APPENDIX F

NOISE AND VIBRATION IMPACT ANALYSIS
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NOISE AND VIBRATION IMPACT ANALYSIS

MISSION FOOTHILLS RESIDENTIAL PROJECT
CITY OF MISSION VIEJO, CA

December 2018
NOISE AND VIBRATION IMPACT ANALYSIS

MISSION FOOTHILLS RESIDENTIAL PROJECT
CITY OF MISSION VIEJO, CA

Prepared for:
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Project No. SHO1704.02

LSA
December 2018
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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEQA</td>
<td>California Environmental Quality Act</td>
</tr>
<tr>
<td>City</td>
<td>City of Rialto</td>
</tr>
<tr>
<td>CNEL</td>
<td>Community Noise Equivalent Level</td>
</tr>
<tr>
<td>dB</td>
<td>decibels</td>
</tr>
<tr>
<td>dBA</td>
<td>A-weighted decibels</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>HVAC</td>
<td>heating, ventilation, and air conditioning</td>
</tr>
<tr>
<td>in/sec</td>
<td>inches per second</td>
</tr>
<tr>
<td>$L_{dn}$</td>
<td>day-night average noise level</td>
</tr>
<tr>
<td>$L_{eq}$</td>
<td>equivalent continuous sound level</td>
</tr>
<tr>
<td>$L_{max}$</td>
<td>maximum instantaneous noise level</td>
</tr>
<tr>
<td>LSA</td>
<td>LSA Associates, Inc.</td>
</tr>
<tr>
<td>$L_V$</td>
<td>velocity in decibels</td>
</tr>
<tr>
<td>PPV</td>
<td>peak particle velocity</td>
</tr>
<tr>
<td>RMS</td>
<td>root-mean-square (velocity)</td>
</tr>
<tr>
<td>SBD</td>
<td>San Bernardino International Airport</td>
</tr>
<tr>
<td>VdB</td>
<td>vibration velocity decibels</td>
</tr>
</tbody>
</table>
INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential impacts associated with the proposed Mission Foothills Residential Project (project), which is a residential development project in Mission Viejo, California. This analysis is intended to satisfy the City of Mission Viejo requirements for a project-specific noise and vibration impact analysis by examining the impacts of the proposed project on noise-sensitive uses in the project area and evaluating the necessary minimization measures that would be incorporated as part of the project design.

PROJECT LOCATION AND DESCRIPTION

The approximately 6.8-acre project site is currently developed with one multi-tenant commercial building and a paved asphalt parking lot. The project site is bounded by SR-241 to the north; a vacant lot and hotel development to the east; commercial uses, a surface parking lot, and Los Alisos Boulevard to the south; and a residential apartment complex to the west. The Upper Oso Reservoir, which is an earth-fill dam, is located directly north of SR-241. Single-family residential uses are located south of Los Alisos Boulevard. The project site is primarily surrounded by residential and commercial uses, with open space and recreation areas also present in the project vicinity. Refer to Figure 1, Project Vicinity, for an aerial photograph of the existing project site and the surrounding area.

The project would involve the demolition of an existing 99,500 sf commercial building on the project site and construction of 105 new homes, 275 parking spaces, and community facilities. The project proposes a total residential building footprint of 91,180 sf. Figure 2 illustrates the site plan of the proposed project.

The proposed residential development would include 61 three-story townhomes (ranging from 1,215 to 1,950 sf) with two to four bedroom floor plans, private patios, and two-car garages. The project would also include 44 three-story single-family detached homes (ranging from 1,886 to 2,130 sf) with three to four bedroom floor plans, private yards, and two-car garages.

As part of the project, a community recreation area is proposed at the eastern portion of the residential development and would include a pool, sitting areas, and restrooms. Other amenities proposed throughout the residential development include a walking loop and central walkway, gathering spaces, barbeques, and a playground.
FIGURE 1

Mission Foothills Residential Project

Project Location

SOURCE: Google Maps, 2018

I:\SHO1704.02\G\Project_Location.cdr (11/26/2018)
Mission Foothills
Residential Project

FIGURE 2

SOURCE: WHA (9-14-2018)

Mission Foothills
Residential Project
Site Plan

LSA

SOURCE: WHA (9-14-2018)
NOISE AND VIBRATIONS FUNDAMENTALS

CHARACTERISTICS OF SOUND

Sound is increasing to such disagreeable levels in the environment that it can threaten quality of life. Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a wave resulting in the tone’s range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound’s effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

Measurement of Sound

Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear’s de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds) decibels are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 decibels (dB) is 10 times more intense than 1 dB, 20 dB is 100 times more intense than 1 dB, and 30 dB is 1,000 times more intense than 1 dB. Thirty decibels (30 dB) represents 1,000 times as much acoustic energy as 1 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the loudness of the sound. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. For a single point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations) the sound decreases 3 dB for each doubling of distance in a hard site environment. Line source (noise in a relatively flat environment with absorptive vegetation) decreases 4.5 dB for each doubling of distance.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous
sound level \( (L_{\text{eq}}) \) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the \( L_{\text{eq}} \) and Community Noise Equivalent Level (CNEL) or the day-night average noise level \( (L_{\text{dn}}) \) based on A-weighted decibels (dBA). CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly \( L_{\text{eq}} \) for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours), and a 10 dBA weighting factor applied to noises occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). \( L_{\text{dn}} \) is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and \( L_{\text{dn}} \) are within 1 dBA of each other and are normally interchangeable. The City uses the CNEL noise scale for long-term noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level \( (L_{\text{max}}) \), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by \( L_{\text{max}} \) which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. It is often used together with another noise scale, or noise standards in terms of percentile noise levels, in noise ordinances for enforcement purposes. For example, the \( L_{10} \) noise level represents the noise level exceeded 10 percent of the time during a stated period. The \( L_{50} \) noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The \( L_{90} \) noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the \( L_{\text{eq}} \) and \( L_{50} \) are approximately the same.

Noise impacts can be described in three categories. The first category includes audible impacts that refer to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

**Physiological Effects of Noise**

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear (the threshold of pain). A sound level of 160–165 dBA will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed area. Table A lists definitions of acoustical terms and Table B shows common sound levels and their sources.
### Table A: Definitions of Acoustical Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decibel, dB</td>
<td>A unit of measurement that denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.</td>
</tr>
<tr>
<td>Frequency, Hz</td>
<td>Of a function periodic in time, the number of times that the quantity repeats itself in 1 second (i.e., number of cycles per second).</td>
</tr>
<tr>
<td>A-Weighted Sound Level, dBA</td>
<td>The sound level obtained by use of A-weighting. The A-weighting filter deemphasizes the very low- and very high-frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. (All sound levels in this report are A-weighted, unless reported otherwise.)</td>
</tr>
<tr>
<td>L1%, L10%, L50%, L90%</td>
<td>The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 1%, 10%, 50%, and 90% of a stated time period.</td>
</tr>
<tr>
<td>Equivalent Continuous Noise Level, L_{eq}</td>
<td>The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.</td>
</tr>
<tr>
<td>Community Noise Equivalent Level, CNEL</td>
<td>The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dBA to sound levels occurring in the evening from 7:00 PM to 10:00 PM and after the addition of 10 dBA to sound levels occurring in the night between 10:00 PM and 7:00 AM.</td>
</tr>
<tr>
<td>Day/Night Noise Level, L_{dn}</td>
<td>The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dBA to sound levels occurring in the night between 10:00 PM and 7:00 AM.</td>
</tr>
<tr>
<td>(L_{\text{max}}, L_{\text{min}})</td>
<td>The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.</td>
</tr>
<tr>
<td>Ambient Noise Level</td>
<td>The all-encompassing noise associated with a given environment at a specified time; usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.</td>
</tr>
<tr>
<td>Intrusive</td>
<td>The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.</td>
</tr>
</tbody>
</table>


### Table B: Common Sound Levels and Their Noise Sources

<table>
<thead>
<tr>
<th>Noise Source</th>
<th>A-Weighted Sound Level in Decibels</th>
<th>Noise Environments</th>
<th>Subjective Evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Jet Engine</td>
<td>140</td>
<td>Deafening</td>
<td>128 times as loud</td>
</tr>
<tr>
<td>Civil Defense Siren</td>
<td>130</td>
<td>Threshold of Pain</td>
<td>64 times as loud</td>
</tr>
<tr>
<td>Hard Rock Band</td>
<td>120</td>
<td>Threshold of Feeling</td>
<td>32 times as loud</td>
</tr>
<tr>
<td>Accelerating Motorcycle at a Few Feet Away</td>
<td>110</td>
<td>Very Loud</td>
<td>16 times as loud</td>
</tr>
<tr>
<td>Pile Driver; Noisy Urban Street/Heavy City Traffic</td>
<td>100</td>
<td>Very Loud</td>
<td>8 times as loud</td>
</tr>
<tr>
<td>Ambulance Siren; Food Blender</td>
<td>95</td>
<td>Very Loud</td>
<td>—</td>
</tr>
<tr>
<td>Garbage Disposal</td>
<td>90</td>
<td>Very Loud</td>
<td>4 times as loud</td>
</tr>
<tr>
<td>Freight Cars; Living Room Music</td>
<td>85</td>
<td>Loud</td>
<td>—</td>
</tr>
<tr>
<td>Pneumatic Drill; Vacuum Cleaner</td>
<td>80</td>
<td>Loud</td>
<td>2 times as loud</td>
</tr>
<tr>
<td>Busy Restaurant</td>
<td>75</td>
<td>Moderately Loud</td>
<td>—</td>
</tr>
</tbody>
</table>

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Table B: Common Sound Levels and Their Noise Sources

<table>
<thead>
<tr>
<th>Noise Source</th>
<th>A-Weighted Sound Level in Decibels</th>
<th>Noise Environments</th>
<th>Subjective Evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Freeway Auto Traffic</td>
<td>70</td>
<td>Moderately Loud</td>
<td>—</td>
</tr>
<tr>
<td>Average Office</td>
<td>60</td>
<td>Quiet</td>
<td>One-half as loud</td>
</tr>
<tr>
<td>Suburban Street</td>
<td>55</td>
<td>Quiet</td>
<td>—</td>
</tr>
<tr>
<td>Light Traffic; Soft Radio Music in Apartment</td>
<td>50</td>
<td>Quiet</td>
<td>One-quarter as loud</td>
</tr>
<tr>
<td>Large Transformer</td>
<td>45</td>
<td>Quiet</td>
<td>—</td>
</tr>
<tr>
<td>Average Residence without Stereo Playing</td>
<td>40</td>
<td>Faint</td>
<td>One-eighth as loud</td>
</tr>
<tr>
<td>Soft Whisper</td>
<td>30</td>
<td>Faint</td>
<td>—</td>
</tr>
<tr>
<td>Rustling Leaves</td>
<td>20</td>
<td>Very Faint</td>
<td>—</td>
</tr>
<tr>
<td>Human Breathing</td>
<td>10</td>
<td>Very Faint</td>
<td>Threshold of Hearing</td>
</tr>
<tr>
<td>—</td>
<td>0</td>
<td>Very Faint</td>
<td>—</td>
</tr>
</tbody>
</table>

Source: Compiled by LSA (2015).

FUNDAMENTALS OF VIBRATION

Vibration refers to groundborne noise and perceptible motion. Groundborne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 vibration velocity decibels (VdB) or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of groundborne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both groundborne vibration and noise from these sources are usually localized to areas within approximately 100 feet from the vibration source, although there are examples of groundborne vibration causing interference out to distances greater than 200 feet (FTA 2018). When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that groundborne vibration from street traffic will not exceed the impact criteria; however, both construction of a project and freight train operations on railroad tracks could result in groundborne vibration that may be perceptible and annoying.

Groundborne noise is not likely to be a problem because noise arriving via the normal airborne path will usually be greater than groundborne noise. Groundborne vibration has the potential to disturb
people and damage buildings. Although it is very rare for train-induced groundborne vibration to cause even cosmetic building damage, it is not uncommon for heavy duty construction processes (e.g., blasting and pile driving) to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018). Groundborne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

\[ L_v = 20 \log_{10} \frac{V}{V_{\text{ref}}} \]

Where \( L_v \) is the VdB, “V” is the RMS velocity amplitude, and “\( V_{\text{ref}} \)” is the reference velocity amplitude, or \( 1 \times 10^{-6} \) inches/second (in/sec) used in the United States.

Factors that influence groundborne vibration and noise include the following:

- **Vibration Source.** Vehicle suspension, wheel types and condition, railroad track/roadway surface, railroad track support system, speed, transit structure, and depth of vibration source.
- **Vibration Path.** Soil type, rock layers, soil layering, depth to water table, and frost depth.
- **Vibration Receiver.** Foundation type, building construction, and acoustical absorption.

Among the factors listed above, there are significant differences in the vibration characteristics when the source is underground compared to at the ground surface. In addition, soil conditions are known to have a strong influence on the levels of groundborne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock.

Experience with groundborne vibration indicates: (1) vibration propagation is more efficient in stiff, clay soils than in loose, sandy soils; and (2) shallow rock seems to concentrate the vibration energy close to the surface and can result in groundborne vibration problems at large distances from a railroad track. Factors including layering of the soil and the depth to the water table can have significant effects on the propagation of groundborne vibration. Soft, loose, sandy soils tend to attenuate more vibration energy than hard, rocky materials. Vibration propagation through groundwater is more efficient than through sandy soils.
REGULATORY SETTING

APPLICABLE NOISE STANDARDS

This section describes the applicable standards for the proposed project. The project would be entirely within the City of Mission Viejo.

The Noise Element of the General Plan

The Noise Element of the Mission Viejo General Plan establishes limitations on sound levels to be received by various land uses. New development may cause existing noise-sensitive land uses to be affected by noise generated from new developments, or it may locate a sensitive use in such a place that it is adversely affected by noise. The Noise Element identifies rail and traffic on public roadways as the major sources of noise in Mission Viejo. The Noise Element uses the same exterior noise level guidelines shown in Table C which is a product of the State of California General Plan Guidelines (State of California 2003). The Noise Element also states that typical noise standards for sensitive land uses include a 65 dBA CNEL for exterior areas and 45 dBA CNEL for interior areas.

Table C: State of California Land Use Compatibility Guidelines

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Normally Acceptable</th>
<th>Conditionally Acceptable</th>
<th>Normally Unacceptable</th>
<th>Clearly Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential-Low Density Single Family, Duplex, Mobile Home</td>
<td>&lt;60</td>
<td>55-70</td>
<td>70-75</td>
<td>75+</td>
</tr>
<tr>
<td>Residential-Multiple Family</td>
<td>&lt;65</td>
<td>60-70</td>
<td>70-75</td>
<td>75+</td>
</tr>
<tr>
<td>Transient Lodging, Motel, Hotel</td>
<td>&lt;65</td>
<td>60-70</td>
<td>70-80</td>
<td>80+</td>
</tr>
<tr>
<td>School, Library, Church, Hospital, Nursing Home</td>
<td>&lt;70</td>
<td>60-70</td>
<td>70-80</td>
<td>80+</td>
</tr>
<tr>
<td>Auditorium, Concert Hall, Amphitheater</td>
<td>&lt;70</td>
<td>65+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports Arenas, Outdoor Spectator Sports</td>
<td>&lt;75</td>
<td>70+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playground, Neighborhood Park</td>
<td>&lt;70</td>
<td>67.5-75</td>
<td>72.5+</td>
<td></td>
</tr>
<tr>
<td>Golf Courses, Stable, Water Recreation, Cemetery</td>
<td>&lt;75</td>
<td>70-80</td>
<td>80+</td>
<td></td>
</tr>
<tr>
<td>Office Building, Business Commercial and Professional</td>
<td>&lt;70</td>
<td>67.5-77.5</td>
<td>75+</td>
<td></td>
</tr>
<tr>
<td>Industrial, Manufacturing, Utilities, Agriculture</td>
<td>&lt;75</td>
<td>70-80</td>
<td>75+</td>
<td></td>
</tr>
</tbody>
</table>

Source: State of California 2003

dBA = A-weighted decibels; Ldn = day-night average noise level; CNEL = Community Noise Equivalent Level.
1 Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
2 New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
3 New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Outdoor areas must be shielded.
4 New construction or development should generally not be undertaken.
Municipal Code

Title 9, Chapter 9.22 of the Mission Viejo Municipal Code includes residential exterior and interior noise standards shown in Table D, which represent the maximum acceptable noise levels as measured from any residential property in the City.

**Table D: Residential Noise Standards (dBA L\text{eq})**

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Daytime (7:00 a.m. to 10:00 p.m.)</th>
<th>Nighttime (10:00 p.m. to 7:00 a.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Exterior Noise Standards</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>Residential Interior Noise Standards</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>Non-Residential Exterior Noise Standards</td>
<td>65</td>
<td>65</td>
</tr>
</tbody>
</table>


Notes:
- Standards are based on measurements taken from any residential property in the City of Laguna Hills.
- \( \text{dBA} \) = A-weighted decibels
- \( \text{L}_{\text{eq}} \) = equivalent continuous sound level

Accordingly, it is unlawful to cause the noise level on any residential property to exceed these exterior noise standards:

1. for a cumulative period of more than 30 minutes in any hour;
2. plus 5 \( \text{dBA} \) for a cumulative period of more than 15 minutes in any hour;
3. plus 10 \( \text{dBA} \) for a cumulative period of more than 5 minutes in any hour;
4. plus 15 \( \text{dBA} \) for a cumulative period of more than 1 minute in any hour; or
5. plus 20 \( \text{dBA} \) for any period of time.

While the exterior noise standard is based on a cumulative period of 30 minutes or more, typically represented by the descriptor \( \text{L}_{50} \), given that noise may occur for up to an hour time period, the same noise level standard will be used to assess hourly standards in this analysis, also defined as \( \text{L}_{\text{eq}} \).

In addition, it is unlawful to cause the noise level on any residential property to exceed these interior noise standards:

1. for a cumulative period of more than 5 minutes in any hour;
2. plus 5 \( \text{dBA} \) for a cumulative period of more than 1 minute in any hour; or
3. plus 10 \( \text{dBA} \) for any period of time.

In the event the alleged offensive noise consists entirely of impact or peak event noise, simple tone noise, speech, music, or any combination thereof, each of the above noise levels is reduced by 5 \( \text{dBA} \).
Section 9.22.035, Special Provisions, of the City Municipal Code regulates the timing of construction activities and includes special provisions for sensitive land uses. According to the Municipal Code, construction activities shall not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a federal holiday.

**Federal Transit Administration**

Given that the Municipal Code exempts construction activities and that no standard criteria for assessing construction noise impacts is provided, for the purposes of determining the significance of the noise increase experienced at noise-sensitive uses surrounding the project, the guidelines within the FTA *Transit Noise and Vibration Impact Assessment Manual* (2018) are used in this analysis for construction noise impact identification. The general assessment criteria for construction noise identifies a 1-hour noise level of 90 dBA $L_{eq}$ for residential uses during daytime hours and a 1-hour noise level of 100 dBA $L_{eq}$ for commercial and industrial uses. This provides reasonable criteria for assessing construction noise impacts based on the potential for adverse community reaction when the noise criteria are exceeded.

**APPLICABLE VIBRATION STANDARDS**

**Federal Transit Administration**

Vibration standards included in the Federal Transit Administration’s (FTA) *Transit Noise and Vibration Impact Assessment* (FTA 2018) are used in this analysis for groundborne vibration impacts on human annoyance, as shown in Table E. The criteria presented in Table E accounts for variation in project types, as well as the frequency of events, which differ widely among projects. It is intuitive that when there will be fewer events per day, it should take higher vibration levels to evoke the same community response. The frequency of events is accounted for in the criteria by distinguishing between projects with frequent and infrequent events, in which the term “occasional events” is defined as between 30 and 70 events per day.

The criteria for environmental impact from groundborne vibration and noise are based on the maximum levels for a single event. Table F lists the potential vibration building damage criteria associated with construction activities, as suggested in the *Transit Noise and Vibration Impact Assessment* (FTA 2018).

FTA guidelines show that a vibration level of up to 102 VdB (equivalent to 0.5 in/sec in PPV) (FTA 2018) is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For a nonengineered timber and masonry building, the construction building vibration damage criterion is 94 VdB (0.2 in/sec in PPV).
### Table E: Groundborne Vibration and Groundborne Noise Impact Criteria for General Assessment

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Groundborne Vibration Impact Levels (VdB re 1 µin/sec)</th>
<th>Groundborne Noise Impact Levels (dB re 20 µPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequent(^1) Events</td>
<td>Occasional(^2) Events</td>
</tr>
<tr>
<td>Category 1: Buildings where low ambient vibration is essential for interior operations.</td>
<td>65 VdB(^4)</td>
<td>65 VdB(^4)</td>
</tr>
<tr>
<td>Category 2: Residences and buildings where people normally sleep.</td>
<td>72 VdB</td>
<td>75 VdB</td>
</tr>
<tr>
<td>Category 3: Institutional land uses with primarily daytime use.</td>
<td>75 VdB</td>
<td>78 VdB</td>
</tr>
</tbody>
</table>


1. Frequent events are defined as more than 70 events per day.
2. Occasional events are defined as between 30 and 70 events per day.
3. Infrequent events are defined as fewer than 30 events per day.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
5. Vibration-sensitive equipment is not sensitive to groundborne noise.

µin/sec = microinches per second
µPa = micropascals
dB = decibels
dBA = A-weighted decibels

---

### Table F: Construction Vibration Damage Criteria

<table>
<thead>
<tr>
<th>Building Category</th>
<th>PPV (in/sec)</th>
<th>Approximate (L_v) (VdB)(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced concrete, steel, or timber (no plaster)</td>
<td>0.50</td>
<td>102</td>
</tr>
<tr>
<td>Engineered concrete and masonry (no plaster)</td>
<td>0.30</td>
<td>98</td>
</tr>
<tr>
<td>Non-engineered timber and masonry buildings</td>
<td>0.20</td>
<td>94</td>
</tr>
<tr>
<td>Buildings extremely susceptible to vibration damage</td>
<td>0.12</td>
<td>90</td>
</tr>
</tbody>
</table>


1. RMS vibration velocity in decibels (VdB) re 1 µin/sec.

µin/sec = inches per second
FPA = Federal Transit Administration
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

---

[1] RMS vibration velocity in decibels (VdB) re 1 µin/sec.
[2] µin/sec = inches per second
[3] FTA = Federal Transit Administration
[4] PPV = peak particle velocity
[5] RMS = root-mean-square
[6] VdB = vibration velocity decibels

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M:\SHO1704\SHO1704.02 Mission Foothills\Noise\Report\Noise Impact Analysis_20181203.docx «12/03/18»
OVERVIEW OF THE EXISTING ENVIRONMENT

This section describes the existing noise environment in the project site vicinity. The primary existing noise sources include nearby roadways, including SR-241 and Los Alisos Boulevard, and the nearby commercial and residential uses.

EXISTING NOISE LEVEL MEASUREMENTS

To assess existing noise levels, LSA conducted two long-term noise measurements and two short-term noise measurements on the project site. The long-term noise measurements were recorded between November 14, 2018 and November 15, 2018. The long-term noise measurements captured hourly $L_{eq}$ data as well as CNEL data, which incorporate the nighttime hours. The short-term noise measurements were recorded along the southern property line on November 14, 2018. Noise measurement data collected during the noise monitoring are summarized in Table G, shown on Figure 3, and the noise measurement sheets are provided in Appendix A.

Table G: Existing Noise Level Measurements

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Daytime Noise Levels(^1) ($\text{dBA } L_{eq}$)</th>
<th>Evening Noise Levels(^2) ($\text{dBA } L_{eq}$)</th>
<th>Nighttime Noise Levels(^3) ($\text{dBA } L_{eq}$)</th>
<th>Average Daily Noise Levels ($\text{dBA CNEL}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT-1</td>
<td>Located on the northwest portion of the project site near the existing Family Member Veterinary Hospital</td>
<td>62.0–67.1</td>
<td>60.6–63.6</td>
<td>49.9–63.3</td>
<td>66.3</td>
</tr>
<tr>
<td>LT-2</td>
<td>Near the center of the existing Mission Foothill Marketplace parking lot</td>
<td>54.9 – 60.3</td>
<td>55.7–58.2</td>
<td>45.4–60.8</td>
<td>61.5</td>
</tr>
<tr>
<td>ST-1(^4)</td>
<td>Located on the northeast portion of the project site near the existing vacant commercial units</td>
<td>50.5–55.9</td>
<td>51.3–53.8</td>
<td>41.0–56.4</td>
<td>57.1</td>
</tr>
<tr>
<td>ST-2(^4)</td>
<td>Located on the western property line of the existing Mission Foothill Marketplace approximately 300 feet from Los Alisos Boulevard.</td>
<td>52.6–57.7</td>
<td>51.2–54.2</td>
<td>40.5–53.9</td>
<td>56.9</td>
</tr>
</tbody>
</table>

Source: Compiled by LSA (November 14-15, 2018).

1 Daytime Noise Levels = noise levels during the hours from 7:00 a.m. to 7:00 p.m.
2 Evening Noise Levels = noise levels during the hours from 7:00 p.m. to 10:00 p.m.
3 Nighttime Noise Levels = noise levels during the hours from 10:00 p.m. to 7:00 a.m.
4 Short-term measurements are normalized to the nearest 24-hour measurement.

dBA = A-weighted decibels
$L_{eq}$ = equivalent continuous sound level
CNEL = Community Noise Equivalent Level
FIGURE 3

Noise Monitoring Locations

Project Site
Short-Term Noise Measurement Location
Long-Term Noise Measurement Location

SOURCE: Google Earth, 2018
Mission Foothills Residential Project
Noise Monitoring Locations

LEGEND
ST-1
ST-2
LT-1
LT-2
APN 839-161-12

Mission Foothills Residential Project
Noise Monitoring Locations

LEGEND
ST-1
ST-2
LT-1
LT-2
APN 839-161-12
VEHICULAR TRAFFIC NOISE

In addition to the existing noise level measurements, the FHWA Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used to identify traffic-related noise impacts from the roadway segments in the project vicinity. Existing traffic volumes in the Caltrans Traffic Census Program (2016) were used to assess the existing traffic noise impacts. The vehicle mix from the Caltrans Traffic Census Program information for truck percentages was used for SR-241.

Table H provides the traffic noise levels along the roadways in the study area under existing conditions. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and where the noise contours are calculated. The specific assumptions used in developing these noise levels and model printouts are provided in Appendix B.

### Table H: Existing Traffic Noise Levels Without Project

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>ADT</th>
<th>Centerline to 70 dBA CNEL (feet)</th>
<th>Centerline to 65 dBA CNEL (feet)</th>
<th>Centerline to 60 dBA CNEL (feet)</th>
<th>CNEL (dBA) 50 feet from Centerline of Outermost Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-241 – North of Los Alisos Boulevard</td>
<td>36,500</td>
<td>150</td>
<td>318</td>
<td>682</td>
<td>74.5</td>
</tr>
</tbody>
</table>

Source: LSA (December 2018).

Note: Traffic noise within 50 feet of the roadway centerline should be evaluated with site-specific information.

ADT = average daily traffic

CNEL = Community Noise Equivalent Level

dBA = A-weighted decibels

In order to assess existing noise levels from the nearby major roadway, SR-241, north of the project site, noise levels from Table H were projected using soft-site conditions due to the large distances from source to receiver at the property line of the project site. When soft-site conditions are utilized, noise levels from traffic are reduced by 4.5 dBA per doubling of distance. The equation utilized is shown below, and the results of the projection are shown in Table I. A comparison of Table G and Table I shows that the results of the noise modeling using the FHWA Highway Traffic Noise Prediction Model are 2.5 dBA CNEL higher that the measured noise levels taken at the project site and justifies the use of soft-site conditions. The discrepancy is likely due to the difference in existing pad elevation as compared to the elevation of SR-241. This calibration factor will be used during the projection of future noise levels in this analysis.

\[
dBA \text{ CNEL (at distance } X) = dBA \text{ CNEL (at } 50 \text{ feet}) - 15 \times \log_{10} \left( \frac{X}{50} \right)
\]
Table I: Modeled Existing Traffic Noise Levels at Project Site

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>CNEL (dBA) 50 ft from Centerline of Outermost Lane</th>
<th>Distance from Centerline of Outermost Lane to Project Site (ft)</th>
<th>CNEL (dBA) at Project Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-241, North of Los Alisos Boulevard</td>
<td>74.5</td>
<td>120</td>
<td>68.8</td>
</tr>
</tbody>
</table>

Source: Compiled by LSA Associates, Inc. (December 2018).
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
ft = foot/feet

AIRCRAFT NOISE

Airport related noise levels are primarily associated with aircraft engine noise made while aircraft are taking off, landing, or running their engines while still on the ground. The closest airport is the Santa Ana – John Wayne International Airport, approximately 13.8 miles west of the project site. Aircraft noise is rarely audible at the project site and no portion of the project site lies within the 65 dBA CNEL noise contours of the airport.

EXISTING SENSITIVE LAND USES IN THE PROJECT AREA

The project site is surrounded by roadways, commercial uses, undeveloped land and single-family residences. The areas adjacent to the project site include the following uses.

- North: SR-241
- South: Existing commercial uses.
- West: The existing Los Alisos at Mission Viejo Apartment Complex.
- East: Currently undeveloped land / parking lot and the existing Ayers Suites Mission Viejo further to the east.
IMPACT ASSESSMENT

SHORT-TERM CONSTRUCTION-RELATED IMPACTS

Construction Noise Impacts

Two types of short-term noise impacts would occur during project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the project site and would incrementally raise noise levels on access roads leading to the site. The pieces of heavy equipment for grading and construction activities will be moved on site, will remain for the duration of each construction phase, and will not add to the daily traffic volume in the project vicinity. Los Alisos Boulevard would be used to access the project site. Although there would be high single-event noise exposure potential at a maximum level of 84 dBA $L_{\text{max}}$ from trucks passing at 50 feet, the effect on longer-term (hourly or daily) ambient noise levels would be small compared to existing hourly and daily traffic volumes. Because construction-related vehicle trips would not approach the hourly and daily traffic volumes described above, hourly and daily traffic noise would not increase by 3 dBA which is considered imperceptible to the human ear in an outdoor environment. Therefore, short-term, construction-related impacts associated with worker commutes and equipment transport to the project site would be less than significant.

The second type of short-term noise impact is related to noise generated during demolition, site preparation, grading, building construction, architectural coating, and paving on the project site. Construction is undertaken in discrete steps, each of which has its own mix of equipment, and consequently its own noise characteristics. These various sequential phases would change the character of the noise generated on the project site. Therefore, the noise levels vary as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table J lists the maximum noise levels recommended for noise impact assessments for typical construction equipment based on a distance of 50 feet between the equipment and a noise receptor. Typical operating cycles for these types of construction equipment may involve 1 to 2 minutes of full power operation followed by 3 to 4 minutes at lower power settings.

In addition to the reference maximum noise level, the usage factor provided in Table J is utilized to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(\text{equip}) = E.L. + 10 \log(U.F.) - 20 \log \left(\frac{D}{50}\right)$$

where:

- $L_{eq}(\text{equip}) = L_{eq}$ at a receiver resulting from the operation of a single piece of equipment over a specified time period
- $E.L.$ = noise emission level of the particular piece of equipment at a reference distance of 50 feet
### Table J: Typical Maximum Construction Equipment Noise Levels (L<sub>max</sub>)

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Acoustical Usage Factor</th>
<th>Suggested Maximum Sound Levels for Analysis (dBA L&lt;sub&gt;max&lt;/sub&gt; at 50 ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Compressor</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Backhoe</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Cement Mixer</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Concrete/Industrial Saw</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>Crane</td>
<td>16</td>
<td>85</td>
</tr>
<tr>
<td>Excavator</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td>Forklift</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td>Generator</td>
<td>50</td>
<td>82</td>
</tr>
<tr>
<td>Grader</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td>Loader</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Pile Driver</td>
<td>20</td>
<td>101</td>
</tr>
<tr>
<td>Paver</td>
<td>50</td>
<td>85</td>
</tr>
<tr>
<td>Roller</td>
<td>20</td>
<td>85</td>
</tr>
<tr>
<td>Rubber Tire Dozer</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td>Scraper</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td>Tractor</td>
<td>40</td>
<td>84</td>
</tr>
<tr>
<td>Truck</td>
<td>40</td>
<td>84</td>
</tr>
<tr>
<td>Welder</td>
<td>40</td>
<td>73</td>
</tr>
</tbody>
</table>


DBA = A-weighted decibel

ft = feet

L<sub>max</sub> = maximum noise level

**U.F.** = usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time

**D** = distance from the receiver to the piece of equipment

Each piece of construction equipment operates as an individual point source. Utilizing the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

\[
Leq \text{ (composite)} = 10 \times \log_{10} \left( \sum_{i=1}^{n} 10^{\frac{L_i}{10}} \right)
\]

The composite noise level of the two loudest pieces of equipment expected to be used, the forklift and tractor, during construction, as required by the FTA criteria, would be 82 dBA L<sub>eq</sub> at a distance of 50 feet from the construction area.

Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:
Leq (at distance X) = Leq (at 50 feet) − 20 \times \log_{10} \left( \frac{X}{50} \right)

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA. It is expected that noise levels for the residences to the west, approximately 100 feet away, would approach 76 dBA Leq, which is potentially higher than the existing noise levels. Additionally, it is expected that noise levels for the commercial uses to the south, approximately 30 feet away, would approach 87 dBA Leq.

Although project construction noise has the potential to be higher than ambient noise in the project vicinity at times, it would cease to occur once project construction is completed. The proposed project would be required to comply with the construction hours and days specified in the City of Mission Viejo Municipal Code. In addition, construction-related noise impacts would remain below the 90 dBA Leq 1-hour construction noise level criteria as established by the FTA and therefore would be less than significant.

Construction Vibration Impacts

Ground-borne noise and vibration from construction activity would be mostly low to moderate. While there is currently limited information regarding vibration source levels, to provide a comparison of vibration levels expected for a project of this size, as shown in Table K, a large bulldozer would generate approximately 87 VdB or 0.089 in/sec of ground-borne vibration when measured at 25 feet, based on the *Transit Noise and Vibration Impact Assessment* (FTA 2018).

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Reference PPV/Lv at 25 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoe Ram</td>
<td>0.089</td>
</tr>
<tr>
<td>Large Bulldozer</td>
<td>0.089</td>
</tr>
<tr>
<td>Caisson Drilling</td>
<td>0.089</td>
</tr>
<tr>
<td>Loaded Trucks</td>
<td>0.076</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>0.035</td>
</tr>
<tr>
<td>Small Bulldozer</td>
<td>0.003</td>
</tr>
</tbody>
</table>


The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project boundary (assuming the construction equipment would be used at or near the project boundary) because vibration impacts occur normally within the buildings. The formula for vibration transmission is provided below.

\[ L_v \text{dB} (D) = L_v \text{dB} (25 \text{ ft}) − 30 \log (D/25) \]
\[ PPV_{\text{equip}} = PPV_{\text{ref}} \times (25/D)^{1.5} \]

**Construction Vibration Damage Potential**

As shown above in Table F, it would take a minimum of 90 VdB (or 0.12 in/sec PPV) to cause any potential building damage and a minimum of 94 VdB (or 0.2 in/sec PPV) for a non-engineered timber and masonry building.

The project site is bounded by existing residential uses to the west and commercial buildings to the south. The closest structures are approximately 30 feet from the project construction area limits. Utilizing the equations above, the operation of a large bulldozer and similar construction equipment would generate ground-borne vibration levels of 85 VdB (0.068 in/sec PPV); however, those levels would not exceed the 0.12 in/sec PPV or 90 VdB guideline that is considered safe for any type of buildings and therefore would be less than significant.

**Construction Vibration Human Annoyance Potential**

As shown above, large bulldozers and other similar equipment used for a project this size would generate levels of approximately 81 VdB of ground-borne vibration at the closest sensitive uses. Based on the information provided earlier in Table E, this level of ground-borne vibration is below the threshold of distinctly perceptible, which is around 83 VdB for infrequent events at uses with primarily daytime use, therefore resulting in a less than significant impact.

**LONG-TERM AIRCRAFT NOISE IMPACTS**

The project is located well outside the 65 dBA CNEL noise contours of the Santa Ana – John Wayne International Airport. Therefore, no noise impacts from aircraft noise would occur and no mitigation measures would be required.

**LAND USE COMPATIBILITY ASSESSMENT**

**Exterior Traffic Noise Assessment**

The project site is located in an area in which most surrounding parcels are currently in use. For this reason, this analysis relies on the existing measured noise levels to provide the most accurate description of the current noise environment and then a growth factor is applied to account for the increase in traffic noise for buildout conditions based on the following equation:

\[
\text{Change in (dBA)} = 10 \times \log_{10}\left( \frac{\text{Current Volume}}{\text{Future Volume}} \right)
\]

In order to provide a conservative assumption of increase in traffic, given the area is generally built out, a future volume of twice the existing traffic volume is used, resulting in an increase of 3 dBA CNEL. Incorporating this increase with the noise levels determined in Table I, the buildout scenario for the proposed project would have noise-sensitive residences located approximately 120 ft from the nearest lane centerline of SR-241 exposed to traffic noise up to 72 dBA CNEL. As shown in Table C, noise environments that range from 70-75 dBA CNEL are normally unacceptable to the City and new construction or development is generally discouraged. However, new development can
proceed with a detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

While this exterior noise level would exceed the City of Mission Viejo exterior noise standard of 65 dBA CNEL for residential land uses, the more-sensitive outdoor uses including the tot lot and community recreation area would be shielded and would not experience noise levels exceeding the exterior standard. Additionally, based on distance attenuation and shielding from the townhome buildings, exterior noise levels at the single-family home private yards will be below the City’s 65 dBA CNEL exterior noise level standard.

**Interior Noise Assessment**

Based on the EPA Protective Noise Levels (1978), with windows and doors open, interior noise levels at the frontline townhome residences would have an interior noise level of 60 dBA CNEL (72 dBA - 12 dBA = 60 dBA) and would exceed the City of Mission Viejo interior noise standard of 45 dBA CNEL. With windows and doors closed, interior noise levels in these frontline townhome units would have an interior noise level of 48 dBA CNEL (72 dBA - 24 dBA = 48 dBA) and would also exceed the City of Mission Viejo interior noise standard of 45 dBA CNEL. In order to achieve the required composite façade reduction, a Final Acoustical Report shall be prepared to identify specific features that will be incorporated into the project to achieve the necessary sound attenuation. The features may include, but are not limited to, the following:

- **Upgraded windows.** Because the reduction provided by the entire assembly is heavily dependent on the rating of the windows due to the much lower noise reducing characteristics of glass and compare to solid walls with insulation, a higher STC rating may be required to reduce interior noise levels. Most major window companies sell windows specifically designed for loud exterior conditions.

- **Reduced window sizes or types.** As stated above, traditionally windows are seen as the “weak point” in an exterior façade. Depending on the necessary reduction needed in a loud environment or the specifications of the windows chosen, it may be necessary to reduce the size or types of windows and sliding glass doors.

- **Upgraded wall construction.** It may be necessary, typically in combination with upgraded windows, to improve the composition of the exterior wall construction. This can be done by adding resilient channels, increasing layers of gypsum board, altering stud spacing, or upgrading insulation.

Implementation of such features would be expected to reduce noise levels for interior spaces by more than 3 dBA which would allow for the units to meet the City’s interior noise standard with windows in a closed position. A form of mechanical ventilation, such as an air-conditioning system, will be required as part of the project design for all on-site buildings/units.

**Municipal Code Compliance Analysis**

The project proposes to have the single-family homes along the southern property line which are adjacent to a parking lot.
Parking lot noise, including engine sounds, car doors slamming, car alarms, loud music, and people conversing, would occur as a result of the proposed project at the project site and on nearby streets. Typical parking lot activities, such as people conversing or doors slamming, generates approximately 60 dBA to 70 dBA L$_{max}$ at 50 feet. The closest sensitive receptors to parking areas would be the single family residences, approximately 20 feet south of the proposed parking areas.

Adjusted for distance, the nearest off-site residences would be exposed to a noise level of up to 78 dBA L$_{max}$ generated by parking lot activities. However, the proposed project would include a solid CMU wall between the residential area and the parking lot, which would reduce noise levels. A wall with a minimum height of 7 feet would reduce noise levels by approximately 8.5 dBA because the majority of the tire noise from vehicles traveling inside the parking lot would be shielded. Therefore, the nearest residences would be exposed to a noise level of up to 69 dBA L$_{max}$ generated by parking lot activities. Therefore, it is expected that noise levels associated with parking lot activity would further be reduced and would not exceed the City’s daytime (7:00 a.m. to 10:00 p.m.) exterior noise level standard of 75 dBA L$_{max}$ or exterior nighttime (10:00 p.m. to 7:00 a.m.) standard of 70 dBA L$_{max}$ attributable to stationary sources as identified in the Municipal Code.

**LONG-TERM VIBRATION IMPACTS**

The proposed residences would not generate vibration. In addition, vibration levels generated from project-related traffic on the adjacent roadways are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Vibration generated from project-related traffic on the adjacent roadways would be less than significant and no mitigation measures would be required.

**MINIMIZATION MEASURES**

The following minimization measures apply to the project and will help to reduce and avoid potential impacts related to noise:

**Construction Noise.**

Prior to issuance of demolition permits, the General Manager of the Mission Viejo (City) Department of Building and Safety, or designee, shall verify that all construction plans include notes stipulating the following:

- Prohibit all noise producing construction activities between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday. Construction shall not be allowed at any time on Sunday or a federal holiday.
- Grading and construction contractors shall use equipment that generates lower vibration levels, such as rubber-tired equipment rather than metal-tracked equipment when feasible.
- Construction haul truck and materials delivery traffic shall avoid residential areas whenever feasible.
• The construction contractor shall place noise- and vibration-generating construction equipment and locate construction staging areas away from sensitive uses whenever feasible.

• The construction contractor shall use on-site electrical sources to power equipment rather than diesel generators where feasible.

• All residential units located within 500 ft of the construction site shall be sent a notice regarding the construction schedule. A sign legible at a distance of 50 ft shall also be posted at the construction site. All notices and the signs shall indicate the dates and durations of construction activities, as well as provide a telephone number for the “noise disturbance coordinator.”

• A “noise disturbance coordinator” shall be established. The disturbance coordinator shall be responsible for responding to any local complaints about construction noise. The disturbance coordinator shall determine the cause of the noise complaint (e.g., starting too early, bad muffler) and shall be required to implement reasonable measures to reduce noise levels.

**Final Acoustical Report.**
Prior to issuance of any certificates of occupancy, the Project Applicant/Developer shall submit a Final Acoustical Report, prepared by a qualified acoustical consultant, to the City of Mission Viejo. The Mission Viejo Department of Building and Safety, or designee, shall verify that the Final Acoustical Report demonstrates that all units with exterior façades, including all bedrooms and living rooms, comply with the City’s interior noise standard (45 dBA Community Noise Equivalent Level [CNEL]). Noise reduction techniques that may be incorporated into construction plans in order to reduce interior noise levels include, but are not limited to, incorporation of upgraded windows and doors, improved wall construction, or reduced window and door sizes.

**Ventilation Requirements.**
Prior to the issuance of building permits, documentation shall be provided to the Mission Viejo Department of Building and Safety, or designee, demonstrating that project buildings meet ventilation standards required by the California Building Code (CBC) with the windows closed. A form of mechanical ventilation, such as an air-conditioning system, will be required as part of the project design for all on-site buildings/units.
REFERENCES


APPENDIX A

NOISE MEASUREMENT SHEETS
Noise Measurement Survey – 24 HR

Project Number: SHO1704.02
Project Name: Mission Foothills
Test Personnel: Corey Knips
Equipment: Quest NoisePro DLX

Site Number: LT-1 Date: 11/14/2018 Time: From 11:00 AM To 11:00 AM

Site Location: 28731 Los Alisos Boulevard, behind building on light pole.

Primary Noise Sources: Traffic on CA-241 and a few vehicles driving through the parking lot.

Comments: Serial No.: NXE100155
Noise Measurement Survey – 24 HR

Project Number: SHO1704.02  Test Personnel: Corey Knips
Project Name: Mission Foothills  Equipment: Quest NoisePro DLX

Site Number: LT-2  Date: 11/14/2018  Time: From 11:00 AM To 11:00 AM

Site Location: 28771 Los Alisos Boulevard, in parking lot in front of building on a tree.

Primary Noise Sources: Traffic on Los Alisos Boulevard, faint traffic noise from CA-241, and a few vehicles driving through the parking lot.

Comments: Serial No.: NXF100119
Noise Measurement Survey

Site Number: ST-1    Date: 11/14/2018    Time: From 10:29 a.m. To 10:49 a.m.

Site Location: Between 28715 and 28721 Los Alisos Boulevard, on west end of parking lot.

Primary Noise Sources: Traffic on CA-241 and Los Alisos Boulevard

Measurement Results

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Comments: _______________________________________________________

______________________________________________________________

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Equipment: Larson Davis 831 SLM

Atmospheric Conditions:

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Project Number: SHO1704.02  
Project Name: Mission Foothills  
Test Personnel: Corey Knips

---

**Noise Measurement Survey**

Site Number: ST-2  
Date: 11/14/2018  
Time: From 11:02 a.m. To 11:22 a.m.

Site Location: 28781 Los Alisos Boulevard, northeast of building, near CA-241.

---

Primary Noise Sources: Traffic on CA-241

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**Measurement Results**

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Comments: ____________________________________________________________

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Equipment: Larson Davis 831 SLM

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**Atmospheric Conditions:**

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APPENDIX B

FHWA HIGHWAY TRAFFIC NOISE MODEL PRINTOUTS
TABLE Existing-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 12/03/2018
ROADWAY SEGMENT: SR-241
NOTES: Mission Foothills - Existing

* * ASSUMPTIONS * *
AVERAGE DAILY TRAFFIC: 36500    SPEED (MPH): 65    GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

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<td>0.09</td>
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ACTIVE HALF-WIDTH (FT): 30    SITE CHARACTERISTICS: SOFT

* * CALCULATED NOISE LEVELS * *
CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 74.45

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<th>DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL</th>
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