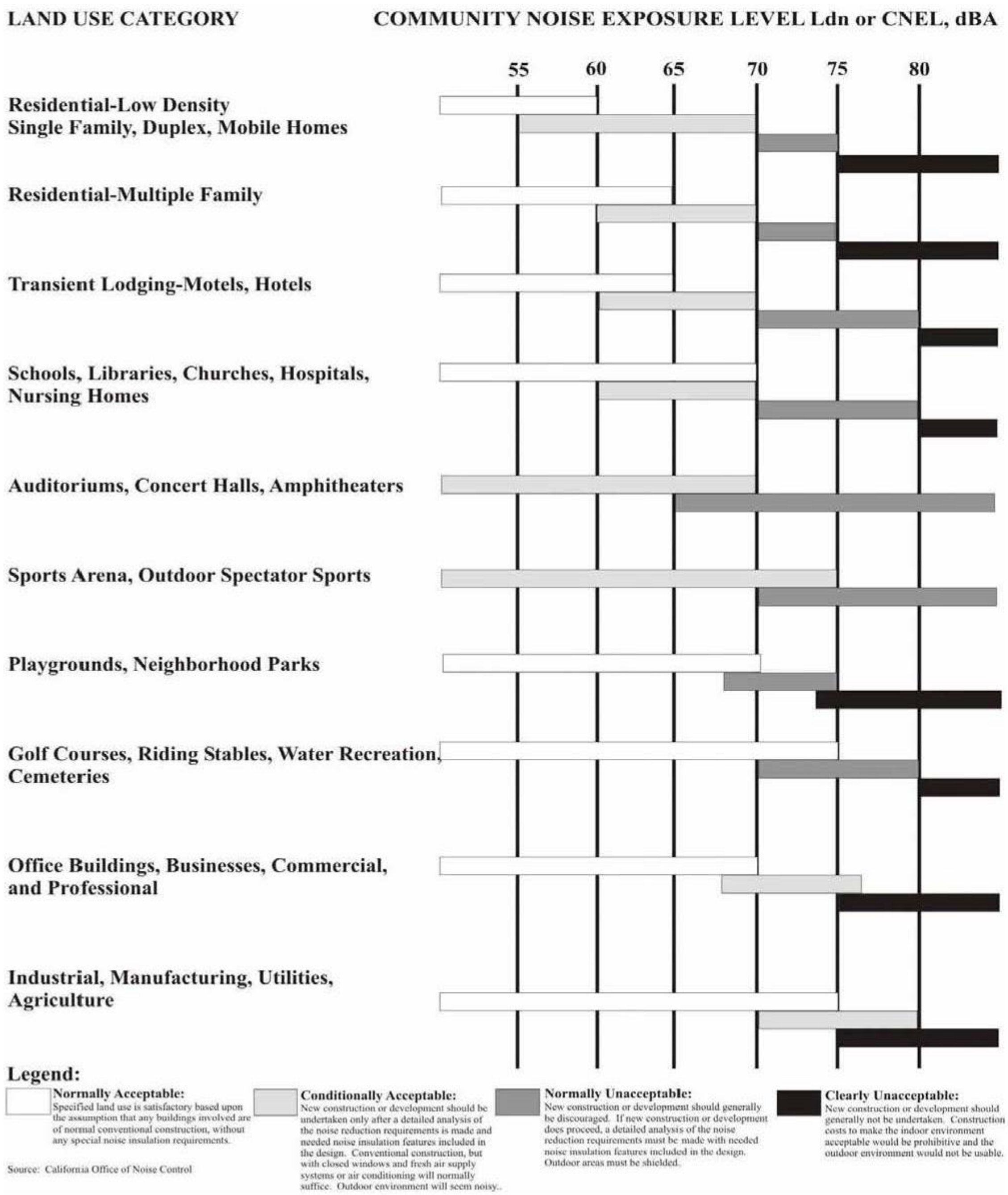
3.3.2 COUNTY OF RIVERSIDE STATIONARY NOISE STANDARDS

The County of Riverside has set stationary-source hourly average L_{eq} exterior noise limits to control loading dock activity, roof-top air conditioning units, trash enclosure activity, parking lot vehicle movements, and truck movements associated with the development of the proposed Muranaka Warehouse. The County considers noise generated using motor vehicles to be a stationary noise source when operated on private property such as at a loading dock. These facility-related noises, as projected to any portion of any surrounding property containing a *habitable dwelling, hospital, school, library or nursing home*, must not exceed the following worst-case noise levels.

Policy N 4.1 of the County of Riverside General Plan Noise Element sets a stationary-source average L_{eq} exterior noise limit not to be exceeded for a cumulative period of more than ten minutes in any hour of 65 dBA L_{eq} for daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. (12)

The County of Riverside Coutny Code Section 9.52.040 *General sound level standards* (included in Appendix 3.1) identify lower, more restrictive exterior noise level standards, which for the purpose of this report, are used to evaluate potential Project-related operational noise level limits instead of the higher the General Plan exterior noise level standards previously identified. The County of Riverside County Code identifies exterior noise level limits of 55 dBA L_{eq} during the daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. for most noise-sensitive uses. (13)

EXHIBIT 3-A: LAND USE COMPATIBILITY FOR COMMUNITY NOISE EXPOSURE



Source: County of Riverside General Plan Noise Element, Table N-1.

Based on several discussions with the County of Riverside Department of Environmental Health (DEH), Office of Industrial Hygiene (OIH), it is important to recognize that the County of Riverside County Code noise level standards, incorrectly identify maximum noise level (L_{max}) standards that should instead reflect the average L_{eq} noise levels. Moreover, the County of Riverside DEH OIH's April 15th, 2015 *Requirements for determining and mitigating, non-transportation noise source impacts to residential properties* also identifies operational (stationary-source) noise level limits using the L_{eq} metric, consistent with the direction of the County of Riverside General Plan guidelines and standards provided in the Noise Element. Therefore, this report has been prepared consistent with direction of the County of Riverside DEH OIH guidelines and standards using the average L_{eq} noise level metric for stationary-source (operational) noise level evaluation.

3.3 CONSTRUCTION NOISE STANDARDS

To control noise impacts associated with the construction of the proposed Project, the County of Riverside has established limits to the hours of construction activities. Section 9.52.020 of the County's Noise Regulation ordinance indicates that noise associated with any private construction activity located within one-quarter of a mile from an inhabited dwelling is considered exempt between the hours of 6:00 a.m. and 6:00 p.m., during the months of June through September, and 7:00 a.m. and 6:00 p.m., during the months of October through May. (13) Neither the County's General Plan nor County Code establish numeric maximum acceptable construction source noise levels at potentially affected receivers for CEQA analysis purposes. Therefore, a numerical construction threshold based on Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual* is used for analysis of daytime construction impacts, as discussed below.

According to the FTA, local noise ordinances are typically not very useful in evaluating construction noise. They usually relate to nuisance and hours of allowed activity, and sometimes specify limits in terms of maximum levels, but are generally not practical for assessing the impact of a construction project. Project construction noise criteria should account for the existing noise environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land use. Due to the lack of standardized construction noise thresholds, the FTA provides guidelines that can be considered reasonable criteria for construction noise assessment. The FTA considers a daytime exterior construction noise level of 80 dBA L_{eq} as a reasonable threshold for noise sensitive residential land use. (8 p. 179)

3.4 CONSTRUCTION VIBRATION STANDARDS

Construction activity can result in varying degrees of ground-borne vibration, depending on the equipment and methods used, distance to the affected structures and soil type. Construction vibration is generally associated with pile driving and rock blasting. Other construction equipment such as air compressors, light trucks, hydraulic loaders, etc., generates little or no ground vibration. Occasionally large bulldozers and loaded trucks can cause perceptible vibration levels at close proximity. The County of Riverside does not have vibration standards for temporary construction, but the County's General Plan Noise Element does contain the human reaction to typical vibration levels. Vibration levels with peak particle velocity of 0.0787 inches per second are considered readily perceptible and above 0.1968 in/sec are considered annoying to people in buildings. Further, County of Riverside General Plan Policy N 16.3 identifies a motion velocity perception threshold for vibration due to passing trains of 0.01 inches per second (in/sec) over the range of one to 100 Hz, which is used in this noise study to assess potential impacts due to Project construction vibration levels. (12)

3.5 BLASTING STANDARDS

The blasting contractor is required to obtain blasting permit(s) from the State, and to notify Riverside County Sheriff's Department within 24 hours of planned blasting events. Air overpressure regulations are identified by the U.S. Bureau of Mines and the ISEE's Blasters' Handbook. (10)

3.5.1 BLASTING NOISE LIMITS

Based on Table 26.17 *Typical Air Overpressure Damage Criteria* of the Blasters' Handbook, an air overpressure of 133 dB is identified as a perception-based criteria level for blasting. As such, to present a conservative approach, the Project blasting-related noise and airblast levels are based on the 133 dB criteria for airblasts identified by the ISEE and U.S. Bureau of Mines. This is the same blasting noise limit outlined in the sample blasting specifications on page D-5 of the Caltrans *Transportation and Construction Vibration Guidance Manual.* (9)

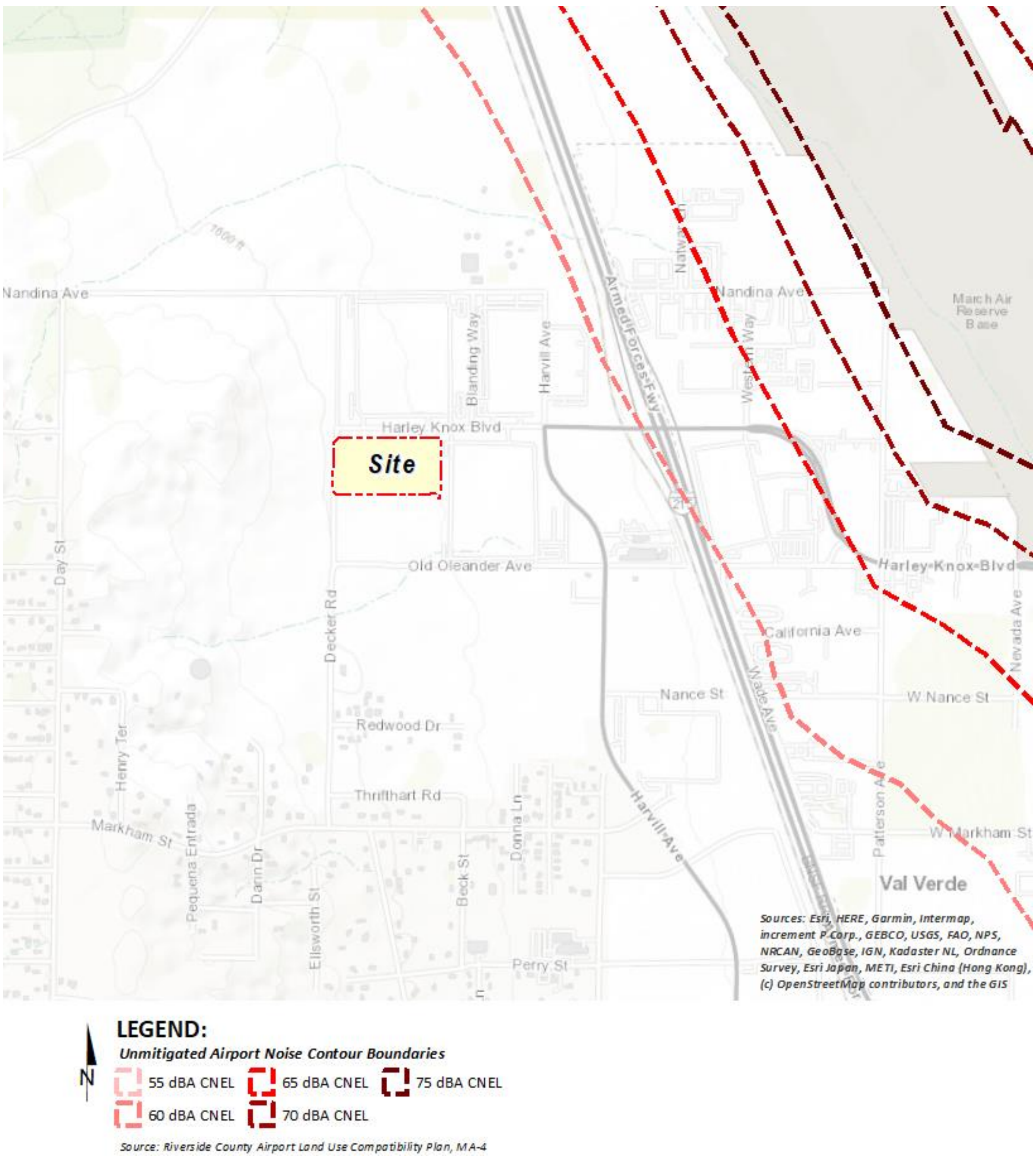
3.5.2 BLASTING VIBRATION LIMITS

To analyze vibration impacts originating from the blasting, vibration-generating rock blasting activities are appropriately evaluated against standards established under a jurisdiction's County Code, if such standards exist. However, the County of Riverside does not identify specific blasting vibration level limits. Therefore, for analysis purposes, the Caltrans *Transportation and Construction Vibration Guidance Manual*, (9 p. 38) Table 19, vibration criteria are used in this noise study to assess construction-related blasting impacts at the closest sensitive receiver locations. Caltrans guidance identifies a maximum acceptable transient peak-particle-velocity (PPV) vibration threshold of 0.5 inches per second (in/sec). Therefore, the 0.5 PPV (in/sec) vibration threshold is used to evaluate the potential blasting-related vibration levels experienced at the closest residences.

3.6 MARCH AIR RESERVE BASE/INLAND PORT AIRPORT LAND USE COMPATIBILITY

The March Air Reserve Base/Inland Port Airport (MARB/IPA) runway is located approximately 0.85 miles northeast of the Project site boundary. The *March Air Reserve Base/Inland Port Airport Land Use Compatibility Plan* (MARB/IPA LUCP) includes the policies for determining the land use compatibility of the Project. (14) The MARB/IPA, Map MA-1, indicates that the Project site is located within Compatibility Zone C2, and the Table MA-1 Compatibility Zone Factors indicates that this area is considered to have a *moderate* noise impact, and is outside the 60 dBA CNEL noise level contour boundaries. Consistent with the Basic Compatibility Criteria, listed in Table MA-2 of the MARB/IPA LUCP, highly noise-sensitive outdoor nonresidential uses are not permitted. The MARB/IPA LUCP does not identify industrial-use specific noise compatibility standards, and therefore, the *Noise/Land Use Noise Compatibility Criteria* (Figure N-10) in the County of Riverside General Plan Noise Element is used to assess potential aircraft-related noise levels at the Project site. The *Noise/Land Use Noise Compatibility Criteria* indicate that industrial uses, such as the Project, are considered *normally acceptable* with exterior noise levels of up to 70 dBA CNEL. (11) The noise contour boundaries of MARB/IPA are presented on Exhibit 3-B of this report and show that the Project is considered *normally acceptable* land use since it is located outside the MARB/IPA 55 dBA CNEL noise level contour boundaries.

EXHIBIT 3-B: MARB/IPA FUTURE AIRPORT NOISE CONTOURS



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4 SIGNIFICANCE CRITERIA

The following significance criteria are based on currently adopted guidance provided by Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (1) For the purposes of this report, impacts would be potentially significant if the Project results in or causes:

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 ground-borne vibration or ground-borne 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?

4.1 NOISE LEVEL INCREASES (THRESHOLD A)

Noise level increases resulting from the Project are evaluated based on the Appendix G CEQA Guidelines described above at the closest sensitive receiver locations. Under CEQA, consideration must be given to the magnitude of the increase, the existing baseline ambient noise levels, and the location of noise-sensitive receivers to determine if a noise increase represents a significant adverse environmental impact. This approach recognizes *that there is no single noise increase that renders the noise impact significant.* (15) This is primarily because of the wide variation in individual thresholds of annoyance and 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 typically be judged.

4.1.1 NOISE-SENSITIVE RECEIVERS

The Federal Interagency Committee on Noise (FICON) (16) developed guidance to be used for the assessment of project-generated increases in noise levels that consider the ambient noise level. The FICON recommendations are based on studies that relate aircraft noise levels to the percentage of persons highly annoyed by aircraft noise. Although the FICON recommendations were specifically developed to assess aircraft noise impacts, these recommendations are often used in environmental noise impact assessments involving the use of cumulative noise exposure metrics, such as the average-daily noise level (CNEL) and equivalent continuous noise level (L_{eq}).

As previously stated, the approach used in this noise study recognizes *that there is no single noise increase that renders the noise impact significant*, based on a 2008 California Court of Appeal ruling on Gray v. County of Madera. (15) For example, if the ambient noise environment is quiet (<60 dBA) and the new noise source greatly increases the noise levels, an impact may occur if the noise criteria may be exceeded. Therefore, for this analysis, a *readily perceptible* 5 dBA or greater project-related noise level increase is considered a significant impact when the without project noise levels are below 60 dBA. Per the FICON, in areas where the without project noise levels range from 60 to 65 dBA, a 3 dBA *barely perceptible* noise level increase appears to be appropriate for most people. When the without project noise levels already exceed 65 dBA, any increase in community noise louder than 1.5 dBA or greater is considered a significant impact if the noise criteria for a given land use is exceeded, since it likely contributes to an existing noise exposure exceedance. The FICON guidance provides an established source of criteria to assess the impacts of substantial temporary or permanent increase in baseline ambient noise levels. Based on the FICON criteria, the amount to which a given noise level increase is considered acceptable is reduced when the without Project (baseline) noise levels are already shown to exceed certain land-use specific exterior noise level criteria. The specific levels are based on typical responses to noise level increases of 5 dBA or *readily perceptible*, 3 dBA or *barely perceptible*, and 1.5 dBA depending on the underlying without Project noise levels for noise-sensitive uses. These levels of increases and their perceived acceptance are consistent with guidance provided by both the Federal Highway Administration (4 p. 9) and Caltrans (17 p. 2_48).

4.1.2 NON-NOISE-SENSITIVE RECEIVERS

The County of Riverside General Plan Noise Element, Table N-1, *Land Use Compatibility for Community Noise Exposure* was used to establish the satisfactory noise levels of significance for non-noise-sensitive land uses in the Project study area. As previously shown on Exhibit 3-A, the *normally acceptable* exterior noise levels for non-noise-sensitive land uses is 70 dBA CNEL. Noise levels greater than 70 dBA CNEL are considered *conditionally acceptable* per the *Land Use Compatibility for Community Noise Exposure*. (12)

To determine if Project-related traffic noise level increases are significant at off-site non-noise-sensitive land uses, a *readily perceptible* 5 dBA and *barely perceptible* 3 dBA criteria were used. When the without Project noise levels at the non-noise-sensitive land uses are below the *normally acceptable* 70 dBA CNEL compatibility criteria, a *readily perceptible* 5 dBA or greater noise level increase is considered a significant impact. When the without Project noise levels are greater than the *normally acceptable* 70 dBA CNEL land use compatibility criteria, a *barely perceptible* 3 dBA or greater noise level increase is considered a significant impact since the noise level criteria is already exceeded. The noise level increases used to determine significant impacts for non-noise-sensitive land uses is generally consistent with the FICON noise level increase thresholds for noise-sensitive land uses but instead rely on the County of Riverside General Plan Noise Element, Table N-1, *Land Use Compatibility for Community Noise Exposure normally acceptable* 70 dBA CNEL exterior noise level criteria.

4.2 VIBRATION (THRESHOLD B)

As described in Section 3.4, the vibration impacts originating from the construction of the Muranaka Warehouse are appropriately evaluated the thresholds of significance outlined in the County of Riverside General Plan. (12) These guidelines identify a motion velocity perception threshold for vibration due to passing trains of 0.01 inches per second (in/sec) over the range of one to 100 Hz, which is used in this noise study to assess potential impacts due to Project construction vibration levels. As described in Section 3.5, the Caltrans *Transportation and Construction Vibration Guidance Manual*, (9 p. 38) Table 19, vibration threshold of 0.5 inches per second (in/sec) is used in this noise study to assess construction-related blasting impacts at the closest sensitive receiver locations.

4.3 CEQA GUIDELINES NOT FURTHER ANALYZED (THRESHOLD C)

The closest airport which would require additional noise analysis under CEQA Appendix G Guideline C is the MARB/IPA. As previously described in Section 3.6, the Project is in Compatibility Zone C-2, and the Table MA-1 Compatibility Zone Factors indicates that this area is considered to have a *moderate* noise impact. In addition, Table MA-2 indicates that the Project land use satisfies the basic compatibility criteria. Therefore, the potential impacts under CEQA Appendix G Guideline C, are *less than significant* and are not further analyzed in this noise study.

4.4 SIGNIFICANCE CRITERIA SUMMARY

Noise impacts shall be considered significant if any of the following occur as a direct result of the proposed development. Table 4-1 shows the significance criteria summary matrix that includes the allowable criteria used to identify potentially significant incremental noise level increases.

TABLE 4-1: SIGNIFICANCE CRITERIA SUMMARY

Analysis	Receiving Land Use	Condition(s)	Significance Criteria	
			Daytime	Nighttime
Off-Site Traffic	Noise-Sensitive[1]	If ambient is < 60 dBA CNEL	≥ 5 dBA CNEL Project increase	
		If ambient is 60 - 65 dBA CNEL	≥ 3 dBA CNEL Project increase	
		If ambient is > 65 dBA CNEL	≥ 1.5 dBA CNEL Project increase	
	Non-Noise-Sensitive[2]	If ambient is < 70 dBA CNEL	≥ 5 dBA CNEL Project increase	
		If ambient is > 70 dBA CNEL	≥ 3 dBA CNEL Project increase	
Operational	Noise-Sensitive	Exterior Noise Level Standards[3]	55 dBA L_{eq}	45 dBA L_{eq}
		If ambient is < 60 dBA Leq[1]	≥ 5 dBA L_{eq} Project increase	
		If ambient is 60 - 65 dBA Leq[1]	≥ 3 dBA L_{eq} Project increase	
		If ambient is > 65 dBA Leq[1]	≥ 1.5 dBA L_{eq} Project increase	
Construction	Noise-Sensitive	Noise Level Threshold[4]	80 dBA L_{eq}	
		Vibration Level Threshold[5]	0.01 in/sec RMS	
Blasting	Noise-Sensitive	Airblast Threshold[6]	133 dB	n/a
		Vibration Level Threshold[7]	0.5 PPV (in/sec)	n/a

[1] FICON, 1992.
[2] County of Riverside General Plan Noise Element, Table N-1.
[3] County of Riverside General Plan County Code, Section 9.52.040.
[4] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual.
[5] County of Riverside General Plan Noise Element, Policy N 16.3.
"Daytime" = 7:00 a.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m.
[6] ISEE's Blasters' Handbook, Table 26.17 Typical Air Overpressure Damage Criteria, and U.S. Bureau of Mines standards.
[7] Caltrans Transportation and Construction Vibration Manual, April 2020 Table 19.

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5 EXISTING NOISE LEVEL MEASUREMENTS

To assess the existing noise level environment, 24-hour noise level measurements were taken at five locations in the Project study area. The receiver locations were selected to describe and document the existing noise environment within the Project study area. Exhibit 5-A provides the boundaries of the Project study area and the noise level measurement locations. To fully describe the existing noise conditions, noise level measurements were collected by Urban Crossroads, Inc. on Wednesday, July 14th, 2021. Appendix 5.1 includes study area photos.

5.1 MEASUREMENT PROCEDURE AND CRITERIA

To describe the existing noise environment, the hourly noise levels were measured during typical weekday conditions over a 24-hour period. By collecting individual hourly noise level measurements, it is possible to describe the equivalent daytime and nighttime hourly noise levels. The long-term noise readings were recorded using Piccolo Type 2 integrating sound level meter and dataloggers. The Piccolo sound level meters were calibrated using a Larson-Davis calibrator, Model CAL 150. All noise meters were programmed in "slow" mode to record noise levels in "A" weighted form. The sound level meters and microphones were equipped with a windscreen during all measurements. All noise level measurement equipment satisfies the American National Standards Institute (ANSI) standard specifications for sound level meters ANSI S1.4-2014/IEC 61672-1:2013. (18)

5.2 NOISE MEASUREMENT LOCATIONS

The long-term noise level measurements were positioned as close to the nearest sensitive receiver locations as possible to assess the existing ambient hourly noise levels surrounding the Project site. Both Caltrans and the FTA recognize that it is not reasonable to collect noise level measurements that can fully represent every part of a private yard, patio, deck, or balcony normally used for human activity when estimating impacts for new development projects. This is demonstrated in the Caltrans general site location guidelines which indicate that, *sites must be free of noise contamination by sources other than sources of interest. Avoid sites located near sources such as barking dogs, lawnmowers, pool pumps, and air conditioners unless it is the express intent of the analyst to measure these sources*. (2) Further, FTA guidance states, t*hat it is not necessary nor recommended that existing noise exposure be determined by measuring at every noise-sensitive location in the project area. Rather, the recommended approach is to characterize the noise environment for clusters of sites based on measurements or estimates at representative locations in the community*. (8)

Based on recommendations of Caltrans and the FTA, it is not necessary to collect measurements at each individual building or residence, because each receiver measurement represents a group of buildings that share acoustical equivalence. (8) In other words, the area represented by the receiver shares similar shielding, terrain, and geometric relationship to the reference noise source. Receivers represent a location of noise sensitive areas and are used to estimate the future noise level impacts. Collecting reference ambient noise level measurements at the nearby sensitive receiver locations allows for a comparison of the before and after Project noise levels and is necessary to assess potential noise impacts due to the Project's contribution to the ambient noise levels.

5.3 NOISE MEASUREMENT RESULTS

The noise measurements presented below focus on the equivalent or the hourly energy average sound levels (L_{eq}). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period. Table 5-1 identifies the hourly daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) noise levels at each noise level measurement location.

TABLE 5-1: AMBIENT NOISE LEVEL MEASUREMENTS

Location[1]	Description	Energy Average Noise Level (dBA L_{eq})[2]	
		Daytime	Nighttime
L1	Located southeast of the Project site near single-family residence at 22980 Peregrine Way.	57.2	59.7
L2	Located south of the Project site near single-family residence at 22730 Redwood Drive.	51.5	48.5
L3	Located south of the Project site near single-family residence at 22510 Redwood Drive.	56.9	48.8
L4	Located southwest of the Project site near single-family residence at 18040 Day Street.	53.5	48.9
L5	Located west of the Project site near single-family residence at 21934 Corson Avenue.	55.2	53.5

[1] See Exhibit 5-A for the noise level measurement locations.
[2] Energy (logarithmic) average levels. The long-term 24-hour measurement worksheets are included in Appendix 5.2.
"Daytime" = 7:00 a.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m.

Table 5-1 provides the equivalent noise levels used to describe the daytime and nighttime ambient conditions. These daytime and nighttime energy average noise levels represent the average of all hourly noise levels observed during these time periods expressed as a single number. Appendix 5.2 provides summary worksheets of the noise levels for each of the daytime and nighttime hours.

EXHIBIT 5-A: NOISE MEASUREMENT LOCATIONS

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6 TRAFFIC NOISE METHODS AND PROCEDURES

The following section outlines the methods and procedures used to estimate and analyze the future traffic noise environment. Consistent with County of Riverside Noise Guidelines for Land Use Planning (see Exhibit 3-A), all transportation related noise levels are presented in terms of the 24-hour CNEL's.

6.1 FHWA TRAFFIC NOISE PREDICTION MODEL

The expected roadway noise level increases from vehicular traffic were calculated by Urban Crossroads, Inc. using a computer program that replicates the Federal Highway Administration (FHWA) Traffic Noise Prediction Model- FHWA-RD-77-108. (19) The FHWA Model arrives at a predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL). In California the national REMELs are substituted with the California Vehicle Noise (Calveno) Emission Levels. (20) Adjustments are then made to the REMEL to account for: the roadway classification (e.g., collector, secondary, major or arterial), the roadway active width (i.e., the distance between the center of the outermost travel lanes on each side of the roadway), the total average daily traffic (ADT), the travel speed, the percentages of automobiles, medium trucks, and heavy trucks in the traffic volume, the roadway grade, the angle of view (e.g., whether the roadway view is blocked), the site conditions ("hard" or "soft" relates to the absorption of the ground, pavement, or landscaping), and the percentage of total ADT which flows each hour throughout a 24-hour period. Research conducted by Caltrans has shown that the use of soft site conditions is appropriate for the application of the FHWA traffic noise prediction model used in this analysis. (21)

6.1.1 OFF-SITE TRAFFIC NOISE PREDICTION MODEL INPUTS

Table 6-1 presents the roadway parameters used to assess the Project's off-site transportation noise impacts. Table 6-1 identifies the three off-site study area roadway segments, the distance from the centerline to adjacent land use based on the functional roadway classifications per the County of Riverside General Plan Circulation Element, and the posted vehicle speeds. The ADT volumes used in this study area presented on Table 6-2 are based on the *Muranaka Warehouse Traffic Analysis*, prepared by EPD Solutions, Inc. for the following traffic scenarios. (22)

- Existing Traffic Conditions
- Existing Plus Project Traffic Conditions
- Opening Year Baseline (corresponding to the project opening year 2023)
- Opening Year plus project

The ADT volumes vary for each roadway segment based on the existing traffic volumes and the combination of project traffic distributions. This analysis relies on a comparative evaluation of the off-site traffic noise impacts at the boundary of the right-of-way of the receiving adjacent land use, without and with project ADT traffic volumes from the Project traffic study.

TABLE 6-1: OFF-SITE ROADWAY PARAMETERS

ID	Roadway	Segment	Receiving Land Use[1]	Distance from Centerline to Receiving Land Use (Feet)[2]	Vehicle Speed (mph)[3]
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	59'	50
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	76'	45
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	76'	45

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] Distance to receiving land use is based upon the right-of-way distances.
[3] Muranaka Warehouse Project Traffic Impact Analysis, EPD Solutions, Inc.

To quantify the off-site noise levels, the Project related truck trips were added to the heavy truck category in the FHWA noise prediction model. The addition of the Project related truck trips increases the percentage of heavy trucks in the vehicle mix. This approach recognizes that the FHWA noise prediction model is significantly influenced by the number of heavy trucks in the vehicle mix.

TABLE 6-2: AVERAGE DAILY TRAFFIC VOLUMES

ID	Roadway	Segment	Average Daily Traffic Volumes[1]			
			Existing		Opening Year	
			Without Project	With Project	Without Project	With Project
1	Harvill Av.	s/o Harley Knox Blvd.	250	334	460	544
2	Harley Knox Blvd.	w/o Harvill Av.	3,630	4,140	11,290	11,800
3	Harley Knox Blvd.	e/o Harvill Av.	1,190	1,616	3,660	4,086

[1] Muranaka Warehouse Project Traffic Impact Analysis, EPD Solutions, Inc.

Table 6-3 provides the time of day (daytime, evening, and nighttime) vehicle splits. The daily Project truck trip-ends were assigned to the individual off-site study area roadway segments based on the County of Riverside Office of Industrial Hygiene. Table 6-4 shows the traffic flow by vehicle type (vehicle mix) used for all without Project traffic scenarios, and Tables 6-5 to 6-8 show the vehicle mixes used for the with Project traffic scenarios.

TABLE 6-3: TIME OF DAY VEHICLE SPLITS

Vehicle Type	Time of Day Splits[1]			Total of Time of Day Splits
	Daytime	Evening	Nighttime	
Autos	75.55%	14.02%	10.43%	100.00%
Medium Trucks	48.00%	2.00%	50.00%	100.00%
Heavy Trucks	48.00%	2.00%	50.00%	100.00%

[1] County of Riverside Office of Industrial Hygiene.
"Daytime" = 7:00 a.m. to 7:00 p.m.; "Evening" = 7:00 p.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m.

TABLE 6-4: WITHOUT PROJECT VEHICLE MIX

Classification	Total % Traffic Flow[1]			Total
	Autos	Medium Trucks	Heavy Trucks	
All Segments	92.00%	3.00%	5.00%	100.00%

[1] County of Riverside Office of Industrial Hygiene.

Due to the added Project truck trips, the increase in Project traffic volumes and the distributions of trucks on the study area road segments, the percentage of autos, medium trucks and heavy trucks will vary for each of the traffic scenarios. This explains why the existing and future traffic volumes and vehicle mixes vary between seemingly identical study area roadway segments.

TABLE 6-5: EXISTING WITH PROJECT VEHICLE MIX

ID	Roadway	Segment	With Project[1]			
			Autos	Medium Trucks	Heavy Trucks	Total[2]
1	Harvill Av.	s/o Harley Knox Blvd.	94.01%	2.25%	3.74%	100.00%
2	Harley Knox Blvd.	w/o Harvill Av.	90.79%	2.94%	6.27%	100.00%
3	Harley Knox Blvd.	e/o Harvill Av.	88.48%	3.01%	8.51%	100.00%

[1] Muranaka Warehouse Project Traffic Impact Analysis, EPD Solutions, Inc.
[2] Total of vehicle mix percentage values rounded to the nearest one-hundredth.

TABLE 6-6: OY (2023) WITH PROJECT VEHICLE MIX

ID	Roadway	Segment	With Project[1]			
			Autos	Medium Trucks	Heavy Trucks	Total[2]
1	Harvill Av.	s/o Harley Knox Blvd.	93.23%	2.54%	4.23%	100.00%
2	Harley Knox Blvd.	w/o Harvill Av.	91.57%	2.98%	5.44%	100.00%
3	Harley Knox Blvd.	e/o Harvill Av.	90.61%	3.01%	6.39%	100.00%

[1] Muranaka Warehouse Project Traffic Impact Analysis, EPD Solutions, Inc.
[2] Total of vehicle mix percentage values rounded to the nearest one-hundredth.

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7 OFF-SITE TRAFFIC NOISE ANALYSIS

To assess the off-site transportation CNEL noise level impacts associated with development of the proposed Project, noise contours were developed based on the Muranaka Warehouse Traffic Impact Analysis prepared by EPD, Inc. (22) Noise contour boundaries represent the equal levels of noise exposure and are measured in CNEL from the center of the roadway.

7.1 TRAFFIC NOISE CONTOURS

Noise contours were used to assess the Project's incremental traffic-related noise impacts at land uses adjacent to roadways conveying Project traffic. The noise contours represent the distance to noise levels of a constant value and are measured from the center of the roadway for the 70, 65, and 60 dBA noise levels. The noise contours do not consider the effect of any existing noise barriers or topography that may attenuate ambient noise levels. In addition, because the noise contours reflect modeling of vehicular noise on area roadways, they appropriately do not reflect noise contributions from the surrounding stationary noise sources within the Project study area. Tables 7-1 to 7-4 present a summary of the exterior traffic noise levels for each traffic condition. Appendix 7.1 includes the traffic noise level contours worksheets for each traffic condition.

TABLE 7-1: EXISTING WITHOUT PROJECT CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	57.5	RW	RW	RW
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	67.0	RW	104	224
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	62.2	RW	RW	106

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 7-2: EXISTING WITH PROJECT CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	57.7	RW	RW	RW
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	68.3	RW	127	273
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	65.3	RW	79	171

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 7-3: OY WITHOUT PROJECT CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	60.1	RW	RW	60
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	72.0	103	221	477
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	67.1	RW	105	225

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 7-4: OY WITH PROJECT CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	60.3	RW	RW	61
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	72.4	110	237	512
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	68.3	RW	127	273

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

7.2 EXISTING PROJECT TRAFFIC NOISE LEVEL INCREASES

An analysis of existing traffic noise levels plus traffic noise generated by the proposed Project has been included in this report for informational purposes and to fully analyze all the existing traffic scenarios identified in the Traffic Impact Analysis prepared by EPD, Inc. However, the analysis of existing off-site traffic noise levels plus traffic noise generated by the proposed Project scenario will not actually occur since the Project would not be fully constructed and operational until Opening Year 2023 conditions. Table 7-1 shows the Existing without Project conditions CNEL noise levels. The Existing without Project exterior noise levels range from 57.5 to 67.0 dBA CNEL, without accounting for any noise attenuation features such as noise barriers or topography. Table 7-2 shows the Existing with Project conditions ranging from 57.7 to 68.3 dBA CNEL. Table 7-5 shows that the Project off-site traffic noise level increases range from 0.2 to 3.1 dBA CNEL on the study area roadway segments. Based on the significance criteria for off-site traffic noise presented in Table 4-1, land uses adjacent to the study area roadway segments would experience *less than significant* noise level increases on receiving land uses due to the Project-related traffic.

7.3 OY TRAFFIC NOISE LEVEL INCREASES

Table 7-3 presents the Opening Year 2023 without Project conditions CNEL noise levels. The Opening Year 2023 without Project exterior noise levels range from 60.1 to 72.0 dBA CNEL, without accounting for any noise attenuation features such as noise barriers or topography. Table 7-4 shows that the Opening Year with Project conditions will range from 60.3 to 72.4 dBA CNEL. Table 7-6 shows that the Project off-site traffic noise level increases range from 0.2 to 1.2 dBA CNEL. Based on the significance criteria for off-site traffic noise presented in Table 4-1, land uses adjacent to the study area roadway segments would experience *less than significant* noise level increases on receiving land uses due to the Project-related traffic.

TABLE 7-5: EXISTING WITH PROJECT TRAFFIC NOISE LEVEL INCREASES

ID	Road	Segment	Receiving Land Use[1]	CNEL at Receiving Land Use (dBA)[2]			Incremental Noise Level Increase Threshold[3]	
				No Project	With Project	Project Addition	Limit	Exceeded?
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	57.5	57.7	0.2	5.0	No
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	67.0	68.3	1.3	5.0	No
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	62.2	65.3	3.1	5.0	No

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the receiving land use.
[3] Does the Project create an incremental noise level increase exceeding the significance criteria (Table 4-1)?

TABLE 7-6: OY WITH PROJECT TRAFFIC NOISE LEVEL INCREASES

ID	Road	Segment	Receiving Land Use[1]	CNEL at Receiving Land Use (dBA)[2]			Incremental Noise Level Increase Threshold[3]	
				No Project	With Project	Project Addition	Limit	Exceeded?
1	Harvill Av.	s/o Harley Knox Blvd.	Non-Sensitive	60.1	60.3	0.2	5.0	No
2	Harley Knox Blvd.	w/o Harvill Av.	Non-Sensitive	72.0	72.4	0.4	3.0	No
3	Harley Knox Blvd.	e/o Harvill Av.	Non-Sensitive	67.1	68.3	1.2	5.0	No

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the receiving land use.
[3] Does the Project create an incremental noise level increase exceeding the significance criteria (Table 4-1)?

8 SENSITIVE RECEIVER LOCATIONS

To assess the potential for long-term operational and short-term construction noise impacts, the following sensitive receiver locations, as shown on Exhibit 8-A, were identified as representative locations for analysis. Sensitive receivers are generally defined as locations where people reside or where the presence of unwanted sound could otherwise adversely affect the use of the land. Noise-sensitive land uses are generally considered to include schools, hospitals, single-family dwellings, mobile home parks, churches, libraries, and recreation areas. Moderately noise-sensitive land uses typically include multi-family dwellings, hotels, motels, dormitories, out-patient clinics, cemeteries, golf courses, country clubs, athletic/tennis clubs, and equestrian clubs. Land uses that are considered relatively insensitive to noise include business, commercial, and professional developments. Land uses that are typically not affected by noise include: industrial, manufacturing, utilities, agriculture, undeveloped land, parking lots, warehousing, liquid and solid waste facilities, salvage yards, and transit terminals. To describe the potential off-site Project noise levels, five receiver locations in the vicinity of the Project site were identified. All distances are measured from the Project site boundary to the outdoor living areas (e.g., private backyards) or at the building façade, whichever is closer to the Project site. The selection of receiver locations is based on FHWA guidelines and is consistent with additional guidance provided by Caltrans and the FTA, as previously described in Section 5.2. Other sensitive land uses in the Project study area that are located at greater distances than those identified in this noise study will experience lower noise levels than those presented in this report due to the additional attenuation from distance and the shielding of intervening structures. Distance is measured in a straight line from the project boundary to each receiver location.

R1: Location R1 represents the existing noise sensitive residence at 22980 Peregrine Way, approximately 1,681 feet southeast of the Project site. R1 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L1, to describe the existing ambient noise environment.

R2: Location R2 represents the existing noise sensitive residence at 22722 Redwood Drive, approximately 1,916 feet south of the Project site. R2 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L2, to describe the existing ambient noise environment.

R3: Location R3 represents the existing noise sensitive residence at 22608 Redwood Drive, approximately 2,066 feet south of the Project site. R3 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L3, to describe the existing ambient noise environment.

R4: Location R4 represents the existing noise sensitive residence at 18088 Day Street, approximately 2,593 feet southwest of the Project site. R4 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L4, to describe the existing ambient noise environment.

R5: Location R5 represents the existing noise sensitive residence at 17771 Day Street, approximately 2,696 feet west of the Project site. R5 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L5, to describe the existing ambient noise environment.

EXHIBIT 8-A: RECEIVER LOCATIONS

9 OPERATIONAL NOISE IMPACTS

This section analyzes the potential stationary-source operational noise impacts at the nearest receiver locations, identified in Section 8, resulting from the operation of the proposed Muranaka Warehouse Project. Exhibit 9-A identifies the noise source locations used to assess the operational noise levels.

9.1 OPERATIONAL NOISE SOURCES

This operational noise analysis is intended to describe noise level impacts associated with the expected typical of daytime and nighttime activities at the Project site. Consistent with similar warehouse uses, the Project business operations would primarily be conducted within the enclosed buildings, except for traffic movement, parking, as well as loading and unloading of trucks at designated loading bays. The on-site Project-related noise sources are expected to include: loading dock activity, roof-top air conditioning units, trash enclosure activity, parking lot vehicle movements, and truck movements.

9.2 REFERENCE NOISE LEVELS

To estimate the Project operational noise impacts, reference noise level measurements were collected from similar types of activities to represent the noise levels expected with the development of the proposed Project. This section provides a detailed description of the reference noise level measurements shown on Table 9-1 used to estimate the Project operational noise impacts. It is important to note that the following projected noise levels assume the worst-case noise environment with the loading dock activity, roof-top air conditioning units, trash enclosure activity, parking lot vehicle movements, and truck movements all operating at the same time. These sources of noise activity will likely vary throughout the day.

9.2.1 MEASUREMENT PROCEDURES

The reference noise level measurements presented in this section were collected using a Larson Davis LxT Type 1 precision sound level meter (serial number 01146). The LxT sound level meter was calibrated using a Larson-Davis calibrator, Model CAL 200, was programmed in "slow" mode to record noise levels in "A" weighted form and was located at approximately five feet above the ground elevation for each measurement. The sound level meters and microphones were equipped with a windscreen during all measurements. All noise level measurement equipment satisfies the American National Standards Institute (ANSI) standard specifications for sound level meters ANSI S1.4-2014/IEC 61672-1:2013. (18)

EXHIBIT 9-A: OPERATIONAL NOISE SOURCE LOCATIONS

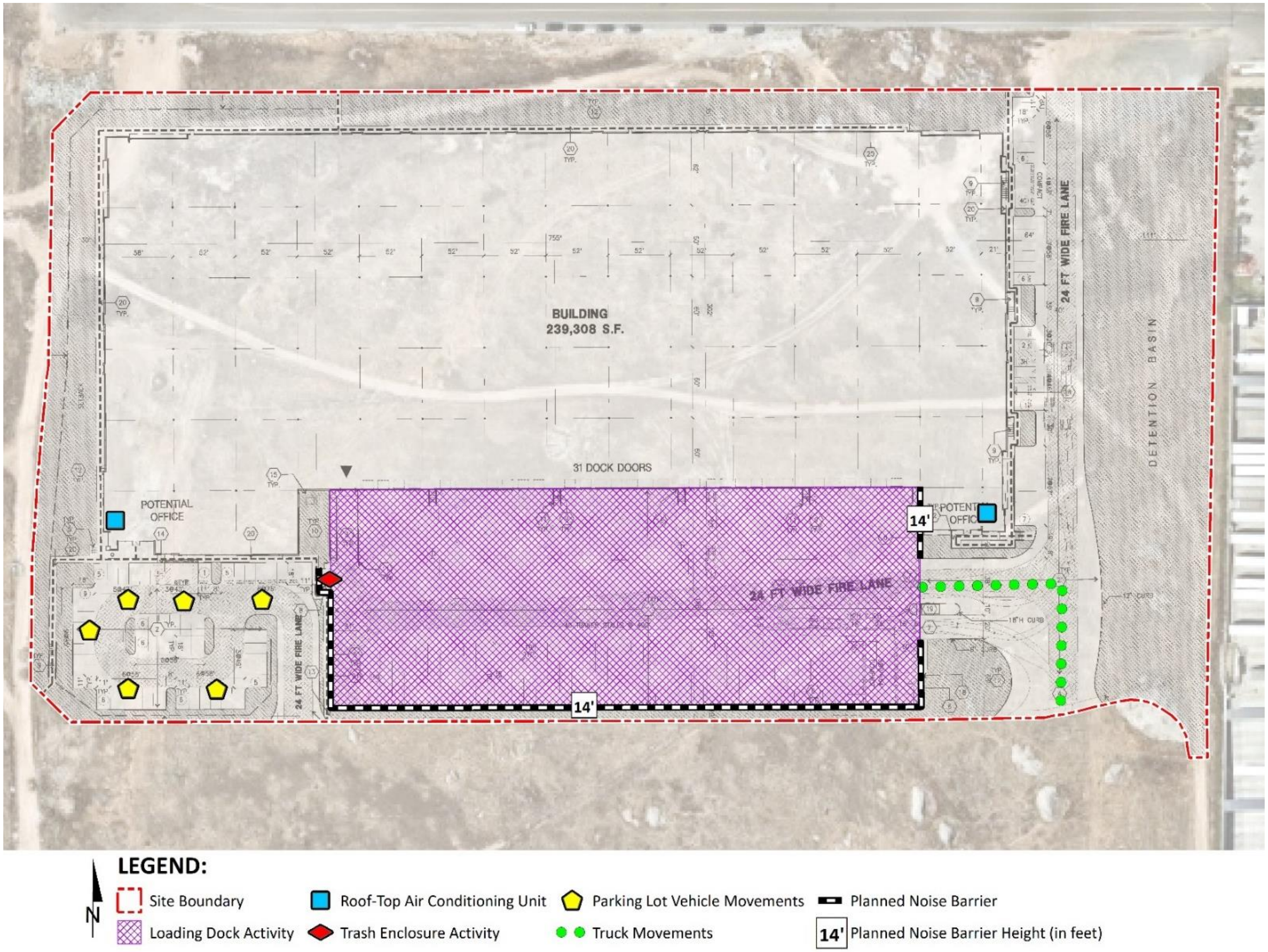

TABLE 9-1: REFERENCE NOISE LEVEL MEASUREMENTS

Noise Source[1]	Noise Source Height (Feet)	Min./ Hour[2]		Reference Noise Level (dBA L_{eq}) @ 50 Feet	Sound Power Level (dBA)[3]
		Day	Night		
Loading Dock Activity	8'	60	60	62.8	103.4
Roof-Top Air Conditioning Units	5'	39	28	57.2	88.9
Trash Enclosure Activity	5'	10	10	57.3	89.0
Parking Lot Vehicle Movements	5'	60	60	56.1	87.8
Truck Movements	8'	60	60	58.0	93.2

[1] As measured by Urban Crossroads, Inc.
[2] Anticipated duration (minutes within the hour) of noise activity during typical hourly conditions expected at the Project site. "Daytime" = 7:00 a.m. - 10:00 p.m.; "Nighttime" = 10:00 p.m. - 7:00 a.m.
[3] Sound power level represents the total amount of acoustical energy (noise level) produced by a sound source independent of distance or surroundings. Sound power levels calculated using the CadnaA noise model at the reference distance to the noise source. Numbers may vary due to size differences between point and area noise sources.

9.2.2 LOADING DOCK ACTIVITY

The reference loading dock activities are intended to describe the typical operational noise source levels associated with the Project. This includes truck idling, deliveries, backup alarms, unloading/loading, docking including a combination of tractor trailer semi-trucks, two-axle delivery trucks, and background forklift operations. At a uniform reference distance of 50 feet, Urban Crossroads collected a reference noise level of 62.8 dBA L_{eq}. The loading dock activity noise level measurement was taken over a fifteen-minute period and represents multiple noise sources taken from the center of activity. The reference noise level measurement includes employees unloading a docked truck container included the squeaking of the truck's shocks when weight was removed from the truck, employees playing music over a radio, as well as a forklift horn and backup alarm. In addition, during the noise level measurement a truck entered the loading dock area and proceeded to reverse and dock in a nearby loading bay, adding truck engine, idling, air brakes noise, in addition to on-going idling of an already docked truck.

9.2.3 ROOF-TOP AIR CONDITIONING UNITS

The noise level measurements describe a single mechanical roof-top air conditioning unit. The reference noise level represents a Lennox SCA120 series 10-ton model packaged air conditioning unit. At the uniform reference distance of 50 feet, the reference noise levels are 57.2 dBA L_{eq}. Based on the typical operating conditions observed over a four-day measurement period, the roof-top air conditioning units are estimated to operate for and average 39 minutes per hour during the daytime hours, and 28 minutes per hour during the nighttime hours. These operating conditions reflect peak summer cooling requirements with measured temperatures approaching 96 degrees Fahrenheit (°F) with average daytime temperatures of 82°F. For this noise analysis, the air conditioning units are expected to be located on the roof of the Project buildings.

9.2.4 TRASH ENCLOSURE ACTIVITY

To describe the noise levels associated with a trash enclosure activity, Urban Crossroads collected a reference noise level measurement at an existing trash enclosure containing two dumpster bins. The trash enclosure noise levels describe metal gates opening and closing, metal scraping against concrete floor sounds, dumpster movement on metal wheels, and trash dropping into the metal dumpster. The reference noise levels describe trash enclosure noise activities when trash is dropped into an empty metal dumpster, as would occur at the Project Site. The measured reference noise level at the uniform 50-foot reference distance is 57.3 dBA L_{eq} for the trash enclosure activity. The reference noise level describes the expected noise source activities associated with the trash enclosures for the Project's proposed building. Typical trash enclosure activities are estimated to occur for 10 minutes per hour.

9.2.5 PARKING LOT VEHICLE MOVEMENTS

To describe the on-site parking lot activity, a long-term 29-hour reference noise level measurement was collected in the center of activity within the staff parking lot of an Amazon warehouse distribution center. At 50 feet from the center of activity, the parking lot produced a reference noise level of 56.1 dBA L_{eq}. Parking activities are expected to take place during the full hour (60 minutes) throughout the daytime and evening hours. The parking lot noise levels are mainly due cars pulling in and out of parking spaces in combination with car doors opening and closing.

9.2.6 TRUCK MOVEMENTS

The truck movements reference noise level measurement was collected over a period of 1 hour and 28 minutes and represents multiple heavy trucks entering and exiting the outdoor loading dock area producing a reference noise level of 59.8 dBA L_{eq} at 50 feet. The noise sources included at this measurement location account for trucks entering and existing the Project driveways and maneuvering in and out of the outdoor loading dock activity area.

9.3 CADNAA NOISE PREDICTION MODEL

To fully describe the exterior operational noise levels from the Project, Urban Crossroads, Inc. developed a noise prediction model using the CadnaA (Computer Aided Noise Abatement) computer program. CadnaA can analyze multiple types of noise sources using the spatially accurate Project site plan, georeferenced Nearmap aerial imagery, topography, buildings, and barriers in its calculations to predict outdoor noise levels.

Using the ISO 9613-2 protocol, CadnaA will calculate the distance from each noise source to the noise receiver locations, using the ground absorption, distance, and barrier/building attenuation inputs to provide a summary of noise level at each receiver and the partial noise level contributions by noise source. Consistent with the ISO 9613-2 protocol, the CadnaA noise prediction model relies on the reference sound power level (L_w) to describe individual noise sources. While sound pressure levels (e.g., L_{eq}) quantify in decibels the intensity of given sound sources at a reference distance, sound power levels (L_w) are connected to the sound source and are independent of distance. Sound pressure levels vary substantially with distance from the source and diminish because of intervening obstacles and barriers, air absorption, wind, and other factors. Sound power is the acoustical energy emitted by the sound source and is an absolute value that is not affected by the environment.

The operational noise level calculations provided in this noise study account for the distance attenuation provided due to geometric spreading, when sound from a localized stationary source (i.e., a point source) propagates uniformly outward in a spherical pattern. A default ground attenuation factor of 0.5 was used in the CadnaA noise analysis to account for mixed ground representing a combination of hard and soft surfaces. Appendix 9.1 includes the detailed noise model inputs used to estimate the Project operational noise levels presented in this section.

9.4 PROJECT OPERATIONAL NOISE LEVELS

Using the reference noise levels to represent the proposed Project operations that include loading dock activity, roof-top air conditioning units, trash enclosure activity, parking lot vehicle movements, and truck movements, Urban Crossroads, Inc. calculated the operational source noise levels that are expected to be generated at the Project site and the Project-related noise level increases that would be experienced at each of the sensitive receiver locations. Table 9-2 shows the Project operational noise levels during the daytime hours of 7:00 a.m. to 10:00 p.m. The daytime hourly noise levels at the off-site receiver locations are expected to range from 26.1 to 32.6 dBA L_{eq}.

TABLE 9-2: DAYTIME PROJECT OPERATIONAL NOISE LEVELS

Noise Source[1]	Operational Noise Levels by Receiver Location (dBA Leq)				
	R1	R2	R3	R4	R5
Loading Dock Activity	27.2	30.1	29.7	26.3	24.3
Roof-Top Air Conditioning Units	17.1	21.5	21.3	18.8	17.3
Trash Enclosure Activity	4.7	6.4	0.0	0.0	0.0
Parking Lot Vehicle Movements	8.5	16.7	17.1	14.8	14.4
Truck Movements	16.4	27.9	26.9	19.6	17.5
Total (All Noise Sources)	**28.0**	**32.6**	**32.1**	**28.0**	**26.1**

[1] See Exhibit 9-A for the noise source locations. CadnaA noise model calculations are included in Appendix 9.1.

Tables 9-3 shows the Project operational noise levels during the nighttime hours of 10:00 p.m. to 7:00 a.m. The nighttime hourly noise levels at the off-site receiver locations are expected to range from 25.8 to 32.5 dBA L_{eq}. The differences between the daytime and nighttime noise levels are largely related to the estimated duration of noise activity as outlined in Table 9-1 and Appendix 9.1.

TABLE 9-3: NIGHTTIME PROJECT OPERATIONAL NOISE LEVELS

Noise Source[1]	Operational Noise Levels by Receiver Location (dBA Leq)				
	R1	R2	R3	R4	R5
Loading Dock Activity	27.2	30.1	29.7	26.3	24.3
Roof-Top Air Conditioning Units	14.7	19.1	18.9	16.4	14.9
Trash Enclosure Activity	3.8	5.4	0.0	0.0	0.0
Parking Lot Vehicle Movements	7.6	15.7	16.2	13.9	13.4
Truck Movements	16.4	27.9	26.9	19.6	17.5
Total (All Noise Sources)	**27.8**	**32.5**	**31.9**	**27.7**	**25.8**

[1] See Exhibit 9-A for the noise source locations. CadnaA noise model calculations are included in Appendix 9.1.

9.5 PROJECT OPERATIONAL NOISE LEVEL COMPLIANCE

To demonstrate compliance with local noise regulations, the Project-only operational noise levels are evaluated against exterior noise level thresholds based on the County of Riverside exterior noise level standards at nearby noise-sensitive receiver locations. Table 9-4 shows the operational noise levels associated with Muranaka Warehouse Project will satisfy the County of Riverside daytime and nighttime exterior noise level standards. Therefore, the operational noise impacts are considered *less than significant* at the nearby noise-sensitive receiver locations.

TABLE 9-4: OPERATIONAL NOISE LEVEL COMPLIANCE

Receiver Location[1]	Project Operational Noise Levels (dBA Leq)[2]		Noise Level Standards (dBA Leq)[3]		Noise Level Standards Exceeded?[4]	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
R1	28.0	27.8	55	45	No	No
R2	32.6	32.5	55	45	No	No
R3	32.1	31.9	55	45	No	No
R4	28.0	27.7	55	45	No	No
R5	26.1	25.8	55	45	No	No

[1] See Exhibit 8-A for the receiver locations.
[2] Proposed Project operational noise levels as shown on Tables 9-2 and 9-3.
[3] Exterior noise level standards, as shown on Table 4-1.
[4] Do the estimated Project operational noise source activities exceed the noise level standards?
"Daytime" = 7:00 a.m. - 10:00 p.m.; "Nighttime" = 10:00 p.m. - 7:00 a.m.

9.5 PROJECT OPERATIONAL NOISE LEVEL INCREASES

To describe the Project operational noise level increases, the Project operational noise levels are combined with the existing ambient noise levels measurements for the nearby receiver locations potentially impacted by Project operational noise sources. Since the units used to measure noise, decibels (dB), are logarithmic units, the Project-operational and existing ambient noise levels cannot be combined using standard arithmetic equations. (2) Instead, they must be logarithmically added using the following base equation:

$$SPL_{Total} = 10\log_{10}[10^{SPL1/10} + 10^{SPL2/10} + \ldots 10^{SPLn/10}]$$

Where "SPL1," "SPL2," etc. are equal to the sound pressure levels being combined, or in this case, the Project-operational and existing ambient noise levels. The difference between the combined Project and ambient noise levels describes the Project noise level increases to the existing ambient noise environment. Noise levels that would be experienced at receiver locations when Project-source noise is added to the daytime and nighttime ambient conditions are presented on Tables 9-5 and 9-6, respectively. As indicated on Tables 9-5 and 9-6, the Project will generate a daytime and nighttime operational noise level increases ranging from 0.0 to 0.1 dBA L_{eq} at the nearest receiver locations. Project-related operational noise level increases will satisfy the operational noise level increase significance criteria presented in Table 4-1, the increases at the sensitive receiver locations will be *less than significant.*

TABLE 9-5: DAYTIME PROJECT OPERATIONAL NOISE LEVEL INCREASES

Receiver Location[1]	Total Project Operational Noise Level[2]	Measurement Location[3]	Reference Ambient Noise Levels[4]	Combined Project and Ambient[5]	Project Increase[6]	Increase Criteria[7]	Increase Criteria Exceeded?
R1	28.0	L1	57.2	57.2	0.0	5.0	No
R2	32.6	L2	51.5	51.6	0.1	5.0	No
R3	32.1	L3	56.9	56.9	0.0	5.0	No
R4	28.0	L4	53.5	53.5	0.0	5.0	No
R5	26.1	L5	55.2	55.2	0.0	5.0	No

[1] See Exhibit 8-A for the receiver locations.
[2] Total Project daytime operational noise levels as shown on Table 9-2.
[3] Reference noise level measurement locations as shown on Exhibit 5-A.
[4] Observed daytime ambient noise levels as shown on Table 5-1.
[5] Represents the combined ambient conditions plus the Project activities.
[6] The noise level increase expected with the addition of the proposed Project activities.
[7] Significance increase criteria as shown on Table 4-1.

TABLE 9-6: NIGHTTIME OPERATIONAL NOISE LEVEL INCREASES

Receiver Location[1]	Total Project Operational Noise Level[2]	Measurement Location[3]	Reference Ambient Noise Levels[4]	Combined Project and Ambient[5]	Project Increase[6]	Increase Criteria[7]	Increase Criteria Exceeded?
R1	27.8	L1	59.7	59.7	0.0	5.0	No
R2	32.5	L2	48.5	48.6	0.1	5.0	No
R3	31.9	L3	48.8	48.9	0.1	5.0	No
R4	27.7	L4	48.9	48.9	0.0	5.0	No
R5	25.8	L5	53.5	53.5	0.0	5.0	No

[1] See Exhibit 8-A for the receiver locations.
[2] Total Project nighttime operational noise levels as shown on Table 9-3.
[3] Reference noise level measurement locations as shown on Exhibit 5-A.
[4] Observed nighttime ambient noise levels as shown on Table 5-1.
[5] Represents the combined ambient conditions plus the Project activities.
[6] The noise level increase expected with the addition of the proposed Project activities.
[7] Significance increase criteria as shown on Table 4-1.

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10 CONSTRUCTION IMPACTS

This section analyzes potential impacts resulting from the short-term construction activities associated with the development of the Project. Exhibit 10-A shows the construction noise source locations in relation to the nearby sensitive receiver locations previously described in Section 8. According to Section 9.52.020 of the County's Noise Regulation ordinance, noise associated with any private construction activity located within one-quarter of a mile from an inhabited dwelling is considered exempt between the hours of 6:00 a.m. and 6:00 p.m., during the months of June through September, and 7:00 a.m. and 6:00 p.m., during the months of October through May. (13)

In addition, since neither the County of Riverside General Plan or County Code establish numeric maximum acceptable construction source noise levels at potentially affected receivers for CEQA analysis purposes. Therefore, a numerical construction threshold based on Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual is used for analysis of daytime construction impacts. The FTA considers a daytime exterior construction noise level of 80 dBA Leq as a reasonable threshold for noise sensitive residential land use. (8 p. 179)

10.1 CONSTRUCTION NOISE LEVELS

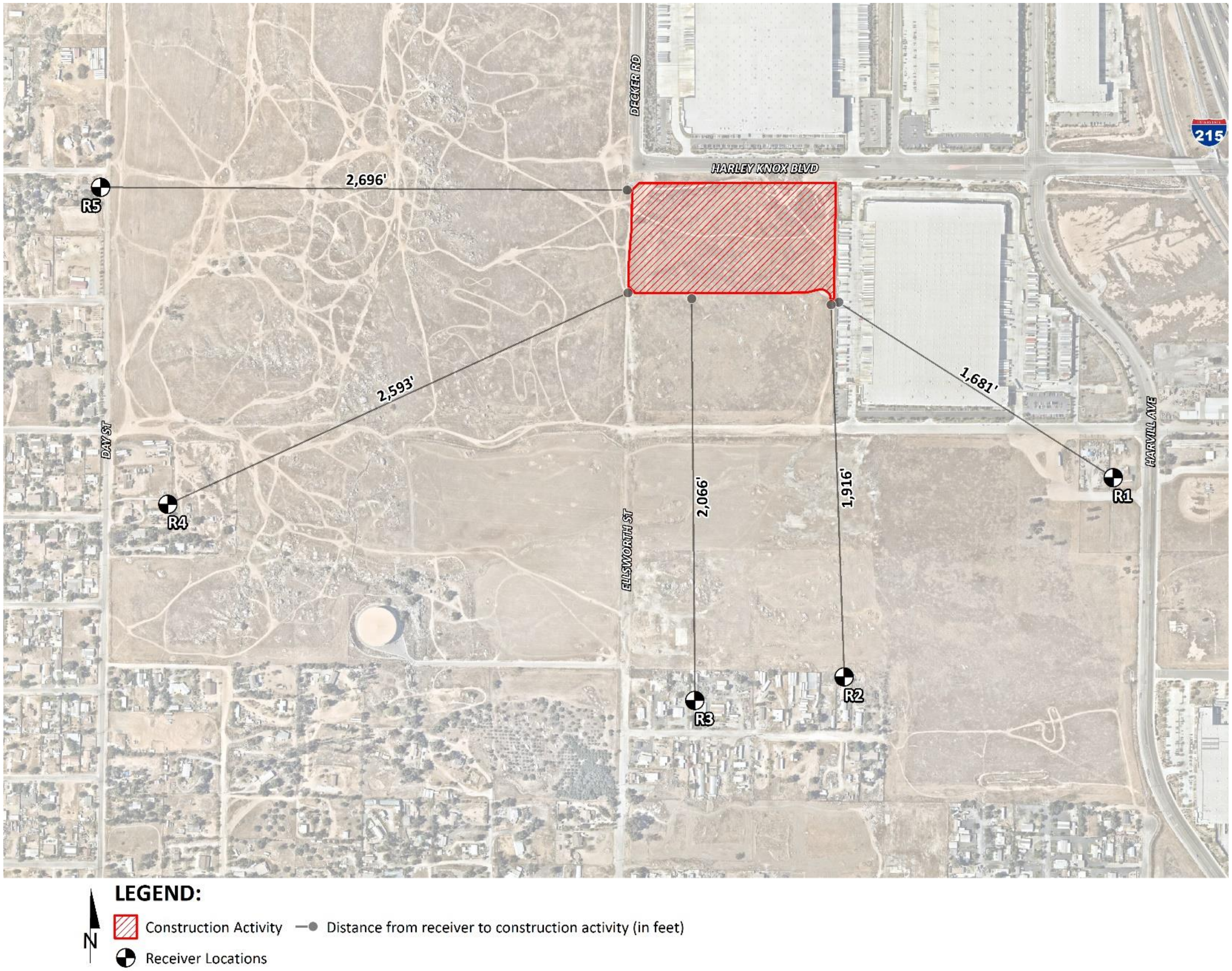
The FTA *Transit Noise and Vibration Impact Assessment Manual* recognizes that construction projects are accomplished in several different stages and outlines the procedures for assessing noise impacts during construction. Each stage has a specific equipment mix, depending on the work to be completed during that stage. As a result of the equipment mix, each stage has its own noise characteristics; some stages have higher continuous noise levels than others, and some have higher impact noise levels than others. The Project construction activities are expected to occur in the following stages:

- Site Preparation
- Grading
- Building Construction
- Paving
- Architectural Coating

10.2 CONSTRUCTION REFERENCE NOISE LEVELS

To describe construction noise activities, this construction noise analysis was prepared using reference construction equipment noise levels from the Federal Highway Administration (FHWA) published the Roadway Construction Noise Model (RCNM), which includes a national database of construction equipment reference noise emission levels. (23) The RCNM equipment database, provides a comprehensive list of the noise generating characteristics for specific types of construction equipment. In addition, the database provides an acoustical usage factor to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation.

EXHIBIT 10-A: TYPICAL CONSTRUCTION NOISE SOURCE LOCATIONS



10.3 CONSTRUCTION NOISE ANALYSIS

Using the reference construction equipment noise levels and the CadnaA noise prediction model, calculations of the Project construction noise level impacts at the nearby sensitive receiver locations were completed. Consistent with FTA guidance for general construction noise assessment, Table 10-1 presents the combined noise levels for the loudest construction equipment, assuming they operate at the same time. As shown on Table 10-2, the construction noise levels are expected to range from 32.2 to 45.6 dBA L_{eq} at the nearby receiver locations. Appendix 10.1 includes the detailed CadnaA construction noise model inputs.

TABLE 10-1: CONSTRUCTION REFERENCE NOISE LEVELS

Construction Stage	Reference Construction Activity	Reference Noise Level @ 50 Feet (dBA L_{eq})[1]	Combined Noise Level (dBA L_{eq})[2]	Combined Sound Power Level (PWL)[3]
Site Preparation	Crawler Tractors	78	80	112
	Hauling Trucks	72		
	Rubber Tired Dozers	75		
Grading	Graders	81	83	115
	Excavators	77		
	Compactors	76		
Building Construction	Cranes	73	81	113
	Tractors	80		
	Welders	70		
Paving	Pavers	74	83	115
	Paving Equipment	82		
	Rollers	73		
Architectural Coating	Cranes	73	77	109
	Air Compressors	74		
	Generator Sets	70		

[1] FHWA Roadway Construction Noise Model (RCNM).
[2] Represents the combined noise level for all equipment assuming they operate at the same time consistent with FTA Transit Noise and Vibration Impact Assessment guidance.
[3] Sound power level represents the total amount of acoustical energy (noise level) produced by a sound source independent of distance or surroundings. Sound power levels calibrated using the CadnaA noise model at the reference distance to the noise source.

TABLE 10-2: CONSTRUCTION EQUIPMENT NOISE LEVEL SUMMARY

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})					
	Site Preparation	Grading	Building Construction	Paving	Architectural Coating	Highest Levels[2]
R1	35.2	38.2	36.2	38.2	32.2	38.2
R2	42.6	45.6	43.6	45.6	39.6	45.6
R3	42.4	45.4	43.4	45.4	39.4	45.4
R4	39.4	42.4	40.4	42.4	36.4	42.4
R5	39.3	42.3	40.3	42.3	36.3	42.3

[1] Noise receiver locations are shown on Exhibit 10-A.
[2] Construction noise level calculations based on distance from the construction activity, which is measured from the Project site boundary to the nearest receiver locations. CadnaA construction noise model inputs are included in Appendix 10.1.

10.4 CONSTRUCTION NOISE LEVEL COMPLIANCE

To evaluate whether the Project will generate potentially significant short-term noise levels at nearest receiver locations, a construction-related daytime noise level threshold of 80 dBA L_{eq} is used as a reasonable threshold to assess the daytime construction noise level impacts. The construction noise analysis shows that the nearest receiver locations will satisfy the reasonable daytime 80 dBA L_{eq} significance threshold during Project construction activities as shown on Table 10-3. Therefore, the noise impacts due to Project construction noise are considered *less than significant* at all receiver locations.

TABLE 10-3: CONSTRUCTION NOISE LEVEL COMPLIANCE

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})		
	Highest Construction Noise Levels[2]	Threshold[3]	Threshold Exceeded?[4]
R1	38.2	80	No
R2	45.6	80	No
R3	45.4	80	No
R4	42.4	80	No
R5	42.3	80	No

[1] Noise receiver locations are shown on Exhibit 10-A.
[2] Highest construction noise level calculations based on distance from the construction noise source activity to the nearest receiver locations as shown on Table 10-2.
[3] Construction noise level thresholds as shown on Table 4-1.
[4] Do the estimated Project construction noise levels exceed the construction noise level threshold?

10.5 CONSTRUCTION VIBRATION IMPACTS

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used, distance to the affected structures and soil type. It is expected that ground-borne vibration from Project construction activities would cause only intermittent, localized intrusion. Ground-borne vibration levels resulting from typical construction activities occurring within the Project site were estimated by data published by the Federal Transit Administration (FTA). (8) However, while vehicular traffic is rarely perceptible, construction has the potential to result in varying degrees of temporary ground vibration, depending on the specific construction activities and equipment used. Ground vibration levels associated with various types of construction equipment are summarized on Table 10-4. Based on the representative vibration levels presented for various construction equipment types, it is possible to estimate the potential Project construction vibration levels using the following vibration assessment methods defined by the FTA. To describe the human response (annoyance) associated with vibration impacts the FTA provides the following equation: $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$

TABLE 10-4: VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	PPV (in/sec) at 25 feet
Small bulldozer	0.003
Jackhammer	0.035
Loaded Trucks	0.076
Large bulldozer	0.089

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual

Using the vibration source level of construction equipment provided on Table 10-4 and the construction vibration assessment methodology published by the FTA, it is possible to estimate the Project vibration impacts. Table 10-5 presents the expected Project related vibration levels at the nearby receiver locations. At distances ranging from 1,681 to 2,696 feet from Project construction activities, construction vibration velocity levels are estimated to be 0.000 in/sec RMS and will remain below the County of Riverside threshold of 0.01 in/sec RMS at all receiver locations, as shown on Table 10-5. Therefore, the Project-related vibration impacts are considered *less than significant* during the construction activities at the Project site.

TABLE 10-5: PROJECT CONSTRUCTION VIBRATION LEVELS

Receiver[1]	Distance to Const. Activity (Feet)	Receiver Levels (in/sec) RMS[2]					Threshold (in/sec) RMS[4]	Threshold Exceeded?[5]
		Small Bulldozer	Jack-hammer	Loaded Trucks	Large Bulldozer	Peak Vibration		
R1	1,681'	0.000	0.000	0.000	0.000	0.000	0.01	No
R2	1,916'	0.000	0.000	0.000	0.000	0.000	0.01	No
R3	2,066'	0.000	0.000	0.000	0.000	0.000	0.01	No
R4	2,593'	0.000	0.000	0.000	0.000	0.000	0.01	No
R5	2,696'	0.000	0.000	0.000	0.000	0.000	0.01	No

[1] Receiver locations are shown on Exhibit 10-A.
[2] Based on the Vibration Source Levels of Construction Equipment included on Table 10-4. Vibration levels in PPV are converted to RMS velocity using a 0.71 conversion factor identified in the Caltrans Transportation and Construction Vibration Guidance Manual, September 2013.
[3] Source: County of Riverside General Plan Noise Element, Policy N 16.3.
[4] Does the vibration level exceed the maximum acceptable vibration threshold?

Moreover, the impacts at the site of the nearest sensitive receiver locations are unlikely to be sustained during the entire construction period but will occur rather only during the times that heavy construction equipment is operating adjacent to the Project site perimeter.

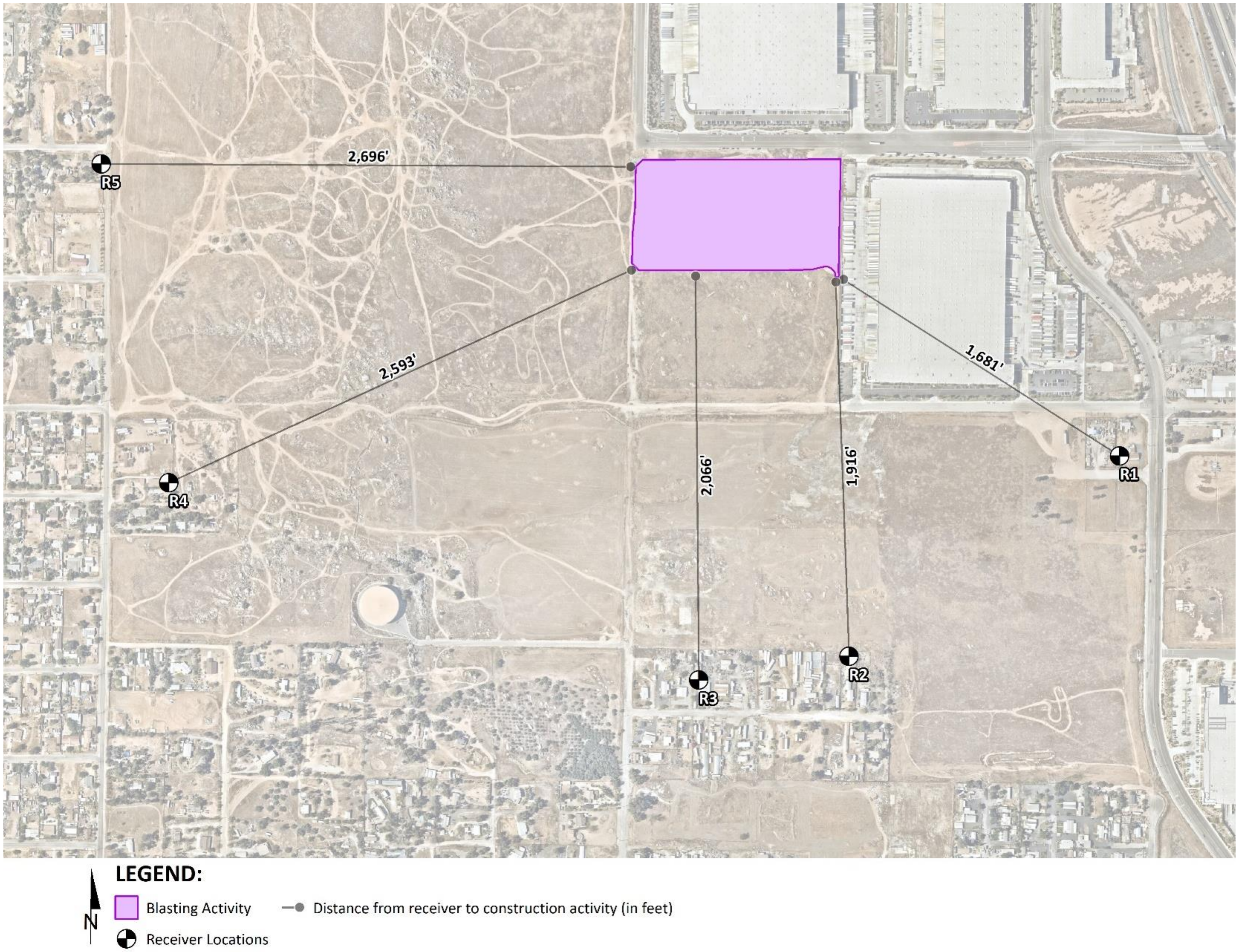
10.6 Blasting Activity

The Project includes potential blasting activities as shown on Exhibit 10-B. To present a conservative approach, this analysis assumes that blasts would occur at the edge of the blasting area (site boundary). Recognizing that it is impossible to foresee all the variables that may be encountered on various project sites, a site-specific blasting plan shall be developed for the project. Blasting shall only be conducted by a licensed blaster. Further, the licensed blaster is required to design all blasts such that they remain below the significance thresholds identified by the USBM and OSMRE in addition to the permitting requirements of the State of California and Riverside County Sheriff's Department.

10.6.1 Blasting Compliance

The blasting contractor is required to obtain blasting permit(s) from the State, and to notify Riverside County Sheriff's Department within 24 hours of planned blasting events. The Project blasting-related vibration and airblast levels are based on the 133 dB criteria for airblasts identified by the ISEE and U.S. Bureau of Mines. The blasting impacts described below represent the worst-case (closest) blast locations describing the potential impacts when measured from the edge of the nearest blast area to the nearest receiver location. When measured at greater distances, the blasts will result in lower airblast noise and vibration levels. The blasting calculations are included in Appendix 10.2.

EXHIBIT 10-B: BLASTING ACTIVITY AREA



10.6.2 AIRBLAST NOISE LEVELS

The following equations are used to calculate the airblast levels from Project blasts based on the ISEE's Blasters' Handbook equation for partially and substantially confined construction blasts, determined based on the anticipated depth of hard rock in each location. This assessment describes partially confined airblast levels since they are calculated using the Blasters' Handbook equation for general construction blasting activities. Table 10-6 shows that the calculated airblast levels from the worst-case (closest) Project blasting activities are expected to range from 107 to 124 dB. The Project airblast levels are shown to satisfy the 133 dB airblast noise limit at the nearest noise sensitive residential receiver locations.

TABLE 10-6: PROJECT BLASTING AND COMPLIANCE SUMMARY

Receiver Location[1]	Distance to Construction Activity (Feet)	Blasting Levels[2]		Threshold[3]		Threshold Exceeded?[4]	
		Airblast (dB)	Vibration (PPV)	Airblast (dB)	Vibration (PPV)	Airblast (dB)	Vibration (PPV)
R1	1,681'	109	0.04	133	0.5	No	No
R2	1,916'	107	0.02	133	0.5	No	No
R3	2,066'	110	0.04	133	0.5	No	No
R4	2,593'	113	0.07	133	0.5	No	No
R5	2,696'	124	0.38	133	0.5	No	No

[1] Noise receiver locations are shown on Exhibit 10-B.
[2] Based on input data provided by California Drilling & Blasting. Calculations are provided in Appendix C for each blast location.
[3] Vibration threshold obtained from the Caltrans Transportation and Construction Vibration Manual, April 2020 Table 19. Airblast threshold is based on ISEE's Blasters' Handbook, Table 26.17 Typical Air Overpressure Damage Criteria, and U.S. Bureau of Mines standards.
[4] Do the blast-related airblast and vibration levels exceed the thresholds?

10.6.3 BLASTING VIBRATION

The following equation is used to calculate all PPV levels from Project blasts based on the ISEE's Blasters' Handbook equation for typical construction blasting vibration levels:

$$PPV = 160 \times (SD_2)^{-1.6}$$

Table 10-6 shows the calculated vibration levels for the worst-case (closest) blast locations near the closest residences to the Project site. The vibration levels of Project blasts are expected to range from 0.02 to 0.38 in/sec PPV at the sensitive receiver locations. Table 10-6 shows that the Project blasting vibration levels will remain below the vibration threshold 0.5 PPV (in/sec) at all the sensitive receiver locations.

11 REFERENCES

1. **State of California.** *California Environmental Quality Act, Appendix G.* 2018.
2. **California Department of Transportation Environmental Program.** *Technical Noise Supplement - A Technical Supplement to the Traffic Noise Analysis Protocol.* Sacramento, CA : s.n., September 2013.
3. **Environmental Protection Agency Office of Noise Abatement and Control.** *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* March 1974. EPA/ONAC 550/9/74-004.
4. **U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch.** *Highway Traffic Noise Analysis and Abatement Policy and Guidance.* December 2011.
5. **U.S. Department of Transportation Federal Highway Administration.** *Highway Noise Barrier Design Handbook.* 2001.
6. **U.S. Department of Transportation, Federal Highway Administration.** *Highway Traffic Noise in the United States, Problem and Response.* April 2000. p. 3.
7. **U.S. Environmental Protection Agency Office of Noise Abatement and Control.** *Noise Effects Handbook-A Desk Reference to Health and Welfare Effects of Noise.* October 1979 (revised July 1981). EPA 550/9/82/106.
8. **U.S. Department of Transportation, Federal Transit Administration.** *Transit Noise and Vibration Impact Assessment Manual.* September 2018.
9. **California Department of Transportation.** *Transportation and Construction Vibration Guidance Manual.* April 2020.
10. **International Society of Explosives Engineer's.** *Blasters' Handbook, 18th Edition.* 2014.
11. **Office of Planning and Research.** *State of California General Plan Guidelines.* 2019.
12. **County of Riverside.** *General Plan Noise Element.* December 2015.
13. —. *Municipal Code, Chapter 9.52 Noise Regulation.*
14. **Riverside County Airport Land Use Commission.** *March Air Reserve Base/Inland Port Airport Land Use Compatibility Plan.* November 2014.
15. **California Court of Appeal.** *Gray v. County of Madera, F053661.* 167 Cal.App.4th 1099; - Cal.Rptr.3d, October 2008.
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20. **California Department of Transportation Environmental Program, Office of Environmental Engineering.** *Use of California Vehicle Noise Reference Energy Mean Emission Levels (Calveno REMELs) in FHWA Highway Traffic Noise Prediction.* September 1995. TAN 95-03.

21. **California Department of Transportation.** *Traffic Noise Attenuation as a Function of Ground and Vegetation Final Report.* June 1995. FHWA/CA/TL-95/23.

22. **Environmental Planning Development Solutions, Inc.** *Muranaka Warehouse Project Traffic Impact Analysis.* July 2021.

23. **U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning.** *FHWA Roadway Construction Noise Model.* January, 2006.

24. **FHWA.** *Roadway Construction Noise Model.* January 2006.

12 CERTIFICATION

The contents of this noise study report represent an accurate depiction of the noise environment and impacts associated with the proposed Muranaka Warehouse Project. The information contained in this noise study report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at (949) 584-3148.

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EDUCATION

Master of Science in Civil and Environmental Engineering
California Polytechnic State University, San Luis Obispo • December, 1993

Bachelor of Science in City and Regional Planning
California Polytechnic State University, San Luis Obispo • June, 1992

PROFESSIONAL REGISTRATIONS

PE – Registered Professional Traffic Engineer – TR 2537 • January, 2009
AICP – American Institute of Certified Planners – 013011 • June, 1997–January 1, 2012
PTP – Professional Transportation Planner • May, 2007 – May, 2013
INCE – Institute of Noise Control Engineering • March, 2004

PROFESSIONAL AFFILIATIONS

ASA – Acoustical Society of America
ITE – Institute of Transportation Engineers

PROFESSIONAL CERTIFICATIONS

Certified Acoustical Consultant – County of San Diego • March, 2018
Certified Acoustical Consultant – County of Orange • February, 2011
FHWA-NHI-142051 Highway Traffic Noise Certificate of Training • February, 2013

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APPENDIX 3.1:

COUNTY OF RIVERSIDE MUNICIPAL CODE

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Chapter 9.52 - NOISE REGULATION

Sections:

9.52.010 - Intent.

At certain levels, sound becomes noise and may jeopardize the health, safety or general welfare of Riverside County residents and degrade their quality of life. Pursuant to its police power, the board of supervisors declares that noise shall be regulated in the manner described in this chapter. This chapter is intended to establish county-wide standards regulating noise. This chapter is not intended to establish thresholds of significance for the purpose of any analysis required by the California Environmental Quality Act and no such thresholds are established.

(Ord. 847 § 1, 2006)

9.52.020 - Exemptions.

Sound emanating from the following sources is exempt from the provisions of this chapter:

A. Facilities owned or operated by or for a governmental agency;
B. Capital improvement projects of a governmental agency;
C. The maintenance or repair of public properties;
D. Public safety personnel in the course of executing their official duties, including, but not limited to, sworn peace officers, emergency personnel and public utility personnel. This exemption includes, without limitation, sound emanating from all equipment used by such personnel, whether stationary or mobile;
E. Public or private schools and school-sponsored activities;
F. Agricultural operations on land designated "Agriculture" in the Riverside County general plan, or land zoned A-l (light agriculture), A-P (light agriculture with poultry), A-2 (heavy agriculture), A-D (agriculture-dairy) or C/V (citrus/vineyard), provided such operations are carried out in a manner consistent with accepted industry standards. This exemption includes, without limitation, sound emanating from all equipment used during such operations, whether stationary or mobile;
G. Wind energy conversion systems (WECS), provided such systems comply with the WECS noise provisions of Riverside County Ordinance No. 348;
H. Private construction projects located one-quarter of a mile or more from an inhabited dwelling;
I. Private construction projects located within one-quarter of a mile from an inhabited dwelling, provided that:

1. Construction does not occur between the hours of six p.m. and six a.m. during the months of June through September, and
2. Construction does not occur between the hours of six p.m. and seven a.m. during the months of October through May;

J. Property maintenance, including, but not limited to, the operation of lawnmowers, leaf blowers, etc., provided such maintenance occurs between the hours of seven a.m. and eight p.m.;

K. Motor vehicles, other than off-highway vehicles. This exemption does not include sound emanating from motor vehicle sound systems;

L. Heating and air conditioning equipment;

M. Safety, warning and alarm devices, including, but not limited to, house and car alarms, and other warning devices that are designed to protect the public health, safety, and welfare;

N. The discharge of firearms consistent with all state laws.

(Ord. 847 § 2, 2006)

9.52.030 - Definitions.

As used in this chapter, the following terms shall have the following meanings:

"Audio equipment" means a television, stereo, radio, tape player, compact disc player, mp3 player, I-POD or other similar device.

"Decibel (dB)" means a unit for measuring the relative amplitude of a sound equal approximately to the smallest difference normally detectable by the human ear, the range of which includes approximately one hundred thirty (130) decibels on a scale beginning with zero decibels for the faintest detectable sound. Decibels are measured with a sound level meter using different methodologies as defined below:

1. "A-weighting (dBA)" means the standard A-weighted frequency response of a sound level meter, which de-emphasizes low and high frequencies of sound in a manner similar to the human ear for moderate sounds.
2. "Maximum sound level (L_{max})" means the maximum sound level measured on a sound level meter.

"Governmental agency" means the United States, the state of California, Riverside County, any city within Riverside County, any special district within Riverside County or any combination of these agencies.

"Land use permit" means a discretionary permit issued by Riverside County pursuant to Riverside County Ordinance No. 348.

"Motor vehicle" means a vehicle that is self-propelled.

"Motor vehicle sound system" means a stereo, radio, tape player, compact disc player, mp3 player, I-POD or other similar device.

"Noise" means any loud, discordant or disagreeable sound.

"Occupied property" means property upon which is located a residence, business or industrial or manufacturing use.

"Off-highway vehicle" means a motor vehicle designed to travel over any terrain.

"Public or private school" means an institution conducting academic instruction at the preschool, elementary school, junior high school, high school, or college level.

"Public property" means property owned by a governmental agency or held open to the public, including, but not limited to, parks, streets, sidewalks, and alleys.

"Sensitive receptor" means a land use that is identified as sensitive to noise in the noise element of the Riverside County general plan, including, but not limited to, residences, schools, hospitals, churches, rest homes, cemeteries or public libraries.

"Sound-amplifying equipment" means a loudspeaker, microphone, megaphone or other similar device.

"Sound level meter" means an instrument meeting the standards of the American National Standards Institute for Type 1 or Type 2 sound level meters or an instrument that provides equivalent data.

(Ord. 847 § 3, 2006)

9.52.040 - General sound level standards.

No person shall create any sound, or allow the creation of any sound, on any property that causes the exterior sound level on any other occupied property to exceed the sound level standards set forth in Table 1.

TABLE 1

Sound Level Standards (Db L_{max})

GENERAL PLAN FOUNDATION COMPONENT	GENERAL PLAN LAND USE DESIGNATION	GENERAL PLAN LAND USE DESIGNATION NAME	DENSITY	MAXIMUM DECIBEL LEVEL

				7 am—10 pm	10 pm—7 am
Community Development	EDR	Estate Density Residential	2 AC	55	45
	VLDR	Very Low Density Residential	1 AC	55	45
	LDR	Low Density Residential	1/2 AC	55	45
	MDR	Medium Density Residential	2—5	55	45
	MHDR	Medium High Density Residential	5—8	55	45
	HDR	High Density Residential	8—14	55	45
	VHDR	Very High Density Residential	14—20	55	45
	H'TDR	Highest Density Residential	20+	55	45
	CR	Retail Commercial		65	55

	CO	Office Commercial		65	55
	CT	Tourist Commercial		65	55
	CC	Community Center		65	55
	LI	Light Industrial		75	55
	HI	Heavy Industrial		75	75
	BP	Business Park		65	45
	PF	Public Facility		65	45
	SP	Specific Plan-Residential		55	45
		Specific Plan-Commercial		65	55
		Specific Plan-Light Industrial		75	55
		Specific Plan-Heavy Industrial		75	75
Rural Community	EDR	Estate Density Residential	2 AC	55	45

	VLDR	Very Low Density Residential	1 AC	55	45
	LDR	Low Density Residential	1/2 AC	55	45
Rural	RR	Rural Residential	5 AC	45	45
	RM	Rural Mountainous	10 AC	45	45
	RD	Rural Desert	10 AC	45	45
Agriculture	AG	Agriculture	10 AC	45	45
Open Space	C	Conservation		45	45
	CH	Conservation Habitat		45	45
	REC	Recreation		45	45
	RUR	Rural	20 AC	45	45
	W	Watershed		45	45
	MR	Mineral Resources		75	45

(Ord. 847 § 4, 2006)

9.52.050 - Sound level measurement methodology.

Sound level measurements may be made anywhere within the boundaries of an occupied property. The actual location of a sound level measurement shall be at the discretion of the enforcement officials identified in Section 9.52.080 of this chapter. Sound level measurements shall be made with a sound level meter. Immediately before a measurement is made, the sound level meter shall be calibrated utilizing an acoustical calibrator meeting the standards of the American National Standards Institute. Following a sound level measurement, the calibration of the sound level meter shall be re-verified. Sound level meters and calibration equipment shall be certified annually.

(Ord. 847 § 5, 2006)

9.52.060 - Special sound sources standards.

The general sound level standards set forth in Section 9.52.040 of this chapter apply to sound emanating from all sources, including the following special sound sources, and the person creating, or allowing the creation of, the sound is subject to the requirements of that section. The following special sound sources are also subject to the following additional standards, the failure to comply with which constitutes separate violations of this chapter:

A. Motor Vehicles.
    1. Off-Highway Vehicles.
        a. No person shall operate an off-highway vehicle unless it is equipped with a USDA-qualified spark arrester and a constantly operating and properly maintained muffler. A muffler is not considered constantly operating and properly maintained if it is equipped with a cutout, bypass or similar device.
        b. No person shall operate an off-highway vehicle unless the noise emitted by the vehicle is not more than ninety-six (96) dBA if the vehicle was manufactured on or after January 1, 1986 or is not more than one hundred one (101) dBA if the vehicle was manufactured before January 1, 1986. For purposes of this subsection, emitted noise shall be measured a distance of twenty (20) inches from the vehicle tailpipe using test procedures established by the Society of Automotive Engineers under Standard J-1287.
    2. Sound Systems. No person shall operate a motor vehicle sound system, whether affixed to the vehicle or not, between the hours of ten p.m. and eight a.m., such that the sound system is audible to the human ear inside any inhabited dwelling. No person shall operate a motor vehicle sound system, whether affixed to the vehicle or not, at any other time such that the sound system is audible to the human ear at a distance greater than one hundred (100) feet from the vehicle.
B. Power Tools and Equipment. No person shall operate any power tools or equipment between the hours of ten p.m. and eight a.m. such that the power tools or equipment

are audible to the human ear inside an inhabited dwelling other than a dwelling in which the power tools or equipment may be located. No person shall operate any power tools or equipment at any other time such that the power tools or equipment are audible to the human ear at a distance greater than one hundred (100) feet from the power tools or equipment.

C. Audio Equipment. No person shall operate any audio equipment, whether portable or not, between the hours of ten p.m. and eight a.m. such that the equipment is audible to the human ear inside an inhabited dwelling other than a dwelling in which the equipment may be located. No person shall operate any audio equipment, whether portable or not, at any other time such that the equipment is audible to the human ear at a distance greater than one hundred (100) feet from the equipment.

D. Sound-Amplifying Equipment and Live Music. No person shall install, use or operate sound-amplifying equipment, or perform, or allow to be performed, live music unless such activities comply with the following requirements. To the extent that these requirements conflict with any conditions of approval attached to an underlying land use permit, these requirements shall control:

1. Sound-amplifying equipment or live music is prohibited between the hours of ten p.m. and eight a.m.
2. Sound emanating from sound-amplifying equipment or live music at any other time shall not be audible to the human ear at a distance greater than two hundred (200) feet from the equipment or music.

(Ord. 847 § 6, 2006)

9.52.070 - Exceptions.

Exceptions may be requested from the standards set forth in Section 9.52.040 or 9.52.060 of this chapter and may be characterized as construction-related, single-event or continuous-events exceptions.

A. Application and Processing.

1. Construction-Related Exceptions. An application for a construction-related exception shall be made to and considered by the director of building and safety on forms provided by the building and safety department and shall be accompanied by the appropriate filing fee. No public hearing is required.
2. Single-Event Exceptions. An application for a single-event exception shall be made to and considered by the planning director on forms provided by the planning department and shall be accompanied by the appropriate filing fee. No public hearing is required.
3. Continuous-Events Exceptions. An application for a continuous-events exception

shall be made to the planning director on forms provided by the planning department and shall be accompanied by the appropriate filing fee. Upon receipt of an application for a continuous-events exception, the planning director shall set the matter for public hearing before the planning commission, notice of which shall be given as provided in Section 18.26c of Riverside County Ordinance No. 348. Notwithstanding the above, an application for a continuous-events exception that is associated with an application for a land use permit shall be processed concurrently with the land use permit in the same manner that the land use permit is required to be processed.

B. Requirements for Approval. The appropriate decisionmaking body or officer shall not approve an exception application unless the applicant demonstrates that the activities described in the application would not be detrimental to the health, safety or general welfare of the community. In determining whether activities are detrimental to the health, safety or general welfare of the community, the appropriate decisionmaking body or officer shall consider such factors as the proposed duration of the activities and their location in relation to sensitive receptors. If an exception application is approved, reasonable conditions may be imposed to minimize the public detriment, including, but not limited to, restrictions on sound level, sound duration and operating hours.

C. Appeals. The director of building and safety's decision on an application for a construction-related exception is considered final. The planning director's decision on an application for a single-event exception is considered final. After making a decision on an application for a continuous-events exception, the appropriate decisionmaking body or officer shall mail notice of the decision to the applicant. Within ten (10) calendar days after the mailing of such notice, the applicant or an interested person may appeal the decision to the board of supervisors. Upon receipt of an appeal and payment of the appropriate appeal fee, the clerk of the board shall set the matter for hearing not less than five days nor more than thirty (30) days thereafter and shall give written notice of the hearing in the same manner as notice of the hearing was given by the appropriate hearing officer or body. The board of supervisors shall render its decision within thirty (30) days after the appeal hearing is closed.

D. Effect of a Pending Continuous-Events Exception Application. For a period of one hundred eighty (180) days from the effective date of this chapter, no person creating any sound prohibited by this chapter shall be considered in violation of this chapter if the sound is related to a use that is operating pursuant to an approved land use permit, if an application for a continuous-events exception has been filed to sanction the sound and if a decision on the application is pending.

(Ord. 847 § 7, 2006)

9.52.080 - Enforcement.

The Riverside County sheriff and code enforcement shall have the primary responsibility for enforcing this chapter; provided, however, the sheriff and code enforcement may be assisted by the public health department. Violations shall be prosecuted as described in Section 9.52.100 of this chapter, but nothing in this chapter shall prevent the sheriff, code enforcement or the department of public health from engaging in efforts to obtain voluntary compliance by means of warnings, notices, or educational programs.

(Ord. 847.1 § 1, 2007: Ord. 847 § 8, 2006)

9.52.090 - Duty to cooperate.

No person shall refuse to cooperate with, or obstruct, the enforcement officials identified in Section 9.52.080 of this chapter when they are engaged in the process of enforcing the provisions of this chapter. This duty to cooperate may require a person to extinguish a sound source so that it can be determined whether sound emanating from the source violates the provisions of this chapter.

(Ord. 847 § 9, 2006)

9.52.100 - Violations and penalties.

Any person who violates any provision of this chapter once or twice within a one hundred eighty (180) day period shall be guilty of an infraction. Any person who violates any provision of this chapter more than twice within a one hundred eighty (180) day period shall be guilty of a misdemeanor. Each day a violation is committed or permitted to continue shall constitute a separate offense and shall be punishable as such. Penalties shall not exceed the following amounts:

A. For the first violation within a one hundred eighty (180) day period, the minimum mandatory fine shall be five hundred dollars ($500.00).
B. For the second violation within a one hundred eighty (180) day period, the minimum mandatory fine shall be seven hundred fifty dollars ($750.00).
C. For any further violations within a one hundred eighty (180) day period, the minimum mandatory fine shall be one thousand dollars ($1,000.00) or imprisonment in the county jail for a period not exceeding six months, or both.

(Ord. 847 § 10, 2006)

APPENDIX 5.1:

STUDY AREA PHOTOS

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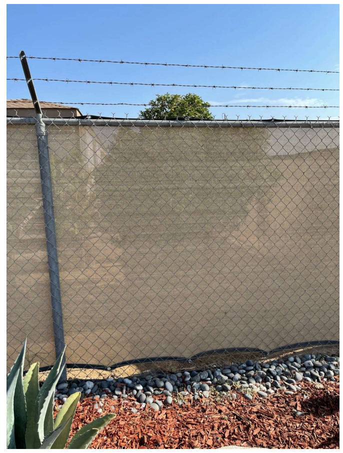
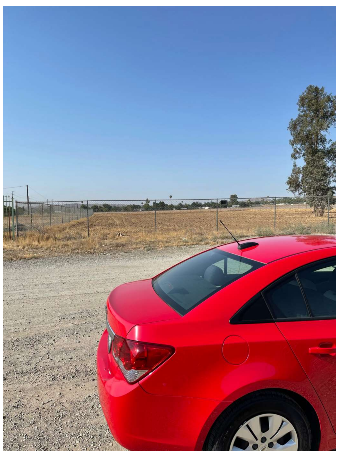
JN: 13660 Study Area Photos

L1-E
33, 51' 28.920000"117, 15' 43.670000"

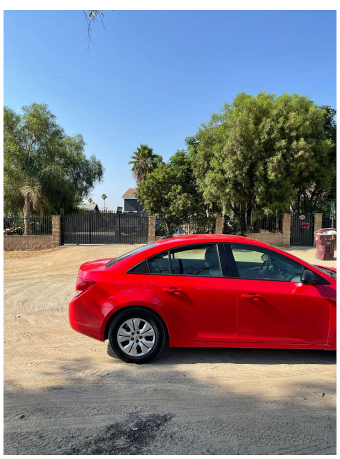


L1-N
33, 51' 28.920000"117, 15' 43.670000"



L1-S
33, 51' 28.920000"117, 15' 43.700000"

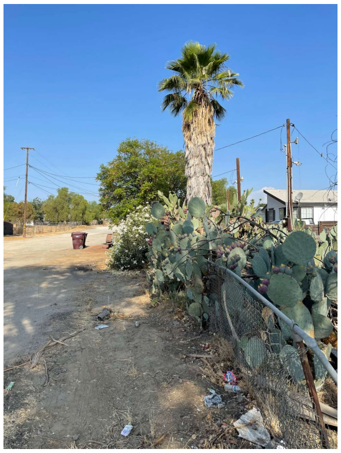
L1-W
33, 51' 28.920000"117, 15' 43.700000"



L2-E
33, 51' 16.730000"117, 15' 57.570000"

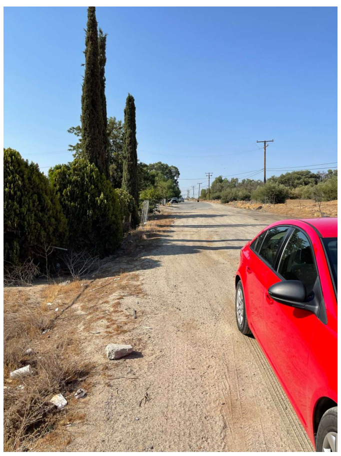
L2-N
33, 51' 16.780000"117, 15' 57.540000"

JN: 13660 Study Area Photos



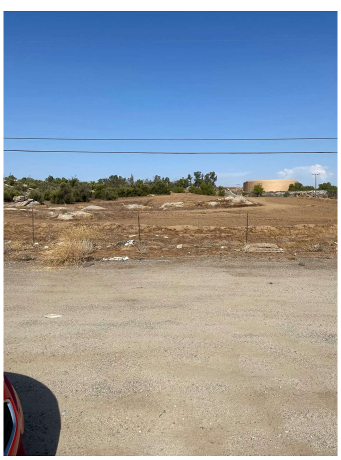
L2-S
33, 51' 16.750000"117, 15' 57.570000"

L2-W
33, 51' 16.750000"117, 15' 57.570000"

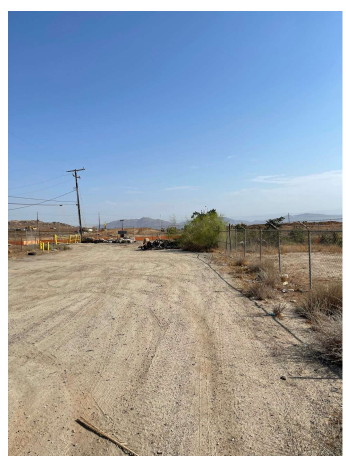


L3-E
33, 51' 18.550000"117, 16' 12.400000"

L3-N
33, 51' 15.420000"117, 16' 11.740000"



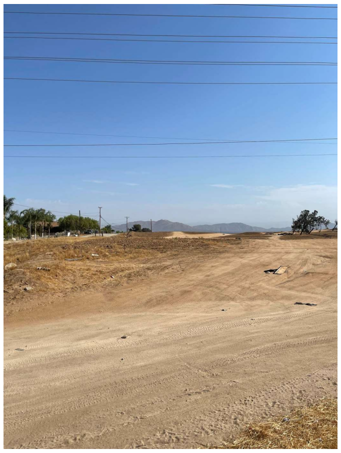
L3-S
33, 51' 18.680000"117, 16' 12.240000"



L3-W
33, 51' 18.550000"117, 16' 12.400000"

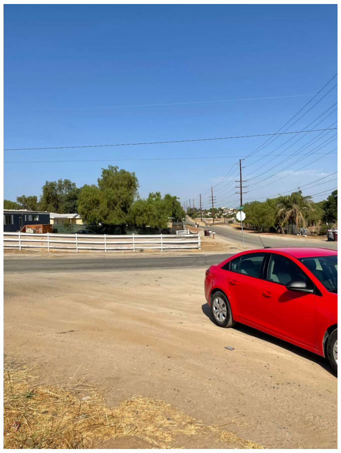
JN: 13660 Study Area Photos

L4-E
33, 51' 31.170000"117, 16' 43.110000"

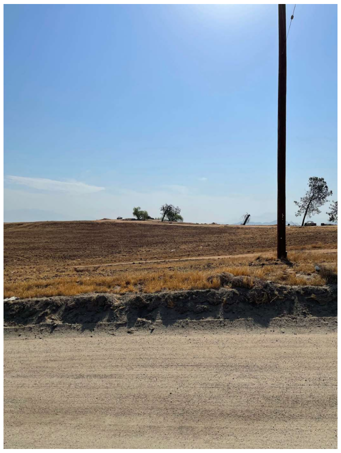


L4-N
33, 51' 31.220000"117, 16' 43.110000"

L4-S
33, 51' 31.170000"117, 16' 43.110000"



L4-W
33, 51' 31.170000"117, 16' 43.110000"

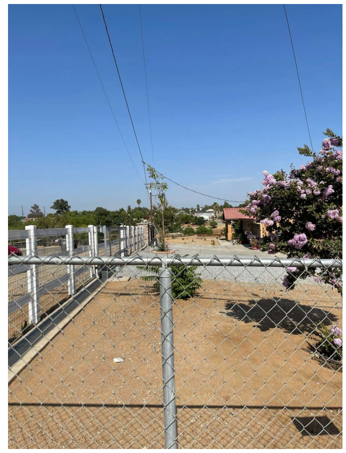


L5-E
33, 51' 38.360000"117, 16' 43.820000"

L5-N
33, 51' 38.360000"117, 16' 43.820000"

JN: 13660 Study Area Photos

L5-S
33, 51' 38.360000"117, 16' 43.820000"



L5-W
33, 51' 38.380000"117, 16' 43.880000"

APPENDIX 5.2:

NOISE LEVEL MEASUREMENT WORKSHEETS

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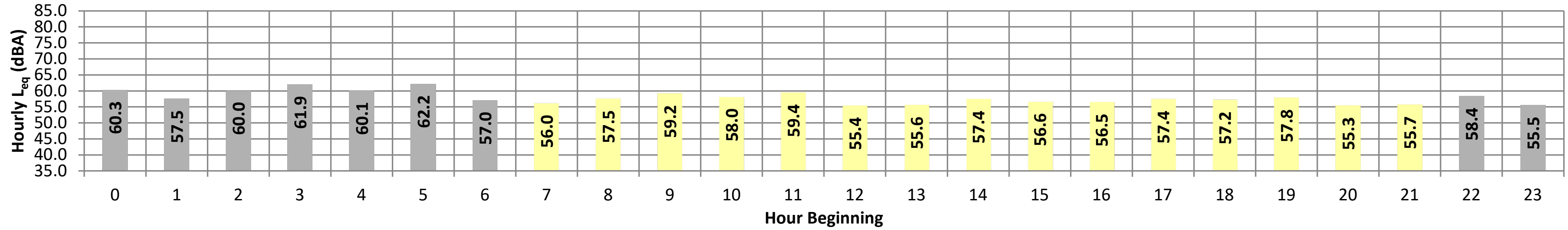
24-Hour Noise Level Measurement Summary

Date: Wednesday, July 14, 2021
Project: Muranaka
Location: L1 -Located southeast of the Project site near single-family
Source: residence at 22980 Peregrine Way.
Meter: Piccolo II
JN: 13660
Analyst: A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	60.3	66.5	46.3	66.0	65.7	64.7	64.0	61.5	59.2	52.1	49.7	47.0	60.3	10.0	70.3
	1	57.5	69.3	46.8	68.8	67.7	64.5	61.5	56.0	53.1	47.4	47.1	46.9	57.5	10.0	67.5
	2	60.0	67.4	49.6	66.7	66.3	64.9	64.0	61.0	58.3	53.4	52.1	50.2	60.0	10.0	70.0
	3	61.9	69.8	49.6	69.1	68.6	67.2	66.4	63.5	59.2	50.9	50.2	49.7	61.9	10.0	71.9
	4	60.1	66.0	56.6	65.5	65.0	63.8	63.0	60.6	59.1	57.3	57.0	56.7	60.1	10.0	70.1
	5	62.2	67.6	59.2	67.3	66.8	65.6	64.8	62.6	61.3	59.9	59.6	59.3	62.2	10.0	72.2
	6	57.0	66.1	51.2	65.7	65.3	63.0	61.2	56.7	53.9	51.7	51.5	51.3	57.0	10.0	67.0
Day	7	56.0	64.2	49.7	63.8	63.2	61.6	60.3	56.4	53.4	50.6	50.2	49.8	56.0	0.0	56.0
	8	57.5	66.3	51.6	65.9	65.3	63.3	61.7	57.4	54.8	52.5	52.1	51.8	57.5	0.0	57.5
	9	59.2	66.7	52.9	66.2	65.4	63.5	62.5	59.9	57.7	54.1	53.6	53.0	59.2	0.0	59.2
	10	58.0	67.2	51.4	66.7	65.9	63.8	62.2	57.9	55.2	52.3	52.0	51.5	58.0	0.0	58.0
	11	59.4	70.5	49.4	70.1	69.2	66.6	64.4	57.6	53.6	50.2	49.9	49.5	59.4	0.0	59.4
	12	55.4	64.2	49.6	63.8	63.1	61.2	59.5	55.2	52.7	50.3	50.0	49.7	55.4	0.0	55.4
	13	55.6	63.2	50.3	62.8	62.3	60.9	59.8	56.0	53.2	51.0	50.7	50.4	55.6	0.0	55.6
	14	57.4	67.2	51.5	66.7	66.2	64.7	61.8	56.1	54.1	52.2	51.9	51.6	57.4	0.0	57.4
	15	56.6	65.7	50.6	65.2	64.6	62.4	60.5	56.5	53.8	51.3	51.0	50.7	56.6	0.0	56.6
	16	56.5	65.3	49.9	64.9	64.4	62.4	60.9	56.5	53.7	50.8	50.4	50.1	56.5	0.0	56.5
	17	57.4	66.2	49.6	65.7	65.2	63.4	61.7	57.5	54.9	50.7	50.2	49.8	57.4	0.0	57.4
	18	57.2	66.4	49.9	65.9	65.1	62.3	60.8	57.3	54.2	50.9	50.3	50.0	57.2	0.0	57.2
	19	57.8	68.5	48.9	68.0	67.2	64.7	62.6	57.0	53.7	50.0	49.5	49.1	57.8	5.0	62.8
	20	55.3	64.4	47.6	64.0	63.4	61.4	60.0	55.6	51.9	48.5	48.1	47.7	55.3	5.0	60.3
	21	55.7	64.3	47.8	63.6	63.0	61.4	60.0	56.3	53.0	49.0	48.5	48.0	55.7	5.0	60.7
Night	22	58.4	67.8	46.9	67.1	66.3	64.0	62.6	58.6	55.8	49.2	47.9	47.1	58.4	10.0	68.4
	23	55.5	63.4	45.1	62.8	62.2	60.7	59.7	56.6	53.6	46.9	45.9	45.3	55.5	10.0	65.5

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	55.3	63.2	47.6	62.8	62.3	60.9	59.5	55.2	51.9	48.5	48.1	47.7
	Max	59.4	70.5	52.9	70.1	69.2	66.6	64.4	59.9	57.7	54.1	53.6	53.0
Energy Average		57.2	Average:		65.5	64.9	62.9	61.2	56.9	54.0	51.0	50.6	50.2
Night	Min	55.5	63.4	45.1	62.8	62.2	60.7	59.7	56.0	53.1	46.9	45.9	45.3
	Max	62.2	69.8	59.2	69.1	68.6	67.2	66.4	63.5	61.3	59.9	59.6	59.3
Energy Average		59.7	Average:		66.6	66.0	64.3	63.0	59.7	57.0	52.1	51.2	50.4

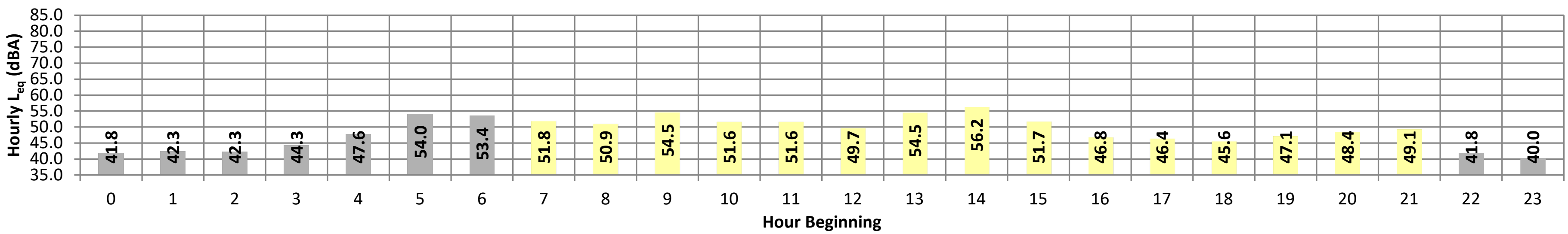
L_{eq} (dBA)		
24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
58.3	**57.2**	**59.7**

URBAN CROSSROADS

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 14, 2021
Project: Muranaka
Location: L2-Located south of the Project site near single-family
Source: residence at 22730 Redwood Drive.
Meter: Piccolo II
JN: 13660
Analyst: A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*	*L_{eq}*	*Adj.*	*Adj. L_{eq}*
Night	0	41.8	46.2	38.7	45.8	45.4	44.9	44.4	42.6	41.1	39.4	39.1	38.9	41.8	10.0	51.8
	1	42.3	48.7	39.3	48.0	47.4	46.1	45.5	42.7	41.1	39.8	39.7	39.5	42.3	10.0	52.3
	2	42.3	45.6	40.4	45.3	45.1	44.6	44.2	42.6	41.8	41.0	40.8	40.5	42.3	10.0	52.3
	3	44.3	46.5	42.8	46.3	46.1	45.7	45.4	44.6	44.0	43.4	43.2	43.0	44.3	10.0	54.3
	4	47.6	50.2	46.1	50.0	49.8	49.5	49.2	48.0	47.4	46.5	46.4	46.2	47.6	10.0	57.6
	5	54.0	59.2	50.1	58.5	58.1	57.1	56.6	54.8	53.3	51.2	50.7	50.3	54.0	10.0	64.0
	6	53.4	60.4	48.3	60.0	59.7	58.7	58.1	55.3	53.0	49.9	49.2	48.6	53.4	10.0	63.4
Day	7	51.8	59.7	44.4	58.9	58.2	56.9	56.0	52.8	49.7	45.5	45.0	44.6	51.8	0.0	51.8
	8	50.9	57.7	42.9	56.9	56.4	55.5	54.5	52.1	49.6	45.2	44.3	43.3	50.9	0.0	50.9
	9	54.5	61.7	45.0	60.8	60.3	59.2	58.4	55.7	53.0	47.8	46.8	45.6	54.5	0.0	54.5
	10	51.6	59.5	43.2	58.9	58.4	57.2	55.9	52.2	49.6	45.1	44.3	43.5	51.6	0.0	51.6
	11	51.6	59.7	43.3	59.2	58.6	56.6	55.9	52.1	49.3	45.4	44.6	43.7	51.6	0.0	51.6
	12	49.7	59.6	43.2	59.0	58.4	57.4	56.6	53.5	49.1	44.4	43.9	43.4	49.7	0.0	49.7
	13	54.5	60.7	44.2	60.1	59.6	58.8	58.2	56.0	53.5	46.9	45.7	44.6	54.5	0.0	54.5
	14	56.2	64.1	45.7	63.5	63.0	61.8	61.0	58.7	55.7	48.3	47.2	46.1	56.2	0.0	56.2
	15	51.7	63.8	43.6	63.4	63.0	60.8	58.9	53.8	49.9	44.7	44.2	43.7	51.7	0.0	51.7
	16	46.8	50.8	43.8	50.5	50.2	49.5	49.0	47.4	46.2	44.5	44.2	43.9	46.8	0.0	46.8
	17	46.4	50.1	43.6	49.7	49.5	48.8	48.4	47.1	46.0	44.3	44.0	43.7	46.4	0.0	46.4
	18	45.6	50.2	42.9	49.9	49.5	48.7	48.1	46.0	44.9	43.5	43.3	43.0	45.6	0.0	45.6
	19	47.1	52.8	43.2	52.3	51.9	50.9	50.1	47.7	46.0	43.9	43.6	43.3	47.1	5.0	52.1
	20	48.4	55.1	42.0	54.7	54.2	53.1	52.3	49.9	46.4	42.9	42.5	42.2	48.4	5.0	53.4
	21	49.1	55.4	41.2	55.1	54.8	54.1	53.6	51.1	45.8	42.1	41.7	41.3	49.1	5.0	54.1
Night	22	41.8	46.5	38.0	46.2	46.0	45.6	44.5	42.6	41.2	38.9	38.5	38.2	41.8	10.0	51.8
	23	40.0	42.5	38.5	42.2	42.0	41.5	41.2	40.4	39.9	39.0	38.8	38.6	40.0	10.0	50.0

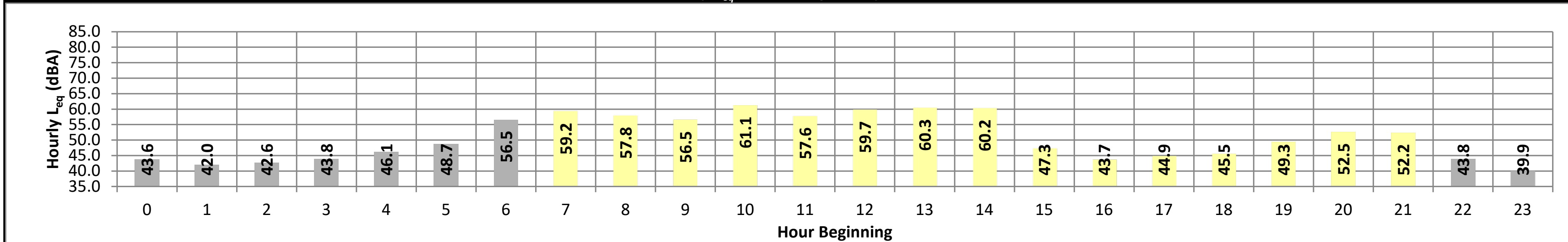
Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*
Day	Min	45.6	50.1	41.2	49.7	49.5	48.7	48.1	46.0	44.9	42.1	41.7	41.3
	Max	56.2	64.1	45.7	63.5	63.0	61.8	61.0	58.7	55.7	48.3	47.2	46.1
Energy Average		51.5	Average:		56.9	56.4	55.3	54.5	51.8	49.0	45.0	44.3	43.7
Night	Min	40.0	42.5	38.0	42.2	42.0	41.5	41.2	40.4	39.9	38.9	38.5	38.2
	Max	54.0	60.4	50.1	60.0	59.7	58.7	58.1	55.3	53.3	51.2	50.7	50.3
Energy Average		48.5	Average:		49.1	48.8	48.2	47.7	46.0	44.7	43.2	42.9	42.6

L_{eq} (dBA)		
24-Hour	*Daytime (7am-10pm)*	*Nighttime (10pm-7am)*
50.6	**51.5**	**48.5**

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 14, 2021	*Location:* L3 -Located south of the Project site near single-family	*Meter:* Piccolo II	*JN:* 13660
Project: Muranaka	*Source:* residence at 22510 Redwood Drive.		*Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*	*L_{eq}*	*Adj.*	*Adj. L_{eq}*
Night	0	43.6	46.8	41.1	46.4	46.1	45.6	45.3	44.3	43.4	41.9	41.7	41.3	43.6	10.0	53.6
	1	42.0	44.7	40.2	44.4	44.1	43.6	43.3	42.3	41.7	40.9	40.7	40.5	42.0	10.0	52.0
	2	42.6	46.0	40.7	45.7	45.4	44.7	44.2	43.0	42.3	41.4	41.2	40.9	42.6	10.0	52.6
	3	43.8	46.5	42.0	46.2	46.0	45.6	45.2	44.2	43.5	42.7	42.5	42.2	43.8	10.0	53.8
	4	46.1	49.2	44.1	48.9	48.7	48.3	47.9	46.5	45.7	44.7	44.6	44.3	46.1	10.0	56.1
	5	48.7	52.3	46.8	51.9	51.4	50.4	50.0	49.2	48.4	47.5	47.3	47.0	48.7	10.0	58.7
	6	56.5	59.8	53.9	59.5	59.2	58.5	58.2	57.2	56.3	54.8	54.5	54.1	56.5	10.0	66.5
Day	7	59.2	62.6	56.2	62.3	62.1	61.7	61.2	59.9	58.7	57.1	56.8	56.4	59.2	0.0	59.2
	8	57.8	60.7	55.1	60.5	60.3	59.7	59.4	58.4	57.6	56.1	55.7	55.3	57.8	0.0	57.8
	9	56.5	59.6	53.7	59.3	59.1	58.6	58.2	57.1	56.2	54.7	54.4	54.0	56.5	0.0	56.5
	10	61.1	65.0	57.9	64.7	64.5	63.9	63.4	61.8	60.6	58.9	58.6	58.1	61.1	0.0	61.1
	11	57.6	60.7	54.9	60.4	60.2	59.7	59.4	58.3	57.3	55.8	55.5	55.1	57.6	0.0	57.6
	12	59.7	62.9	56.5	62.7	62.5	62.0	61.6	60.4	59.3	57.4	57.1	56.7	59.7	0.0	59.7
	13	60.3	63.4	57.3	63.2	63.0	62.6	62.3	61.2	60.0	58.3	57.9	57.5	60.3	0.0	60.3
	14	60.2	63.8	57.2	63.4	63.2	62.6	62.2	60.8	59.8	58.1	57.8	57.4	60.2	0.0	60.2
	15	47.3	62.6	40.6	62.1	61.4	60.1	59.4	51.9	45.2	41.6	41.3	40.8	47.3	0.0	47.3
	16	43.7	51.1	40.0	50.4	49.4	47.4	46.2	44.0	42.6	40.8	40.5	40.2	43.7	0.0	43.7
	17	44.9	51.5	40.3	50.7	49.9	48.6	47.9	45.7	43.8	41.3	41.0	40.6	44.9	0.0	44.9
	18	45.5	53.1	40.3	52.6	52.0	50.5	49.3	45.8	43.6	41.4	41.1	40.5	45.5	0.0	45.5
	19	49.3	55.8	42.6	55.1	54.5	53.2	52.4	50.2	48.3	44.6	43.8	42.9	49.3	5.0	54.3
	20	52.5	59.8	43.7	59.3	58.8	57.8	57.2	54.1	49.5	45.1	44.5	43.9	52.5	5.0	57.5
	21	52.2	61.7	44.2	61.4	61.1	60.1	59.4	56.3	51.1	45.9	45.3	44.6	52.2	5.0	57.2
Night	22	43.8	49.5	38.7	49.2	48.9	48.1	47.5	44.9	42.4	39.4	39.1	38.9	43.8	10.0	53.8
	23	39.9	44.4	37.2	44.0	43.6	42.7	42.2	40.4	39.3	37.9	37.7	37.4	39.9	10.0	49.9

Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*	*L_{eq} (dBA)*		
Day	Min	43.7	51.1	40.0	50.4	49.4	47.4	46.2	44.0	42.6	40.8	40.5	40.2	*24-Hour*	*Daytime (7am-10pm)*	*Nighttime (10pm-7am)*
	Max	61.1	65.0	57.9	64.7	64.5	63.9	63.4	61.8	60.6	58.9	58.6	58.1			
Energy Average		56.9	Average:		59.2	58.8	57.9	57.3	55.1	52.9	50.5	50.1	49.6	**55.2**	**56.9**	**48.8**
Night	Min	39.9	44.4	37.2	44.0	43.6	42.7	42.2	40.4	39.3	37.9	37.7	37.4			
	Max	56.5	59.8	53.9	59.5	59.2	58.5	58.2	57.2	56.3	54.8	54.5	54.1			
Energy Average		48.8	Average:		48.5	48.1	47.5	47.1	45.8	44.8	43.5	43.2	43.0			

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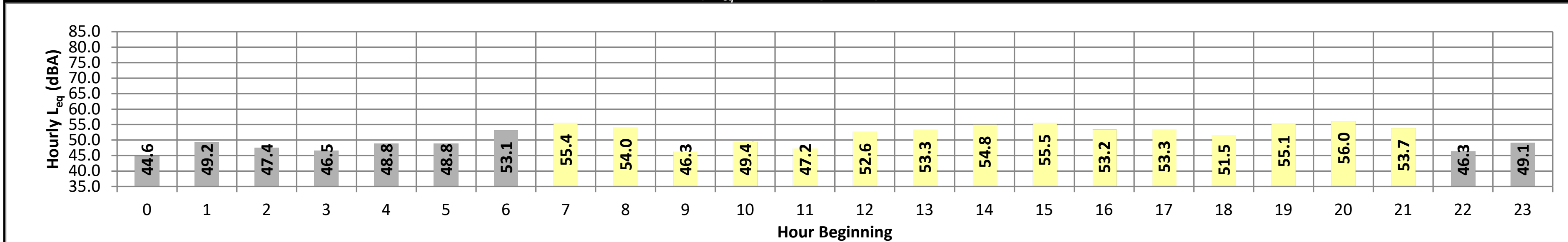
URBAN CROSSROADS

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 14, 2021
Project: Muranaka
Location: L4 - Located southwest of the Project site near single-family
Source: residence at 18040 Day Street.
Meter: Piccolo II
JN: 13660
Analyst: A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	44.6	51.2	41.2	50.8	50.3	49.2	47.9	44.8	43.0	41.7	41.5	41.3	44.6	10.0	54.6
	1	49.2	58.1	40.1	57.6	56.9	55.9	55.0	49.6	44.5	40.9	40.6	40.2	49.2	10.0	59.2
	2	47.4	65.8	41.0	65.2	64.6	62.3	59.8	49.6	45.7	42.0	41.6	41.2	47.4	10.0	57.4
	3	46.5	54.5	42.3	54.1	53.7	52.6	51.5	45.5	44.2	42.9	42.7	42.5	46.5	10.0	56.5
	4	48.8	57.2	42.9	56.9	56.5	55.0	54.4	47.8	44.8	43.4	43.2	43.0	48.8	10.0	58.8
	5	48.8	55.9	44.8	55.6	55.4	54.5	53.2	48.6	46.5	45.4	45.2	45.0	48.8	10.0	58.8
	6	53.1	62.4	46.5	62.0	61.4	60.0	58.7	51.9	48.6	47.0	46.8	46.6	53.1	10.0	63.1
Day	7	55.4	72.0	52.9	71.4	70.8	68.2	65.3	59.6	58.3	54.5	54.4	53.4	55.4	0.0	55.4
	8	54.0	63.5	41.7	63.1	62.8	61.7	60.9	51.2	46.8	42.7	42.3	41.8	54.0	0.0	54.0
	9	46.3	67.4	40.0	66.9	66.4	64.1	60.1	45.9	43.4	40.9	40.6	40.2	46.3	0.0	46.3
	10	49.4	72.3	39.3	71.9	71.5	69.2	67.3	62.0	45.9	40.4	40.0	39.5	49.4	0.0	49.4
	11	47.2	56.2	38.5	55.9	55.3	54.0	52.9	46.1	42.6	39.6	39.2	38.6	47.2	0.0	47.2
	12	52.6	65.0	41.7	64.8	64.2	61.4	55.0	48.1	45.0	42.8	42.4	41.9	52.6	0.0	52.6
	13	53.3	65.1	40.2	64.7	64.1	61.4	58.8	50.2	46.4	41.9	41.2	40.4	53.3	0.0	53.3
	14	54.8	71.2	43.8	70.2	69.3	67.5	65.7	61.1	50.3	46.0	45.2	44.2	54.8	0.0	54.8
	15	55.5	68.4	41.6	68.1	67.5	66.1	64.2	58.6	48.4	43.3	42.7	41.9	55.5	0.0	55.5
	16	53.2	64.4	41.1	63.7	63.1	61.8	58.0	51.0	46.7	42.3	41.8	41.2	53.2	0.0	53.2
	17	53.3	74.8	42.9	74.0	73.5	69.7	66.4	57.5	49.7	44.5	43.8	43.1	53.3	0.0	53.3
	18	51.5	60.6	42.0	60.2	59.7	58.2	56.4	51.3	48.0	43.3	42.8	42.2	51.5	0.0	51.5
	19	55.1	71.8	44.0	71.3	70.7	68.1	65.9	58.3	51.1	45.7	45.1	44.3	55.1	5.0	60.1
	20	56.0	68.1	44.0	67.8	67.4	66.2	65.3	60.0	51.7	45.2	44.7	44.2	56.0	5.0	61.0
	21	53.7	67.6	42.2	67.4	67.1	65.8	64.2	56.8	49.3	43.6	42.9	42.3	53.7	5.0	58.7
Night	22	46.3	56.5	37.9	56.0	55.6	54.5	53.0	43.5	40.5	38.6	38.3	38.0	46.3	10.0	56.3
	23	49.1	59.6	38.1	58.8	57.9	56.2	54.6	48.2	43.7	38.9	38.5	38.2	49.1	10.0	59.1

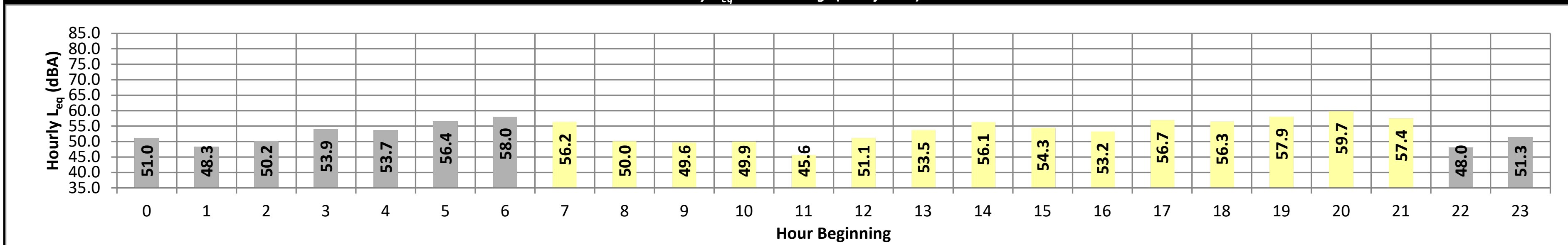
Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq} (dBA)		
Day	Min	46.3	56.2	38.5	55.9	55.3	54.0	52.9	45.9	42.6	39.6	39.2	38.6	24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
	Max	56.0	74.8	52.9	74.0	73.5	69.7	67.3	62.0	58.3	54.5	54.4	53.4			
Energy Average		53.5	Average:		66.8	66.2	64.2	61.8	54.5	48.2	43.8	43.3	42.6	52.3	53.5	48.9
Night	Min	44.6	51.2	37.9	50.8	50.3	49.2	47.9	43.5	40.5	38.6	38.3	38.0			
	Max	53.1	65.8	46.5	65.2	64.6	62.3	59.8	51.9	48.6	47.0	46.8	46.6			
Energy Average		48.9	Average:		57.4	56.9	55.6	54.2	47.7	44.6	42.3	42.1	41.8			

URBAN CROSSROADS

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 14, 2021 *Location:* L5 -Located west of the Project site near single-family *Meter:* Piccolo II *JN:* 13660
Project: Muranaka *Source:* residence at 21934 Corson Avenue. *Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	51.0	57.7	48.4	57.2	56.3	54.2	53.0	51.2	50.3	49.0	48.8	48.5	51.0	10.0	61.0
	1	48.3	51.6	46.3	51.1	50.8	50.2	49.8	48.7	48.0	46.9	46.8	46.5	48.3	10.0	58.3
	2	50.2	56.9	47.2	56.2	55.6	54.0	52.9	50.2	49.0	47.8	47.6	47.3	50.2	10.0	60.2
	3	53.9	74.8	48.8	73.8	73.4	73.0	72.4	64.9	55.7	49.8	49.4	49.1	53.9	10.0	63.9
	4	53.7	77.3	50.5	76.5	75.8	74.0	73.1	69.4	65.8	55.2	53.1	51.2	53.7	10.0	63.7
	5	56.4	63.7	51.5	62.8	62.2	60.8	59.9	57.5	54.9	52.1	51.9	51.7	56.4	10.0	66.4
	6	58.0	69.9	52.7	69.2	67.8	63.5	60.5	56.0	54.6	53.4	53.1	52.9	58.0	10.0	68.0
Day	7	56.2	67.2	50.1	66.5	65.5	63.5	61.1	53.6	51.9	50.7	50.5	50.3	56.2	0.0	56.2
	8	50.0	62.8	41.5	62.0	60.7	56.8	54.0	46.5	44.2	42.1	41.9	41.6	50.0	0.0	50.0
	9	49.6	76.8	41.3	75.9	74.8	71.9	69.9	58.2	45.7	42.5	42.0	41.5	49.6	0.0	49.6
	10	49.9	84.7	40.7	83.2	81.4	74.9	69.2	54.5	47.3	42.0	41.4	40.9	49.9	0.0	49.9
	11	45.6	52.5	40.5	52.1	51.5	50.2	49.3	46.4	44.0	41.5	41.1	40.7	45.6	0.0	45.6
	12	51.1	62.7	41.2	62.1	60.8	57.4	55.1	50.1	46.6	42.3	41.8	41.4	51.1	0.0	51.1
	13	53.5	63.9	43.4	63.2	62.2	59.1	58.2	53.0	49.8	45.2	44.4	43.7	53.5	0.0	53.5
	14	56.1	65.3	45.8	64.8	64.3	63.0	62.1	55.3	51.7	47.1	46.6	46.1	56.1	0.0	56.1
	15	54.3	72.9	45.4	72.1	71.0	68.9	66.3	58.1	52.0	47.3	46.6	45.8	54.3	0.0	54.3
	16	53.2	62.2	44.9	61.6	60.7	58.6	57.2	53.7	50.4	46.5	45.9	45.1	53.2	0.0	53.2
	17	56.7	75.5	46.1	74.0	72.6	67.5	65.1	58.1	53.3	48.3	47.3	46.4	56.7	0.0	56.7
	18	56.3	72.6	46.5	71.7	70.3	66.1	63.0	56.0	52.3	48.2	47.5	46.8	56.3	0.0	56.3
	19	57.9	80.6	48.3	79.7	79.4	77.4	75.4	62.3	56.7	49.8	49.2	48.6	57.9	5.0	62.9
	20	59.7	72.1	49.7	71.7	70.9	69.2	68.3	64.0	57.6	51.4	50.8	50.0	59.7	5.0	64.7
	21	57.4	71.6	48.1	71.0	70.3	68.9	67.8	62.6	56.4	49.7	49.0	48.5	57.4	5.0	62.4
Night	22	48.0	54.5	43.1	54.0	53.4	52.3	51.3	48.8	46.6	44.0	43.6	43.3	48.0	10.0	58.0
	23	51.3	64.2	42.8	63.6	62.4	58.0	54.8	46.8	44.9	43.6	43.4	43.0	51.3	10.0	61.3

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	45.6	52.5	40.5	52.1	51.5	50.2	49.3	46.4	44.0	41.5	41.1	40.7
	Max	59.7	84.7	50.1	83.2	81.4	77.4	75.4	64.0	57.6	51.4	50.8	50.3
Energy Average		55.2	Average:		68.8	67.8	64.9	62.8	55.5	50.7	46.3	45.7	45.1
Night	Min	48.0	51.6	42.8	51.1	50.8	50.2	49.8	46.8	44.9	43.6	43.4	43.0
	Max	58.0	77.3	52.7	76.5	75.8	74.0	73.1	69.4	65.8	55.2	53.1	52.9
Energy Average		53.5	Average:		62.7	62.0	60.0	58.6	54.8	52.2	49.1	48.6	48.2

L_{eq} (dBA)		
24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
54.7	55.2	53.5

URBAN CROSSROADS

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APPENDIX 7.1:

OFF-SITE TRAFFIC NOISE LEVEL CALCULATIONS

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FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: Existing Without Project
Road Name: Harvill Av.
Road Segment: s/o Harley Knox Blvd.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	250 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	25 vehicles
Vehicle Speed:	50 mph
Near/Far Lane Distance:	48 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	59.0 feet
Centerline Dist. to Observer:	59.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	92.00%
Medium Trucks:	48.0%	2.0%	50.0%	3.00%
Heavy Trucks:	48.0%	2.0%	50.0%	5.00%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	54.129
Medium Trucks:	53.966
Heavy Trucks:	53.982

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	70.20	-18.68	-0.62	-1.20	*-4.69*	0.000	0.000
Medium Trucks:	81.00	-33.54	-0.60	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	85.38	-31.33	-0.60	-1.20	*-5.35*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	49.7	47.7	46.4	40.3	48.8	49.4
Medium Trucks:	45.7	41.7	33.9	43.1	49.3	49.3
Heavy Trucks:	52.2	48.3	40.5	49.7	55.9	55.9
Vehicle Noise:	54.7	51.5	47.6	51.0	57.4	57.5

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	8	18	39	85
CNEL:	9	19	40	86

Wednesday, August 25, 2021

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: Existing Without Project
Road Name: Harley Knox Blvd.
Road Segment: w/o Harvill Av.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	3,630 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	363 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	Day	Evening	Night	Daily
Autos:	75.6%	14.0%	10.4%	92.00%
Medium Trucks:	48.0%	2.0%	50.0%	3.00%
Heavy Trucks:	48.0%	2.0%	50.0%	5.00%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	REMEL	Traffic Flow	Distance	Finite Road	Fresnel	Barrier Atten	Berm Atten
Autos:	68.46	-6.60	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-21.47	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-19.25	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	58.8	56.8	55.5	49.4	57.9	58.5
Medium Trucks:	54.9	51.0	43.2	52.4	58.5	58.6
Heavy Trucks:	62.0	58.0	50.2	59.4	65.6	65.6
Vehicle Noise:	64.2	60.9	56.8	60.5	66.9	67.0

Centerline Distance to Noise Contour (in feet)

	70 dBA	65 dBA	60 dBA	55 dBA
Ldn:	47	102	220	474
CNEL:	48	104	224	482

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: Existing Without Project
Road Name: Harley Knox Blvd.
Road Segment: e/o Harvill Av.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	1,190 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	119 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	Day	Evening	Night	Daily
Autos:	75.6%	14.0%	10.4%	92.00%
Medium Trucks:	48.0%	2.0%	50.0%	3.00%
Heavy Trucks:	48.0%	2.0%	50.0%	5.00%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	REMEL	Traffic Flow	Distance	Finite Road	Fresnel	Barrier Atten	Berm Atten
Autos:	68.46	-11.44	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-26.31	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-24.09	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	54.0	52.0	50.7	44.6	53.0	53.7
Medium Trucks:	50.1	46.1	38.3	47.5	53.7	53.7
Heavy Trucks:	57.1	53.1	45.4	54.6	60.7	60.8
Vehicle Noise:	59.4	56.1	52.0	55.7	62.1	62.2

Centerline Distance to Noise Contour (in feet)

	70 dBA	65 dBA	60 dBA	55 dBA
Ldn:	23	49	105	225
CNEL:	23	49	106	229

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario:	Existing + Project	*Project Name:*	Muranaka Warehouse
Road Name:	Harvill Av.	*Job Number:*	13660
Road Segment:	s/o Harley Knox Blvd.		

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	334 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	33 vehicles
Vehicle Speed:	50 mph
Near/Far Lane Distance:	48 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	59.0 feet
Centerline Dist. to Observer:	59.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	94.01%
Medium Trucks:	48.0%	2.0%	50.0%	2.25%
Heavy Trucks:	48.0%	2.0%	50.0%	3.74%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	54.129
Medium Trucks:	53.966
Heavy Trucks:	53.982

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	70.20	-17.33	-0.62	-1.20	*-4.69*	0.000	0.000
Medium Trucks:	81.00	-33.54	-0.60	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	85.38	-31.33	-0.60	-1.20	*-5.35*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	51.1	49.0	47.8	41.7	50.1	50.8
Medium Trucks:	45.7	41.7	33.9	43.1	49.3	49.3
Heavy Trucks:	52.2	48.3	40.5	49.7	55.9	55.9
Vehicle Noise:	55.2	52.1	48.6	51.1	57.6	57.7

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	9	19	41	88
CNEL:	9	19	42	90

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: Existing + Project
Road Name: Harley Knox Blvd.
Road Segment: w/o Harvill Av.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	4,140 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	414 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	90.79%
Medium Trucks:	48.0%	2.0%	50.0%	2.94%
Heavy Trucks:	48.0%	2.0%	50.0%	6.27%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	68.46	-6.09	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-20.98	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-17.70	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	59.3	57.3	56.0	50.0	58.4	59.0
Medium Trucks:	55.4	51.5	43.7	52.9	59.0	59.1
Heavy Trucks:	63.5	59.5	51.8	61.0	67.1	67.1
Vehicle Noise:	65.4	62.0	57.6	61.9	68.2	68.3

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	58	125	268	578
CNEL:	59	127	273	587

Wednesday, August 25, 2021

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: Existing + Project
Road Name: Harley Knox Blvd.
Road Segment: e/o Harvill Av.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	1,616 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	162 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	88.48%
Medium Trucks:	48.0%	2.0%	50.0%	3.01%
Heavy Trucks:	48.0%	2.0%	50.0%	8.51%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	68.46	-10.28	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-24.96	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-20.45	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	55.1	53.1	51.8	45.8	54.2	54.8
Medium Trucks:	51.4	47.5	39.7	48.9	55.0	55.1
Heavy Trucks:	60.8	56.8	49.0	58.2	64.4	64.4
Vehicle Noise:	62.2	58.7	53.8	58.9	65.2	65.3

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	36	78	169	364
CNEL:	37	79	171	368

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL			
Scenario:	OY (2023)	*Project Name:*	Muranaka Warehouse
Road Name:	Harvill Av.	*Job Number:*	13660
Road Segment:	s/o Harley Knox Blvd.		

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	460 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	46 vehicles
Vehicle Speed:	50 mph
Near/Far Lane Distance:	48 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	59.0 feet
Centerline Dist. to Observer:	59.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	92.00%
Medium Trucks:	48.0%	2.0%	50.0%	3.00%
Heavy Trucks:	48.0%	2.0%	50.0%	5.00%

Noise Source Elevations (in feet)

Autos:	0.000		
Medium Trucks:	2.297		
Heavy Trucks:	8.004	*Grade Adjustment:*	0.0

Lane Equivalent Distance (in feet)

Autos:	54.129
Medium Trucks:	53.966
Heavy Trucks:	53.982

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	70.20	-16.03	-0.62	-1.20	*-4.69*	0.000	0.000
Medium Trucks:	81.00	-30.90	-0.60	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	85.38	-28.68	-0.60	-1.20	*-5.35*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	52.4	50.3	49.1	43.0	51.4	52.1
Medium Trucks:	48.3	44.3	36.5	45.8	51.9	51.9
Heavy Trucks:	54.9	50.9	43.1	52.3	58.5	58.5
Vehicle Noise:	57.4	54.1	50.2	53.6	60.0	60.1

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	13	27	59	127
CNEL:	13	28	60	130

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: OY (2023)
Road Name: Harley Knox Blvd.
Road Segment: w/o Harvill Av.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	11,290 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	1,129 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	92.00%
Medium Trucks:	48.0%	2.0%	50.0%	3.00%
Heavy Trucks:	48.0%	2.0%	50.0%	5.00%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	68.46	-1.67	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-16.54	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-14.32	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	63.7	61.7	60.4	54.4	62.8	63.4
Medium Trucks:	59.9	55.9	48.1	57.3	63.5	63.5
Heavy Trucks:	66.9	62.9	55.1	64.3	70.5	70.5
Vehicle Noise:	69.1	65.8	61.7	65.5	71.9	72.0

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	101	218	469	1,010
CNEL:	103	221	477	1,028

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: OY (2023)
Road Name: Harley Knox Blvd.
Road Segment: e/o Harvill Av.

Project Name: Muranaka Warehouse
Job Number: 13660

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	3,660 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	366 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	92.00%
Medium Trucks:	48.0%	2.0%	50.0%	3.00%
Heavy Trucks:	48.0%	2.0%	50.0%	5.00%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	68.46	-6.56	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-21.43	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-19.21	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	58.8	56.8	55.5	49.5	57.9	58.5
Medium Trucks:	55.0	51.0	43.2	52.4	58.6	58.6
Heavy Trucks:	62.0	58.0	50.2	59.4	65.6	65.6
Vehicle Noise:	64.3	60.9	56.9	60.6	67.0	67.1

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	48	103	221	477
CNEL:	49	105	225	485

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario:	OYP (2023)	*Project Name:*	Muranaka Warehouse
Road Name:	Harvill Av.	*Job Number:*	13660
Road Segment:	s/o Harley Knox Blvd.		

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	544 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	54 vehicles
Vehicle Speed:	50 mph
Near/Far Lane Distance:	48 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	59.0 feet
Centerline Dist. to Observer:	59.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	93.23%
Medium Trucks:	48.0%	2.0%	50.0%	2.54%
Heavy Trucks:	48.0%	2.0%	50.0%	4.23%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	54.129
Medium Trucks:	53.966
Heavy Trucks:	53.982

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	70.20	-15.24	-0.62	-1.20	*-4.69*	0.000	0.000
Medium Trucks:	81.00	-30.90	-0.60	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	85.38	-28.68	-0.60	-1.20	*-5.35*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	53.1	51.1	49.8	43.8	52.2	52.8
Medium Trucks:	48.3	44.3	36.5	45.8	51.9	51.9
Heavy Trucks:	54.9	50.9	43.1	52.3	58.5	58.5
Vehicle Noise:	57.7	54.5	50.8	53.7	60.1	60.3

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	13	28	60	130
CNEL:	13	29	61	132

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario:	OYP (2023)	*Project Name:*	Muranaka Warehouse
Road Name:	Harley Knox Blvd.	*Job Number:*	13660
Road Segment:	w/o Harvill Av.		

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	11,800 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	1,180 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	91.57%
Medium Trucks:	48.0%	2.0%	50.0%	2.98%
Heavy Trucks:	48.0%	2.0%	50.0%	5.44%

Noise Source Elevations (in feet)

Autos:	0.000
Medium Trucks:	2.297
Heavy Trucks:	8.004

Grade Adjustment: 0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	68.46	-1.50	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-16.38	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-13.76	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	63.9	61.9	60.6	54.5	63.0	63.6
Medium Trucks:	60.0	56.1	48.3	57.5	63.6	63.7
Heavy Trucks:	67.5	63.5	55.7	64.9	71.1	71.1
Vehicle Noise:	69.6	66.2	62.0	65.9	72.3	72.4

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	108	234	503	1,084
CNEL:	110	237	512	1,102

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario:	OYP (2023)	*Project Name:*	Muranaka Warehouse
Road Name:	Harley Knox Blvd.	*Job Number:*	13660
Road Segment:	e/o Harvill Av.		

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	4,086 vehicles
Peak Hour Percentage:	10.00%
Peak Hour Volume:	409 vehicles
Vehicle Speed:	45 mph
Near/Far Lane Distance:	78 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.0
Centerline Dist. to Barrier:	76.0 feet
Centerline Dist. to Observer:	76.0 feet
Barrier Distance to Observer:	0.0 feet
Observer Height (Above Pad):	5.0 feet
Pad Elevation:	0.0 feet
Road Elevation:	0.0 feet
Road Grade:	0.0%
Left View:	-90.0 degrees
Right View:	90.0 degrees

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.6%	14.0%	10.4%	90.61%
Medium Trucks:	48.0%	2.0%	50.0%	3.01%
Heavy Trucks:	48.0%	2.0%	50.0%	6.39%

Noise Source Elevations (in feet)

Autos:	0.000		
Medium Trucks:	2.297		
Heavy Trucks:	8.004	*Grade Adjustment:*	0.0

Lane Equivalent Distance (in feet)

Autos:	65.422
Medium Trucks:	65.286
Heavy Trucks:	65.299

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	68.46	-6.15	-1.85	-1.20	*-4.73*	0.000	0.000
Medium Trucks:	79.45	-20.95	-1.84	-1.20	*-4.88*	0.000	0.000
Heavy Trucks:	84.25	-17.67	-1.84	-1.20	*-5.25*	0.000	0.000

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	59.3	57.2	55.9	49.9	58.3	59.0
Medium Trucks:	55.5	51.5	43.7	52.9	59.1	59.1
Heavy Trucks:	63.5	59.6	51.8	61.0	67.1	67.2
Vehicle Noise:	65.4	62.0	57.5	61.9	68.2	68.3

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	58	125	269	580
CNEL:	59	127	273	589

APPENDIX 9.1:

CADNAA OPERATIONAL NOISE MODEL INPUTS

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13660_ Muranaka Warehouse

CadnaA Noise Prediction Model: 13660_05.cna
Date: 26.08.21
Analyst: S. Shami

Calculation Configuration

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (#(Unit,LEN))	2000.01
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (#(Unit,LEN))	999.99
Min. Length of Section (#(Unit,LEN))	1.01
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	5.00
Night-time Penalty (dB)	10.00
DTM	
Standard Height (m)	0.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	2
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Incl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (#(Unit,TEMP))	10
rel. Humidity (%)	70
Ground Absorption G	0.50
Wind Speed for Dir. (#(Unit,SPEED))	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (FTA/FRA)	
Aircraft (???)	
Strictly acc. to AzB	

Receiver Noise Levels

Name	M.	ID	Level Lr			Limit. Value			Land Use			Height		Coordinates		
			Day	Night	CNEL	Day	Night	CNEL	Type	Auto	Noise Type			X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)				(ft)		(ft)	(ft)	(ft)
RECEIVERS		R1	28.0	27.8	34.5	55.0	45.0	0.0				5.00	a	6254425.34	2257398.96	5.00
RECEIVERS		R2	32.6	32.4	39.1	55.0	45.0	0.0				5.00	a	6253060.57	2256387.67	5.00
RECEIVERS		R3	32.1	31.9	38.5	55.0	45.0	0.0				5.00	a	6252303.06	2256268.13	5.00
RECEIVERS		R4	27.9	27.7	34.3	55.0	45.0	0.0				5.00	a	6249630.92	2257264.01	5.00
RECEIVERS		R5	26.1	25.8	32.5	55.0	45.0	0.0				5.00	a	6249289.39	2258871.96	5.00

Point Source(s)

Name	M.	ID	Result. PWL			Lw / Li			Operating Time			K0	Height		Coordinates		
			Day	Evening	Night	Type	Value	norm.	Day	Special	Night				X	Y	Z
			(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	(dB)	(ft)		(ft)	(ft)	(ft)
POINTSOURCE		AC01	88.9	88.9	88.9	Lw	88.9		585.00	0.00	252.00	0.0	5.00	g	6252813.06	2258519.48	50.00
POINTSOURCE		AC02	88.9	88.9	88.9	Lw	88.9		585.00	0.00	252.00	0.0	5.00	g	6252040.49	2258512.86	50.00
POINTSOURCE		TRASH01	89.0	89.0	89.0	Lw	89.0		150.00	0.00	90.00	0.0	5.00	a	6252230.18	2258460.71	5.00
POINTSOURCE		PARK01	79.0	79.0	79.0	Lw	79.0		900.00	0.00	540.00	0.0	5.00	a	6252052.04	2258442.77	5.00
POINTSOURCE		PARK02	79.0	79.0	79.0	Lw	79.0		900.00	0.00	540.00	0.0	5.00	a	6252101.26	2258441.47	5.00
POINTSOURCE		PARK03	79.0	79.0	79.0	Lw	79.0		900.00	0.00	540.00	0.0	5.00	a	6252170.55	2258442.77	5.00
POINTSOURCE		PARK04	79.0	79.0	79.0	Lw	79.0		900.00	0.00	540.00	0.0	5.00	a	6252052.04	2258363.76	5.00
POINTSOURCE		PARK05	79.0	79.0	79.0	Lw	79.0		900.00	0.00	540.00	0.0	5.00	a	6252130.40	2258363.11	5.00
POINTSOURCE		PARK06	79.0	79.0	79.0	Lw	79.0		900.00	0.00	540.00	0.0	5.00	a	6252017.72	2258415.57	5.00

Line Source(s)

Name	M.	ID	Result. PWL			Result. PWL'			Lw / Li			Operating Time			Moving Pt. Src				Height
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	Number			Speed	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	Day	Evening	Night	(mph)	(ft)
LINESOURCE		TRUCK01	93.2	93.2	93.2	77.4	77.4	77.4	Lw	93.2									8
LINESOURCE		TRUCK02	93.2	93.2	93.2	77.7	77.7	77.7	Lw	93.2									8

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
LINESOURCE	8.00	a			6252754.96	2258453.72	8.00	0.00
					6252879.65	2258457.02	8.00	0.00
LINESOURCE	8.00	a			6252879.65	2258457.02	8.00	0.00
					6252878.07	2258341.54	8.00	0.00

Area Source(s)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Operating Time			Height
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	(ft)
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	
AREASOURCE		DOCK01	103.4	103.4	103.4	63.7	63.7	63.7	Lw	103.4					8

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
AREASOURCE	8.00	a			6252230.43	2258539.95	8.00	0.00
					6252753.75	2258542.83	8.00	0.00
					6252753.59	2258348.60	8.00	0.00
					6252232.82	2258347.75	8.00	0.00

Barrier(s)

Name	M.	ID	Absorption		Z-Ext.	Cantilever		Height				Coordinates			
			left	right		horz.	vert.	Begin		End		x	y	z	Ground
					(ft)	(ft)	(ft)	(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
BARRIERTEMP		0						14.00	a			6252753.91	2258407.45	14.00	0.00
												6252754.79	2258347.46	14.00	0.00
												6252231.53	2258346.58	14.00	0.00
												6252231.10	2258449.05	14.00	0.00
												6252221.46	2258449.05	14.00	0.00
												6252220.59	2258470.94	14.00	0.00
BARRIERTEMP		0						14.00	a			6252753.80	2258479.08	14.00	0.00
												6252753.75	2258542.83	14.00	0.00

Building(s)

Name	M.	ID	RB	Residents	Absorption	Height		Coordinates			
						Begin		x	y	z	Ground
						(ft)		(ft)	(ft)	(ft)	(ft)
BUILDING		BUILDING00001	x	0		45.00	a	6252032.08	2258853.74	45.00	0.00
								6252827.40	2258856.78	45.00	0.00
								6252828.92	2258502.97	45.00	0.00
								6252754.13	2258504.11	45.00	0.00
								6252753.75	2258542.83	45.00	0.00
								6252202.15	2258539.79	45.00	0.00
								6252202.53	2258482.09	45.00	0.00
								6252030.18	2258484.36	45.00	0.00
BUILDING		BUILDING00002	x	0		45.00	a	6253166.46	2258801.96	45.00	0.00
								6253876.45	2258789.14	45.00	0.00
								6253873.89	2258628.94	45.00	0.00
								6253854.67	2258632.79	45.00	0.00
								6253840.57	2257861.27	45.00	0.00
								6253895.68	2257858.71	45.00	0.00
								6253891.83	2257761.31	45.00	0.00
								6253148.52	2257775.41	45.00	0.00
								6253147.23	2257871.53	45.00	0.00
								6253202.34	2257871.53	45.00	0.00
								6253216.44	2258698.15	45.00	0.00
								6253167.74	2258701.99	45.00	0.00

APPENDIX 10.1:

CADNAA CONSTRUCTION NOISE MODEL INPUTS

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13660_ Muranaka Warehouse

CadnaA Noise Prediction Model: 13660_10_Construction.cna
Date: 13.12.21
Analyst: S. Shami

Calculation Configuration

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (#(Unit,LEN))	2000.01
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (#(Unit,LEN))	999.99
Min. Length of Section (#(Unit,LEN))	1.01
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	5.00
Night-time Penalty (dB)	10.00
DTM	
Standard Height (m)	0.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	2
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Incl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (#(Unit,TEMP))	10
rel. Humidity (%)	70
Ground Absorption G	0.50
Wind Speed for Dir. (#(Unit,SPEED))	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (FTA/FRA)	
Aircraft (???)	
Strictly acc. to AzB	

Receiver Noise Levels

Name	M.	ID	Level Lr			Limit. Value			Land Use			Height		Coordinates		
			Day	Night	CNEL	Day	Night	CNEL	Type	Auto	Noise Type			X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)				(ft)		(ft)	(ft)	(ft)
RECEIVERS		R1	38.2	38.2	44.8	55.0	45.0	0.0				5.00	a	6254425.34	2257398.96	5.00
RECEIVERS		R2	45.6	45.6	52.3	55.0	45.0	0.0				5.00	a	6253060.57	2256387.67	5.00
RECEIVERS		R3	45.4	45.4	52.1	55.0	45.0	0.0				5.00	a	6252303.06	2256268.13	5.00
RECEIVERS		R4	42.4	42.4	49.1	55.0	45.0	0.0				5.00	a	6249630.92	2257264.01	5.00
RECEIVERS		R5	42.3	42.3	49.0	55.0	45.0	0.0				5.00	a	6249289.39	2258871.96	5.00
RECEIVERS		R5	63.9	63.9	70.6	55.0	45.0	0.0				5.00	a	6252439.62	2258285.93	5.00

Area Source(s)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Operating Time			Height
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	(ft)
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	
SITEBOUNDARY		CONSTRUCTION	115.0	115.0	115.0	67.7	67.7	67.7	Lw	115					8

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
SITEBOUNDARY	8.00	a			6251984.98	2258857.89	8.00	0.00
					6252018.10	2258892.13	8.00	0.00
					6253017.53	2258895.70	8.00	0.00
					6253007.71	2258338.88	8.00	0.00
					6253008.39	2258302.86	8.00	0.00

Name	Height		Coordinates			
	Begin	End	x	y	z	Ground
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
			6252992.32	2258302.37	8.00	0.00
			6252990.86	2258310.16	8.00	0.00
			6252989.40	2258321.85	8.00	0.00
			6252984.04	2258332.56	8.00	0.00
			6252976.74	2258339.86	8.00	0.00
			6252967.00	2258346.19	8.00	0.00
			6252958.72	2258351.06	8.00	0.00
			6252950.45	2258353.01	8.00	0.00
			6252940.22	2258353.98	8.00	0.00
			6252930.49	2258352.52	8.00	0.00
			6252920.26	2258350.09	8.00	0.00
			6252908.09	2258347.65	8.00	0.00
			6252893.97	2258343.76	8.00	0.00
			6252880.34	2258340.84	8.00	0.00
			6252872.06	2258339.86	8.00	0.00
			6252864.28	2258337.98	8.00	0.00
			6252725.03	2258335.48	8.00	0.00
			6252001.05	2258334.02	8.00	0.00
			6251965.51	2258369.07	8.00	0.00
			6251966.48	2258453.30	8.00	0.00
			6251966.48	2258475.21	8.00	0.00
			6251967.45	2258490.79	8.00	0.00
			6251968.92	2258507.35	8.00	0.00
			6251969.89	2258523.90	8.00	0.00
			6251970.86	2258541.43	8.00	0.00
			6251972.81	2258562.85	8.00	0.00
			6251973.78	2258575.99	8.00	0.00
			6251975.73	2258597.42	8.00	0.00
			6251977.68	2258616.41	8.00	0.00
			6251979.14	2258636.37	8.00	0.00
			6251981.09	2258649.51	8.00	0.00

Building(s)

Name	M.	ID	RB	Residents	Absorption	Height		Coordinates			
						Begin		x	y	z	Ground
						(ft)		(ft)	(ft)	(ft)	(ft)
BUILDING		BUILDING00002	x	0		45.00	a	6253166.46	2258801.96	45.00	0.00
								6253876.45	2258789.14	45.00	0.00
								6253873.89	2258628.94	45.00	0.00
								6253854.67	2258632.79	45.00	0.00
								6253840.57	2257861.27	45.00	0.00
								6253895.68	2257858.71	45.00	0.00
								6253891.83	2257761.31	45.00	0.00
								6253148.52	2257775.41	45.00	0.00
								6253147.23	2257871.53	45.00	0.00
								6253202.34	2257871.53	45.00	0.00
								6253216.44	2258698.15	45.00	0.00
								6253167.74	2258701.99	45.00	0.00

APPENDIX 10.2:

BLASTING CALCULATIONS

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BLASTING INPUTS & CALCULATIONS

Scaled Distance

Source: ISEE's Blaster's Handbook, 2018 Edition.

Square Root Scaled Distance

$SD_2 = R / W^{1/2}$

R =	1681	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_2 = 336.20 $ft/lbs^{1/2}$

Peak Particle Velocity

$PPV = A * (SD_2)^{-B}$

A =	160	**"Best Fit" 160 per blasting contractor guidance based on site conditions.**
SD_2 =	336.20	*All blasts will be designed on-site by the blasting contractor to remain below 0.5 in/sec PPV*
B =	1.6	Slope of the line (note that the slope is **negative** in the equation)

PPV = 0.01 in/sec

Vibration Amplitude Equations For Various Blasting Industries

Industry	Metric Equations mm/sec.	U.S. Equations in./sec.	Confidence level	Source
General	$PPV = 1{,}140(SD_2)^{-1.6}$	$PPV = 160(SD_2)^{-1.6}$	Best Fit	DuPont
Construction	$PPV = 173(SD_2)^{-1.6}$	$PPV = 24.2(SD_2)^{-1.6}$	Lower Bound	Oriard
Construction	$PPV = 1{,}730(SD_2)^{-1.6}$	$PPV = 242(SD_2)^{-1.6}$	Upper Bound	Oriard (2005)
Construction	$PPV = 4{,}320(SD_2)^{-1.6}$	$PPV = 605(SD_2)^{-1.6}$	Upper Bound - High Confinement	Oriard (2005)
Construction	$PPV = 53(SD_2)^{-1.09}$	$PPV = 5(SD_2)^{-1.09}$	Best Fit	USBM RI 8507
Quarries	$PPV = 1{,}090(SD_2)^{-1.82}$	$PPV = 182(SD_2)^{-1.82}$	Best Fit	USBM Bulletin 656
Coal Mines	$PPV = 905(SD_2)^{-1.52}$	$PPV = 119(SD_2)^{-1.52}$	Best Fit	USBM RI 8507
Coal Mines	$PPV = 3{,}330(SD_2)^{-1.52}$	$PPV = 438(SD_2)^{-1.52}$	Upper bound	USBM RI 8507
Coal - Low Frequency sites	$PPV = 1{,}252(SD_2)^{-1.31}$	$PPV = 138(SD_2)^{-1.31}$	Best Fit	USBM RI 9226

Air Overpressure/Airblast

Cubed Root Scaled Distance

$SD_3 = R / W^{1/3}$

R =	1681	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_3 = 574.89 $ft/lbs^{1/3}$

Air Overpressure Prediction

$P = A * SD_3^{-B}$

R1

A =	0.5	Partially confined.
SD_3 =	574.89	
B =	1.1	Slope of the line (note that the slope is negative)

P = 0.0005 psi

Air Overpressure Prediction Equations				
Blasting	Metric Equations mb	U.S. Equations psi	Statistical Type	Source
Open air (no confinement)	$P = 3589 \times SD_3^{-1.38}$	$P = 187 \times SD_3^{-1.38}$	Best Fit	Perkins
Coal mines (parting)	$P = 2596 \times SD_3^{-1.62}$	$P = 169 \times SD_3^{-1.62}$	Best Fit	USBM RI 8485
Coal mines (highwall)	$P = 5.37 \times SD_3^{-0.79}$	$P = 0.162 \times SD_3^{-0.79}$	Best Fit	USBM RI 8485
Quarry face	$P = 37.1 \times SD_3^{-0.97}$	$P = 1.32 \times SD_3^{-0.97}$	Best Fit	USBM RI 8485
Metal Mine	$P = 14.3 \times SD_3^{-0.71}$	$P = 0.401 \times SD_3^{-0.71}$	Best Fit	USBM RI 8485
Construction (average)	$P = 24.8 \times SD_3^{-1.1}$	$P = 1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Construction (highly confined)	$P = 2.48 \times SD_3^{-1.1}$	$P = 0.1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Buried (total confinement)	$P = 1.73 \times SD_3^{-0.96}$	$P = 0.061 \times SD_3^{-0.96}$	Best Fit	USBM RI 8485

Decibels (Linear)

$P_s = 20 * \log(P / P_0)$

P =	0.0005 psi	
P_0 =	2.9E-09 pascals	Reference value: $2.9 * 10^{-9}$ lbs/inch^2

P_s = 104.02 dB

BLASTING INPUTS & CALCULATIONS

Scaled Distance

Source: ISEE's Blaster's Handbook, 2018 Edition.

Square Root Scaled Distance

$SD_2 = R / W^{1/2}$

R =	1916	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_2 = 383.20 $ft/lbs^{1/2}$

Peak Particle Velocity

$PPV = A * (SD_2)^{-B}$

A =	160	**"Best Fit" 160 per blasting contractor guidance based on site conditions.**
SD_2 =	383.20	*All blasts will be designed on-site by the blasting contractor to remain below 0.5 in/sec PPV*
B =	1.6	Slope of the line (note that the slope is **negative** in the equation)

PPV = 0.01 in/sec

Vibration Amplitude Equations For Various Blasting Industries

Industry	Metric Equations mm/sec.	U.S. Equations in./sec.	Confidence level	Source
General	$PPV = 1{,}140(SD_2)^{-1.6}$	$PPV = 160(SD_2)^{-1.6}$	Best Fit	DuPont
Construction	$PPV = 173(SD_2)^{-1.6}$	$PPV = 24.2(SD_2)^{-1.6}$	Lower Bound	Oriard
Construction	$PPV = 1{,}730(SD_2)^{-1.6}$	$PPV = 242(SD_2)^{-1.6}$	Upper Bound	Oriard (2005)
Construction	$PPV = 4{,}320(SD_2)^{-1.6}$	$PPV = 605(SD_2)^{-1.6}$	Upper Bound - High Confinement	Oriard (2005)
Construction	$PPV = 53(SD_2)^{-1.09}$	$PPV = 5(SD_2)^{-1.09}$	Best Fit	USBM RI 8507
Quarries	$PPV = 1{,}090(SD_2)^{-1.82}$	$PPV = 182(SD_2)^{-1.82}$	Best Fit	USBM Bulletin 656
Coal Mines	$PPV = 905(SD_2)^{-1.52}$	$PPV = 119(SD_2)^{-1.52}$	Best Fit	USBM RI 8507
Coal Mines	$PPV = 3{,}330(SD_2)^{-1.52}$	$PPV = 438(SD_2)^{-1.52}$	Upper bound	USBM RI 8507
Coal - Low Frequency sites	$PPV = 1{,}252(SD_2)^{-1.31}$	$PPV = 138(SD_2)^{-1.31}$	Best Fit	USBM RI 9226

Air Overpressure/Airblast

Cubed Root Scaled Distance

$SD_3 = R / W^{1/3}$

R =	1916	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_3 = 655.26 $ft/lbs^{1/3}$

Air Overpressure Prediction

$P = A * SD_3^{-B}$

R2

A =	0.5	Partially confined.
SD_3 =	655.26	
B =	1.1	Slope of the line (note that the slope is negative)

P = 0.0004 psi

Air Overpressure Prediction Equations				
Blasting	**Metric Equations mb**	**U.S. Equations psi**	**Statistical Type**	**Source**
Open air (no confinement)	$P = 3589 \times SD_3^{-1.38}$	$P = 187 \times SD_3^{-1.38}$	Best Fit	Perkins
Coal mines (parting)	$P = 2596 \times SD_3^{-1.62}$	$P = 169 \times SD_3^{-1.62}$	Best Fit	USBM RI 8485
Coal mines (highwall)	$P = 5.37 \times SD_3^{-0.79}$	$P = 0.162 \times SD_3^{-0.79}$	Best Fit	USBM RI 8485
Quarry face	$P = 37.1 \times SD_3^{-0.97}$	$P = 1.32 \times SD_3^{-0.97}$	Best Fit	USBM RI 8485
Metal Mine	$P = 14.3 \times SD_3^{-0.71}$	$P = 0.401 \times SD_3^{-0.71}$	Best Fit	USBM RI 8485
Construction (average)	$P = 24.8 \times SD_3^{-1.1}$	$P = 1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Construction (highly confined)	$P = 2.48 \times SD_3^{-1.1}$	$P = 0.1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Buried (total confinement)	$P = 1.73 \times SD_3^{-0.96}$	$P = 0.061 \times SD_3^{-0.96}$	Best Fit	USBM RI 8485

Decibels (Linear)

$P_s = 20 * \log(P / P_0)$

P =	0.0004	psi	
P_0 =	2.9E-09	pascals	Reference value: $2.9 * 10^{-9}$ lbs/inch^2

P_s = 102.77 dB

URBAN CROSSROADS

BLASTING INPUTS & CALCULATIONS

Scaled Distance

Source: ISEE's Blaster's Handbook, 2018 Edition.

Square Root Scaled Distance

$SD_2 = R / W^{1/2}$

R =	2066	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_2 = 413.20 $ft/lbs^{1/2}$

Peak Particle Velocity

$PPV = A * (SD_2)^{-B}$

A =	160	**"Best Fit" 160 per blasting contractor guidance based on site conditions.**
SD_2 =	413.20	*All blasts will be designed on-site by the blasting contractor to remain below 0.5 in/sec PPV*
B =	1.6	Slope of the line (note that the slope is **negative** in the equation)

PPV = 0.01 in/sec

Vibration Amplitude Equations For Various Blasting Industries

Industry	Metric Equations mm/sec.	U.S. Equations in./sec.	Confidence level	Source
General	$PPV = 1{,}140(SD_2)^{-1.6}$	$PPV = 160(SD_2)^{-1.6}$	Best Fit	DuPont
Construction	$PPV = 173(SD_2)^{-1.6}$	$PPV = 24.2(SD_2)^{-1.6}$	Lower Bound	Oriard
Construction	$PPV = 1{,}730(SD_2)^{-1.6}$	$PPV = 242(SD_2)^{-1.6}$	Upper Bound	Oriard (2005)
Construction	$PPV = 4{,}320(SD_2)^{-1.6}$	$PPV = 605(SD_2)^{-1.6}$	Upper Bound - High Confinement	Oriard (2005)
Construction	$PPV = 53(SD_2)^{-1.09}$	$PPV = 5(SD_2)^{-1.09}$	Best Fit	USBM RI 8507
Quarries	$PPV = 1{,}090(SD_2)^{-1.82}$	$PPV = 182(SD_2)^{-1.82}$	Best Fit	USBM Bulletin 656
Coal Mines	$PPV = 905(SD_2)^{-1.52}$	$PPV = 119(SD_2)^{-1.52}$	Best Fit	USBM RI 8507
Coal Mines	$PPV = 3{,}330(SD_2)^{-1.52}$	$PPV = 438(SD_2)^{-1.52}$	Upper bound	USBM RI 8507
Coal - Low Frequency sites	$PPV = 1{,}252(SD_2)^{-1.31}$	$PPV = 138(SD_2)^{-1.31}$	Best Fit	USBM RI 9226

Air Overpressure/Airblast

Cubed Root Scaled Distance

$SD_3 = R / W^{1/3}$

R =	2066	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_3 = 706.56 $ft/lbs^{1/3}$

Air Overpressure Prediction

$P = A * SD_3^{-B}$

URBAN CROSSROADS

R3

A =	0.5	Partially confined.
SD_3 =	706.56	
B =	1.1	Slope of the line (note that the slope is negative)

P = 0.0004 psi

Air Overpressure Prediction Equations				
Blasting	**Metric Equations mb**	**U.S. Equations psi**	**Statistical Type**	**Source**
Open air (no confinement)	$P = 3589 \times SD_3^{-1.38}$	$P = 187 \times SD_3^{-1.38}$	Best Fit	Perkins
Coal mines (parting)	$P = 2596 \times SD_3^{-1.62}$	$P = 169 \times SD_3^{-1.62}$	Best Fit	USBM RI 8485
Coal mines (highwall)	$P = 5.37 \times SD_3^{-0.79}$	$P = 0.162 \times SD_3^{-0.79}$	Best Fit	USBM RI 8485
Quarry face	$P = 37.1 \times SD_3^{-0.97}$	$P = 1.32 \times SD_3^{-0.97}$	Best Fit	USBM RI 8485
Metal Mine	$P = 14.3 \times SD_3^{-0.71}$	$P = 0.401 \times SD_3^{-0.71}$	Best Fit	USBM RI 8485
Construction (average)	$P = 24.8 \times SD_3^{-1.1}$	$P = 1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Construction (highly confined)	$P = 2.48 \times SD_3^{-1.1}$	$P = 0.1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Buried (total confinement)	$P = 1.73 \times SD_3^{-0.96}$	$P = 0.061 \times SD_3^{-0.96}$	Best Fit	USBM RI 8485

Decibels (Linear)

$P_s = 20 * \log(P / P_0)$

P =	0.0004	psi	
P_0 =	2.9E-09	pascals	Reference value: $2.9 * 10^{-9}$ lbs/inch^2

P_s = 102.05 dB

BLASTING INPUTS & CALCULATIONS

Scaled Distance

Source: ISEE's Blaster's Handbook, 2018 Edition.

Square Root Scaled Distance

$SD_2 = R / W^{1/2}$

R =	2593	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_2 = 518.60 $ft/lbs^{1/2}$

Peak Particle Velocity

$PPV = A * (SD_2)^{-B}$

A =	160	**"Best Fit" 160 per blasting contractor guidance based on site conditions.**
SD_2 =	518.60	*All blasts will be designed on-site by the blasting contractor to remain below 0.5 in/sec PPV*
B =	1.6	Slope of the line (note that the slope is **negative** in the equation)

PPV = 0.01 in/sec

Vibration Amplitude Equations For Various Blasting Industries

Industry	Metric Equations mm/sec.	U.S. Equations in./sec.	Confidence level	Source
General	$PPV = 1,140(SD_2)^{-1.6}$	$PPV = 160(SD_2)^{-1.6}$	Best Fit	DuPont
Construction	$PPV = 173(SD_2)^{-1.6}$	$PPV = 24.2(SD_2)^{-1.6}$	Lower Bound	Oriard
Construction	$PPV = 1,730(SD_2)^{-1.6}$	$PPV = 242(SD_2)^{-1.6}$	Upper Bound	Oriard (2005)
Construction	$PPV = 4,320(SD_2)^{-1.6}$	$PPV = 605(SD_2)^{-1.6}$	Upper Bound - High Confinement	Oriard (2005)
Construction	$PPV = 53(SD_2)^{-1.09}$	$PPV = 5(SD_2)^{-1.09}$	Best Fit	USBM RI 8507
Quarries	$PPV = 1,090(SD_2)^{-1.82}$	$PPV = 182(SD_2)^{-1.82}$	Best Fit	USBM Bulletin 656
Coal Mines	$PPV = 905(SD_2)^{-1.52}$	$PPV = 119(SD_2)^{-1.52}$	Best Fit	USBM RI 8507
Coal Mines	$PPV = 3,330(SD_2)^{-1.52}$	$PPV = 438(SD_2)^{-1.52}$	Upper bound	USBM RI 8507
Coal - Low Frequency sites	$PPV = 1,252(SD_2)^{-1.31}$	$PPV = 138(SD_2)^{-1.31}$	Best Fit	USBM RI 9226

Air Overpressure/Airblast

Cubed Root Scaled Distance

$SD_3 = R / W^{1/3}$

R =	2593	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_3 = 886.79 $ft/lbs^{1/3}$

Air Overpressure Prediction

$P = A * SD_3^{-B}$

R4

A =	0.5	Partially confined.
SD_3 =	886.79	
B =	1.1	Slope of the line (note that the slope is negative)

P = 0.0003 psi

Air Overpressure Prediction Equations				
Blasting	Metric Equations mb	U.S. Equations psi	Statistical Type	Source
Open air (no confinement)	$P = 3589 \times SD_3^{-1.38}$	$P = 187 \times SD_3^{-1.38}$	Best Fit	Perkins
Coal mines (parting)	$P = 2596 \times SD_3^{-1.62}$	$P = 169 \times SD_3^{-1.62}$	Best Fit	USBM RI 8485
Coal mines (highwall)	$P = 5.37 \times SD_3^{-0.79}$	$P = 0.162 \times SD_3^{-0.79}$	Best Fit	USBM RI 8485
Quarry face	$P = 37.1 \times SD_3^{-0.97}$	$P = 1.32 \times SD_3^{-0.97}$	Best Fit	USBM RI 8485
Metal Mine	$P = 14.3 \times SD_3^{-0.71}$	$P = 0.401 \times SD_3^{-0.71}$	Best Fit	USBM RI 8485
Construction (average)	$P = 24.8 \times SD_3^{-1.1}$	$P = 1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Construction (highly confined)	$P = 2.48 \times SD_3^{-1.1}$	$P = 0.1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Buried (total confinement)	$P = 1.73 \times SD_3^{-0.96}$	$P = 0.061 \times SD_3^{-0.96}$	Best Fit	USBM RI 8485

Decibels (Linear)

$P_s = 20 * \log(P / P_0)$

P =	0.0003	psi	
P_0 =	2.9E-09	pascals	Reference value: $2.9 * 10^{-9}$ lbs/inch^2

P_s = 99.88 dB

URBAN CROSSROADS

BLASTING INPUTS & CALCULATIONS

Scaled Distance

Source: ISEE's Blaster's Handbook, 2018 Edition.

Square Root Scaled Distance

$SD_2 = R / W^{1/2}$

R =	2696	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_2 = 539.20 $ft/lbs^{1/2}$

Peak Particle Velocity

$PPV = A * (SD_2)^{-B}$

A =	160	**"Best Fit" 160 per blasting contractor guidance based on site conditions.**
SD_2 =	539.20	*All blasts will be designed on-site by the blasting contractor to remain below 0.5 in/sec PPV*
B =	1.6	Slope of the line (note that the slope is **negative** in the equation)

PPV = 0.01 in/sec

Vibration Amplitude Equations For Various Blasting Industries

Industry	Metric Equations mm/sec.	U.S. Equations in./sec.	Confidence level	Source
General	$PPV = 1{,}140(SD_2)^{-1.6}$	$PPV = 160(SD_2)^{-1.6}$	Best Fit	DuPont
Construction	$PPV = 173(SD_2)^{-1.6}$	$PPV = 24.2(SD_2)^{-1.6}$	Lower Bound	Oriard
Construction	$PPV = 1{,}730(SD_2)^{-1.6}$	$PPV = 242(SD_2)^{-1.6}$	Upper Bound	Oriard (2005)
Construction	$PPV = 4{,}320(SD_2)^{-1.6}$	$PPV = 605(SD_2)^{-1.6}$	Upper Bound - High Confinement	Oriard (2005)
Construction	$PPV = 53(SD_2)^{-1.09}$	$PPV = 5(SD_2)^{-1.09}$	Best Fit	USBM RI 8507
Quarries	$PPV = 1{,}090(SD_2)^{-1.82}$	$PPV = 182(SD_2)^{-1.82}$	Best Fit	USBM Bulletin 656
Coal Mines	$PPV = 905(SD_2)^{-1.52}$	$PPV = 119(SD_2)^{-1.52}$	Best Fit	USBM RI 8507
Coal Mines	$PPV = 3{,}330(SD_2)^{-1.52}$	$PPV = 438(SD_2)^{-1.52}$	Upper bound	USBM RI 8507
Coal - Low Frequency sites	$PPV = 1{,}252(SD_2)^{-1.31}$	$PPV = 138(SD_2)^{-1.31}$	Best Fit	USBM RI 9226

Air Overpressure/Airblast

Cubed Root Scaled Distance

$SD_3 = R / W^{1/3}$

R =	2696	feet	Distance from blast to a point of intereste (meters or feet)
W =	25	lbs	Maximum charge-weigh detonated within any 8-millisecond period (kilograms or pounds)

SD_3 = 922.02 $ft/lbs^{1/3}$

Air Overpressure Prediction

$P = A * SD_3^{-B}$

R5

A =	0.5	Partially confined.
SD_3 =	922.02	
B =	1.1	Slope of the line (note that the slope is negative)

P = 0.0003 psi

Air Overpressure Prediction Equations

Blasting	Metric Equations mb	U.S. Equations psi	Statistical Type	Source
Open air (no confinement)	$P = 3589 \times SD_3^{-1.38}$	$P = 187 \times SD_3^{-1.38}$	Best Fit	Perkins
Coal mines (parting)	$P = 2596 \times SD_3^{-1.62}$	$P = 169 \times SD_3^{-1.62}$	Best Fit	USBM RI 8485
Coal mines (highwall)	$P = 5.37 \times SD_3^{-0.79}$	$P = 0.162 \times SD_3^{-0.79}$	Best Fit	USBM RI 8485
Quarry face	$P = 37.1 \times SD_3^{-0.97}$	$P = 1.32 \times SD_3^{-0.97}$	Best Fit	USBM RI 8485
Metal Mine	$P = 14.3 \times SD_3^{-0.71}$	$P = 0.401 \times SD_3^{-0.71}$	Best Fit	USBM RI 8485
Construction (average)	$P = 24.8 \times SD_3^{-1.1}$	$P = 1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Construction (highly confined)	$P = 2.48 \times SD_3^{-1.1}$	$P = 0.1 \times SD_3^{-1.1}$	Best Fit	Oriard (2005)
Buried (total confinement)	$P = 1.73 \times SD_3^{-0.96}$	$P = 0.061 \times SD_3^{-0.96}$	Best Fit	USBM RI 8485

Decibels (Linear)

$P_s = 20 * \log(P / P_0)$

P =	0.0003	psi	
P_0 =	2.9E-09	pascals	Reference value: $2.9 * 10^{-9}$ lbs/inch^2

P_s = 99.51 dB