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December 10, 2015

Mr. Doug Rich
Valley Oak Partners, LLC
734 The Alameda
San José, California 95126

Via email: doug@valleyoakpartners.com

Subject: Old Warm Springs Boulevard South Master Plan, Fremont, CA – Environmental Noise and Vibration Assessment

Dear Mr. Rich:

The Warm Springs / South Fremont Community Plan proposes the construction of a mixed-use development on 28.66 acres of undeveloped land located north of South Grimmer Boulevard between Fremont Boulevard and the Union Pacific Railroad (UPRR) tracks in Fremont, California. The project site has been divided into seven parcels: Parcel 1 would include a hotel located in the northwest corner of the intersection at South Grimmer Boulevard and Old Warm Springs Boulevard; Parcel 2, which is located to the north of Parcel 1 along Old Warm Springs Boulevard, would include shared office space with at-grade parking; Parcel 3A would consist of apartments with a parking garage and is located between Old Warm Springs Boulevard and the UPRR tracks; Parcels 3B-1, 3B-2, and 3B-3, which are located to the west of Parcels 1 and 2, would include townhomes and flats with individual garages; and Parcel 4 would consist of an office building with an adjacent parking garage and is located along Fremont Boulevard just north of the existing office and commercial buildings. Additionally, several access roadways would be constructed on the project site.

The Warm Springs/South Fremont Community Plan EIR[1] evaluated noise and vibration impacts in the plan area and project vicinity. While the proposed project was not included in the Community Plan, the noise and vibration impacts and mitigation measures discussed in the EIR

[1] City of Fremont, *Mitigation Monitoring and Reporting Program for the Final CEQA Environmental Compliance Checklist: Warm Springs/South Fremont Community Plan Planning Area 9 Master Plan (Toll Brothers)*, June 11, 2015.

are relevant to the proposed project and were considered during the analysis of the proposed project.

Illingworth & Rodkin, Inc. (I&R) has reviewed the initial project drawings and the Warm Springs/South Fremont Community Plan EIR and has completed an environmental noise and vibration study for the proposed project to determine specific acoustical recommendations regarding environmental noise and vibration control at outdoor use areas and project interiors. This report includes a discussion of results from a noise and vibration monitoring survey conducted on the project site, summarizes future noise and vibration levels expected at the project site, describes measures necessary to reduce noise levels to acceptable levels, and discusses any additional impacts created by the proposed project that were not evaluated in the Community Plan EIR.

Fundamentals of Environmental Noise

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

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

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

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

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

Fundamentals of Ground-borne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess ground-borne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration has been correlated best with the velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1×10^{-6} in./sec. RMS, which equals 0 VdB, and 1 in./sec. equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

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

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

TABLE 2 Typical Noise Levels in the Environment

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

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

TABLE 3 Reactions of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

TABLE 4 Typical Levels of Ground-borne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, May 2006.

Regulatory Background

The proposed project would be subject to noise- and vibration-related regulations, plans, and policies established within documents prepared by the State of California and the City of Fremont. These documents are implemented during the environmental review process to limit noise and vibration exposure at existing and proposed noise sensitive land uses. Applicable planning documents include the 2010 California Building Cal Green Code, the Fremont General Plan, and the Fremont Municipal Code, which form the basis of the significance criteria used to assess project impacts. Additionally, the Warm Springs/South Fremont Community Plan EIR provided mitigation measures for the planning areas identified as potentially resulting in noise and vibrations level exposures in excess of the standards outlined by the City's General Plan and Municipal Code. The recommended mitigation measures from the Community Plan are summarized below.

2010 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2010 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). These standards were not altered in the 2013 revisions, and the sections that pertain to this project are as follows:
5.507.4.1 Exterior noise transmission, prescriptive method. Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.

5.507.4.2 Performance method. For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

City of Fremont General Plan. The City of Fremont's General Plan Safety Element establishes goals, policies, and methods of implementation for noise and vibration sources. Applicable goals, policies, and implementation measures presented in the General Plan are as follows:

Goal 10-8: Noise & Vibration. Minimal impacts to residents and property due to noise and ground vibration sources.

- **Policy 10-8.1: Site Development Acceptable Noise Environment**

  A noise environment which meets acceptable standards as defined by the State of California Building Code and local policies contained herein.

- **Implementation 10-8.1.A: Noise Standards**

New development projects shall meet acceptable exterior noise level standards. The "normally acceptable" noise standards for new land uses established in Land Use Compatibility for Community Exterior Noise Environments shown in Figure 10-4 shall be used as modified by the following:

1. The goal for maximum acceptable noise levels in residential areas is an L_{dn} of 60 dB(A). This level shall guide the design of future development, and is a goal for the reduction of noise in existing development. A 60 L_{dn} goal will be applied where outdoor use is a major consideration (e.g., backyards in single family developments and recreation areas in multifamily projects). The outdoor standard will not normally be applied to small decks associated with apartments and condominiums, but these will be evaluated on a case-by-case basis. When the City determines that providing an outdoor L_{dn} of 60 dB(A) or lower cannot be achieved after the application of appropriate mitigations an L_{dn} of 65 dB(A) may be permitted at the discretion of the City Council.

2. Indoor noise level shall not exceed an L_{dn} of 45 dB(A) in new housing units. A noise insulation study, conforming to the methodology of the State Building Code, shall be prepared for all new housing, hotels, and motels exposed to an exterior L_{dn} of 60 dB(A) or greater and submitted to the building department prior to issuance of a permit.

3. Railroad noise sources may create instances when the outdoor noise exposure criterion can exceed 65 L_{dn} up to 70 L_{dn} for future development, recognizing that train noise is characterized by relatively few loud events. Railroad noise influence shall be evaluated independent of other noise sources. Indoor noise level shall not exceed an L_{dn} of 45 dB(A) in new housing units.

4. Typical maximum instantaneous noise level in bedrooms at night should not exceed 50 dB(A). Typical maximum instantaneous noise levels in other rooms and bedrooms during the daytime should not exceed 55 dB(A). The typical maximum noise level is the maximum level that is exceeded during 30 percent of the measured pass-bys, based on the measurement of at least 10 events during the daytime and the nighttime.

Table 10-4
Land Use Compatibility for Community Exterior Noise Environments

Land Use Category	Exterior Noise Exposure (Ldn)															
	<55		55		60		65		70		75		80		>80	
Single-Family and Multi-Family Residential																
Hotels, Motels and other lodging																
Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds																
Schools, Libraries, Museums, Hospitals, Personal Care, Meeting Halls, Churches																
Office Buildings, Business, Commercial, and Professional																
Auditoriums, Concert Halls, Amphitheaters																

NORMALLY ACCEPTABLE:
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special insulation requirements

CONDITIONALLY ACCEPTABLE:
Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

UNACCEPTABLE:
New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies

- **Implementation 10-8.1.D: Noise Mitigation**

  Encourage the use of site design, setbacks, landscaping, earth berms, and other non-structural methods to reduce and mitigate the effects of traffic noise and other sources. Building placement should also be utilized to mitigate noise impacts on outdoor areas. In general, the use and construction of sound walls is discouraged unless no other alternative exists. If landscaping is used then appropriate controls for irrigation and maintenance shall be provided.

- **Policy 10-8.3: Noise Environment Protection**

  Protect existing residential neighborhoods from noise. In general, the City will require evaluation of mitigation measures for projects under the following circumstances:

1. The project would cause the L_{dn} to increase by 5 dB(A) or more but would remain below 60 dB(A), or;

2. The project would cause the L_{dn} to increase by 3 dB(A) or more and exceed 60 dB(A), or;

3. The project has the potential to generate significant adverse community response due to the unusual character of the noise.

- **Policy 10-8.10: Vibration Environment**

  A vibration environment which meets acceptable guidelines as provided by the Federal Transit Administration (FTA).

  - **Implementation 10-8.10.A: New Development to Meet FTA Guidelines**

    New development projects shall meet acceptable vibration guidelines. These guidelines are those established by the U.S. Department of Transportation, Federal Transit Administration, as shown in Table 10-3. Where new vibration sensitive development is proposed adjacent to an existing source of vibration (e.g., heavy rail or BART), the vibration guidelines shall be applied at the distance from the vibration source where the buildings are proposed. Normally, for development such as residences, the vibration velocity level measured in the vertical direction is sufficient for comparison to the guidelines. More detailed analyses may be required for highly vibration sensitive uses, such as microelectronics manufacturing. Adjust rail vibration standards to address high volumes of freight traffic if deemed necessary.

  - **Implementation 10-8.10.B: Vibration Studies**

    Residential projects proposed within 150 feet of the centerline of BART tracks or railroad tracks require a site-specific vibration study.

  - **Implementation 10-8.10.C: Evaluation of Vibration Impacts**

    The FTA Guidelines shall be used to evaluate vibration impacts from rail projects that could increase (i.e. BART extensions, changes to BART service, or changes to UPRR rail facilities) vibration levels due to a change in the horizontal or vertical alignment of the tracks or the train speeds.

- **Implementation 10-8.10.D: Vibration Mitigation**

  Incorporate vibration mitigation measures when vibration levels would exceed the guidelines, including site planning (by increasing the distance between the vibration source and the vibration sensitive building), isolating buildings, or incorporating vibration isolation into new or modified rail transportation systems. Ensure building design does not substantially amplify vibration to upper levels.

City of Fremont Municipal Code. The City's Municipal Code establishes provisions for residential developments adjacent to railroads. The portions of the Municipal Code that are relevant for this project are as follows:

Chapter 17.25.110 Noise attenuation – Residential lots adjacent to freeways, railroads, thoroughfares, parkways and certain uses. Residential lots adjacent to the right-of-way of a freeway, railroad (including rapid transit district line), thoroughfare or parkway, or to industrial, commercial or recreational uses, shall be protected by suitable noise attenuation structures and/or design features, including but not limited to walls, fences and mounds, which are capable of reducing the community noise equivalent level (CNEL) emanating from such uses or rights-of-way to such lots to 60 dB(A); provided, however, that where the planning manager finds, based upon studies in the possession of the city as to the existing or projected ambient noise levels adjacent to any such right-of-way or use, that such community noise equivalent level will be at an acceptable level, or that the CNEL noise level on the residential lots will be reduced to 60 dB(A) or less by a reduction of noise transmitted to the subject site through the enforcement of other provisions of this code, including but not limited to noise performance standards and use permit conditions, the report prepared by a professional acoustician may be waived. The advisory agency shall have the power to require, as a condition of approval of a tentative map or tentative parcel map, that the subdivider install such noise attenuation structures or design features adjacent to such residential lots as are recommended in the acoustician's report as will be sufficient to reduce the community noise equivalent level to one which is normally acceptable. (Ord. 1215 § 2, 12-20-77; Ord. 1813 § 2, 3-15-88; amended during 2012 reformat. 1990 Code § 8-1508.5.)

Warm Springs/South Fremont Community Plan EIR. Impacts NOI-2 and NOI-5 of the Community Plan EIR identified potential ground-borne vibration impacts at sensitive receptors adjacent to railroad tracks and land use compatibility impacts due to future transportation noise and vibration at proposed noise-sensitive receptors in planning areas 3, 4, 8, and 9, which are shown in Figure 1. Since the proposed Old Warm Springs Boulevard South project site lies within planning area 3, this would qualify. The following mitigation measures would apply to the proposed project:

- **MM NOI-2**: Prior to issuance of building permits for any vibration sensitive uses within 200 feet of the Union Pacific Railroad centerline, the applicant shall retain a qualified

acoustical/vibration consultant to perform a site-specific ground-borne noise and vibration assessment. The assessment shall be prepared in accordance with Federal Transit Administration and Caltrans guidelines and identify whether the proposed uses would be exposed to excessive vibration. No vibration-sensitive uses shall be located within 100 feet of the railroad centerline unless it can be demonstrated that such uses would not be exposed to excessive vibration. The recommendations of the assessment shall be incorporated into the development plans.

- **MM NOI-5a**: Plans submitted for building and/or grading permits shall include an acoustical analysis that verifies that the project would meet applicable noise standards.

- **MM NOI-5b**: Projects determined to have the potential to expose noise-sensitive uses to noise levels exceeding the City of Fremont noise standards shall incorporate site-specific design considerations to reduce exterior noise exposure levels. Site design includes but is not limited to the following measures:

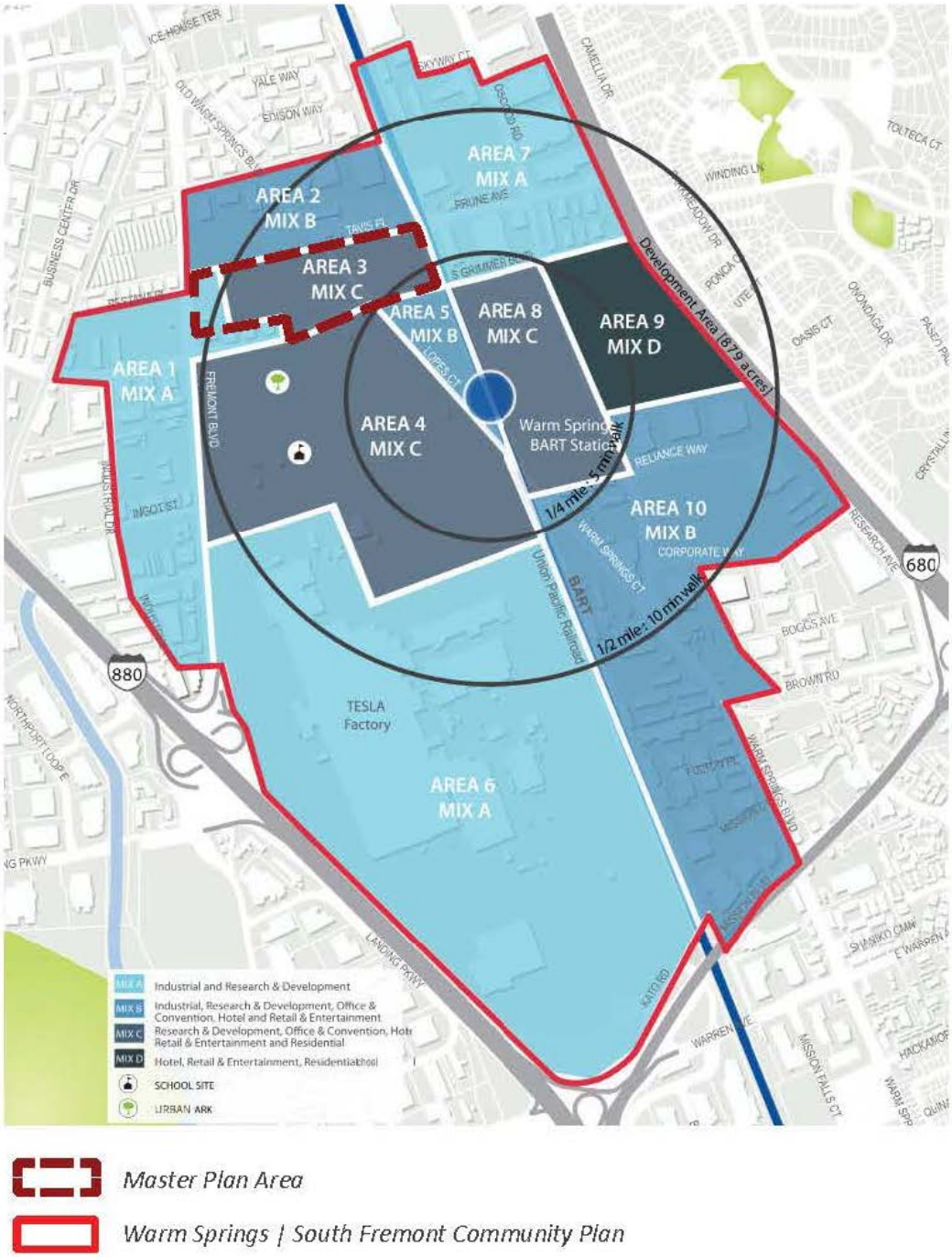
    - Distances between noise sources and noise-sensitive uses shall be maximized through the use of noise buffers/setbacks. Setback areas can take the form of open space, frontage roads, recreational areas, storage yards, or other City approved setback.

    - Common outdoor activity areas, such as play structures, swimming pools, or other outdoor congregation areas included in multi-family residential and/or mixed-use developments shall be located such that the building(s) serve as a sound barrier to the nearest predominant noise source whenever feasible.

    - Noise barriers shall be constructed to provide shielding of noise-sensitive uses and outdoor activity areas. Barriers may include man-made walls, earthen berms, a combination of walls and berms, and other structures breaking line of sight from noise source to receptor. Barriers shall be located close to either the noise source or the sensitive receptor.

    - A site-specific acoustical analysis shall be performed to determine noise level exposure, and determine effectiveness of various site design measures based on detailed project construction plans. The acoustical analysis shall verify that incorporation of the mitigation measures into the project design would reduce exterior noise level exposures to comply with applicable City of Fremont noise standards.

FIGURE 1 Warm Springs/South Fremont Community Plan Boundary



Source: *Warm Springs/South Fremont Community Plan Old Warm Springs Boulevard Community Plan Area (Valley Oak Partners)*

Existing Noise Environment

The Old Warm Springs Boulevard South Master Plan project site is proposed on two vacant lots north of South Grimmer Boulevard between Fremont Boulevard and the UPRR tracks, with Old Warm Springs Boulevard dividing the two lots. Existing office and commercial buildings adjacent to the project site are located along South Grimmer Boulevard near the intersection at Fremont Boulevard. No other land uses currently exist on the project site. The site is surrounded to the north, to the east opposite the UPRR tracks, and to the west opposite Fremont Boulevard by local businesses, manufacturing buildings, storage facilities, and a train yard. To the south opposite South Grimmer Boulevard, there is mostly open land and a single-family residence.

A noise monitoring survey was performed in the area of the project site beginning on Tuesday May 26, 2015 and concluding on Thursday May 28, 2015. The monitoring survey included six long-term and two short-term noise measurements, as shown in Figure 2. The noise environment at the site and in the surrounding areas results primarily from vehicular traffic along Fremont Boulevard and South Grimmer Boulevard. Local traffic along Old Warm Springs Boulevard also affects the noise environment. Trains along the UPRR tracks and aircraft associated with nearby airports are sources of intermittent noise at the project site.

Long-term measurement LT-1 was made along Fremont Boulevard behind the existing office and commercial buildings adjacent to the project site. LT-1 was approximately 75 feet east of the centerline of Fremont Boulevard. Hourly average noise levels at LT-1 typically ranged from 62 to 71 dBA L_{eq} during the day, and from 55 to 65 dBA L_{eq} at night. The day-night average noise level on Wednesday May 27, 2015 was 69 dBA L_{dn}. The daily trend in noise levels at LT-1 is shown in Figure 3.

LT-2 was positioned in a tree north of South Grimmer Boulevard, approximately 165 feet east of the parking lot for the existing office and commercial buildings. LT-2 was approximately 55 feet north of the centerline of South Grimmer Boulevard. Hourly average noise levels at LT-2 typically ranged from 63 to 71 dBA L_{eq} during the day, and from 54 to 69 dBA L_{eq} at night. The day-night average noise level on Wednesday May 27, 2015 was 70 dBA L_{dn}. The daily trend in noise levels at LT-2 is shown in Figure 4.

LT-3 was made along the northern boundary of the project site, east of Old Warm Springs Boulevard. LT-3 was approximately 15 feet south of the centerline of Tavis Place and approximately 245 feet east of the centerline of Old Warm Springs Boulevard. At this long-term measurement location, hourly average noise levels typically ranged from 52 to 68 dBA L_{eq} during the day, and from 44 to 58 dBA L_{eq} at night, with a day-night average noise level on Wednesday May 27, 2015 of 57 dBA L_{dn}. Figure 5 shows the daily trend in noise levels at LT-3.

To capture the trend in noise levels due to train activity at the adjacent UPRR tracks, LT-4 was positioned approximately 100 feet from the nearest track. The distance from LT-4 to the center

of the turnaround at the end of Tavis Place was approximately 150 feet. Hourly average noise levels at LT-4 typically ranged from 48 to 59 dBA L_{eq} during the day, and from 41 to 60 dBA L_{eq} at night, and the day-night average was 53 dBA L_{dn} on Wednesday May 27, 2015. Figure 6 shows the daily trend in noise levels at LT-4. From the figure, there appeared to be little to no train activity during the measurement period.

LT-5 was made along Old Warm Springs Boulevard, approximately midway between South Grimmer Boulevard and Tavis Place. LT-5 was approximately 35 feet west of the centerline of Old Warm Springs Boulevard. At this location, the hourly average noise levels typically ranged from 58 to 69 dBA L_{eq} during daytime hours and from 46 to 63 dBA L_{eq} during nighttime hours, and the day-night average was 64 dBA L_{dn} on Wednesday May 27, 2015. The daily trend in noise levels at LT-5 is shown in Figure 7.

The final long-term measurement, LT-6, was made along the northern property line of the project site, approximately midway between Fremont Boulevard and Old Warm Springs Boulevard. LT-6 was approximately 495 feet east of the centerline of Fremont Boulevard. Hourly average noise levels at LT-6 typically ranged from 47 to 59 dBA L_{eq} during the day, and from 42 to 67 dBA L_{eq} at night, and the day-night average was 53 dBA L_{dn} on Wednesday May 27, 2015. Figure 8 shows the daily trend in noise levels at LT-6.

The two short-term noise measurements that completed the survey were made on Tuesday May 26, 2015, between 2:10 p.m. and 2:40 p.m. in ten-minute intervals. ST-1 was made in the southeast corner of the intersection of South Grimmer Boulevard and Lopes Court. ST-1 was located near the single-family residence south of the project site and was approximately 75 feet south of the centerline of South Grimmer Boulevard. The ten-minute $L_{eq(10)}$ measured at ST-1 was 62 dBA $L_{eq(10)}$, and the estimated day-night average noise level was 63 dBA L_{dn}. ST-2 was made at the rear of the parking lot of the existing office and commercial buildings along South Grimmer Boulevard. ST-2 was approximately 165 feet north of the centerline of South Grimmer Boulevard and approximately 450 feet east of the centerline of Fremont Boulevard. The ten-minute $L_{eq(10)}$ measured at ST-2 was 55 dBA $L_{eq(10)}$, and the estimated day-night average noise level was 56 dBA L_{dn}. Table 4 summarizes the results for the short-term measurements.

FIGURE 2 Noise Measurement Locations

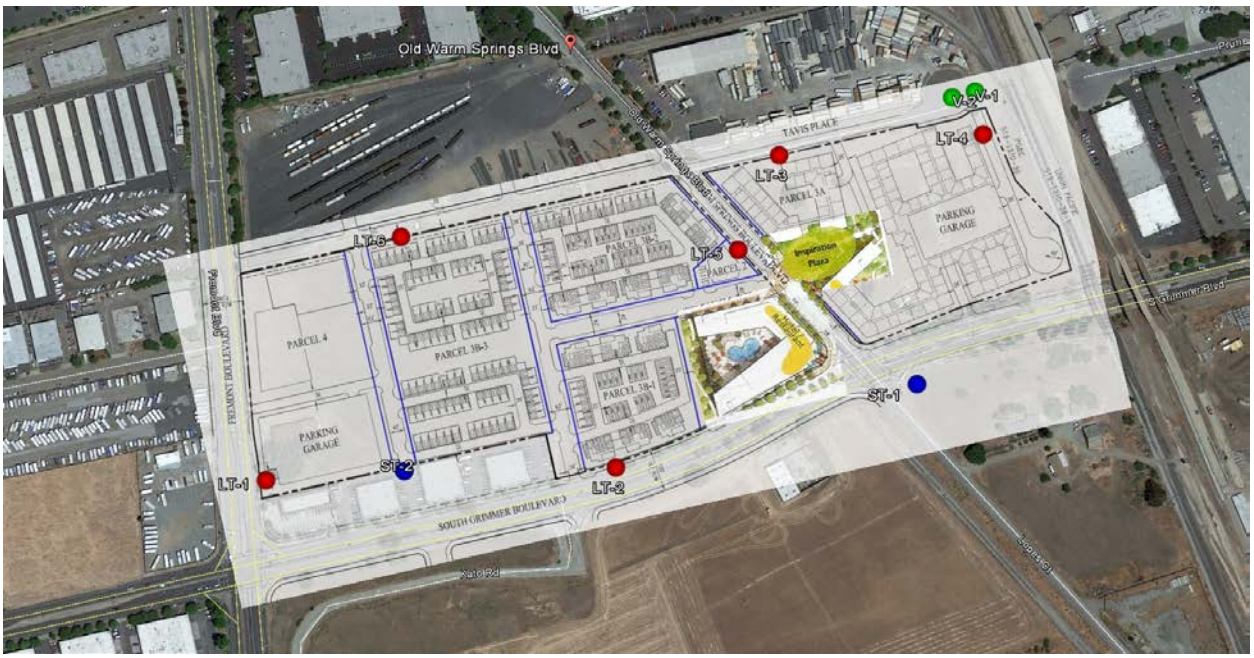


FIGURE 3 Noise Levels at LT-1, ~75 feet East of the Centerline of Fremont Boulevard, from May 26 through 28, 2015

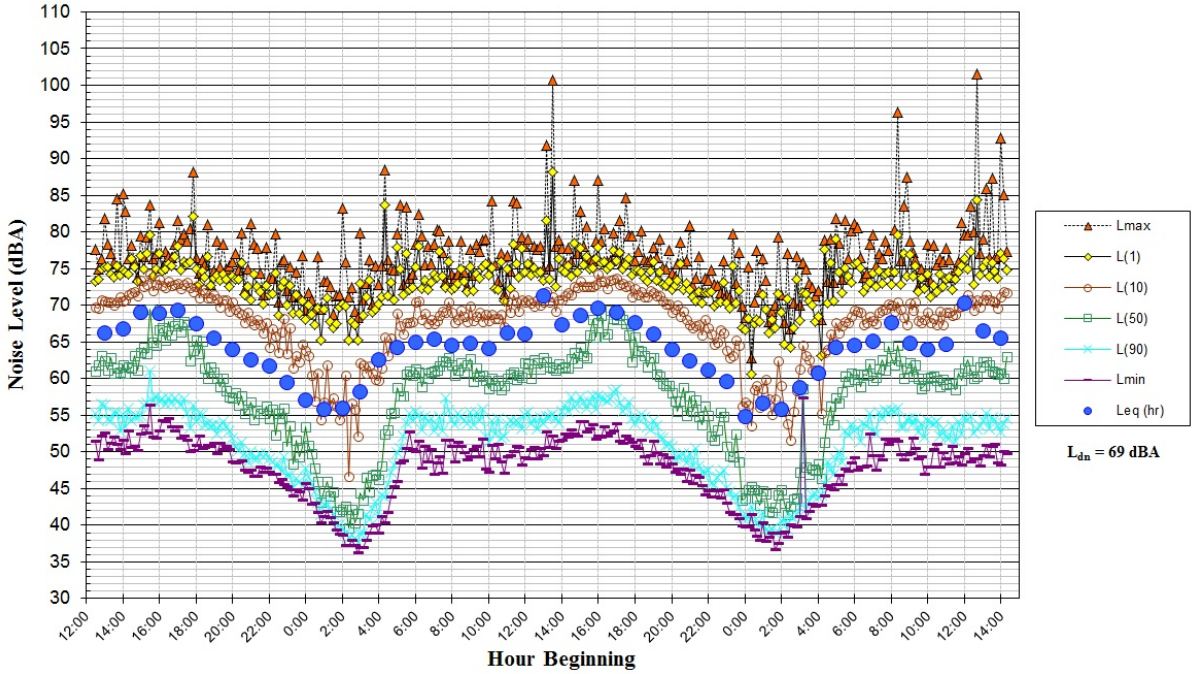


FIGURE 4 Noise Levels at LT-2, ~55 feet North of the Centerline of South Grimmer Boulevard, from May 26 through 28, 2015

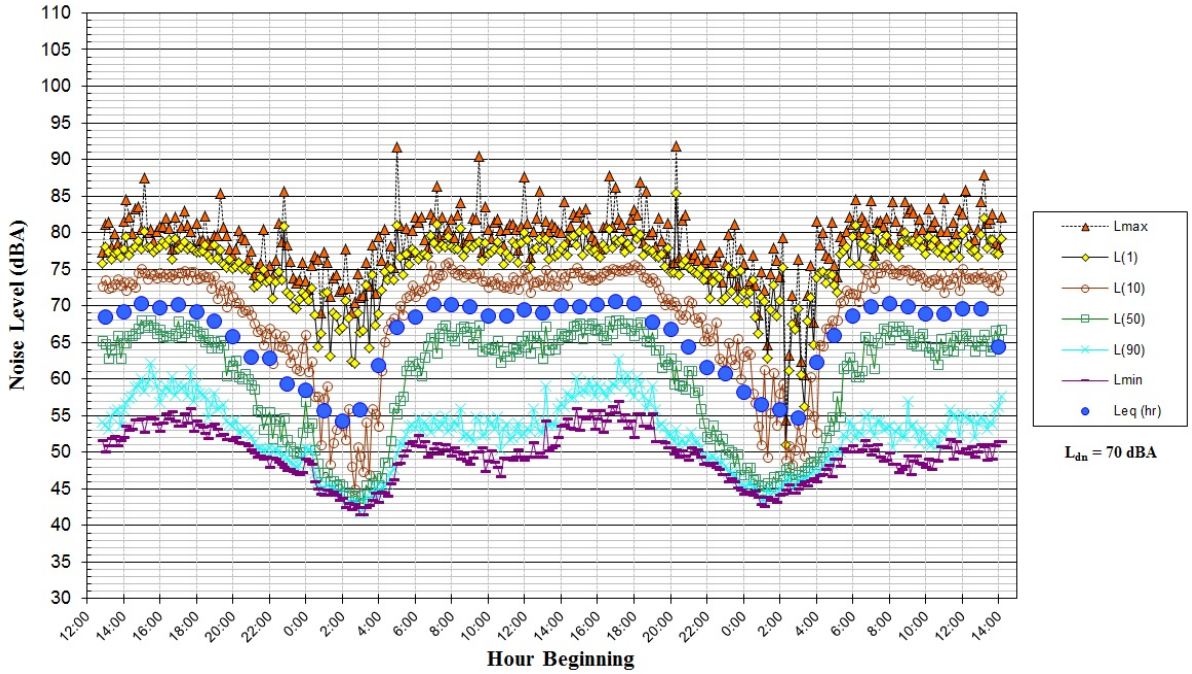


FIGURE 5 Noise Levels at LT-3, ~15 feet South of the Centerline of Tavis Place, from May 26 through 28, 2015

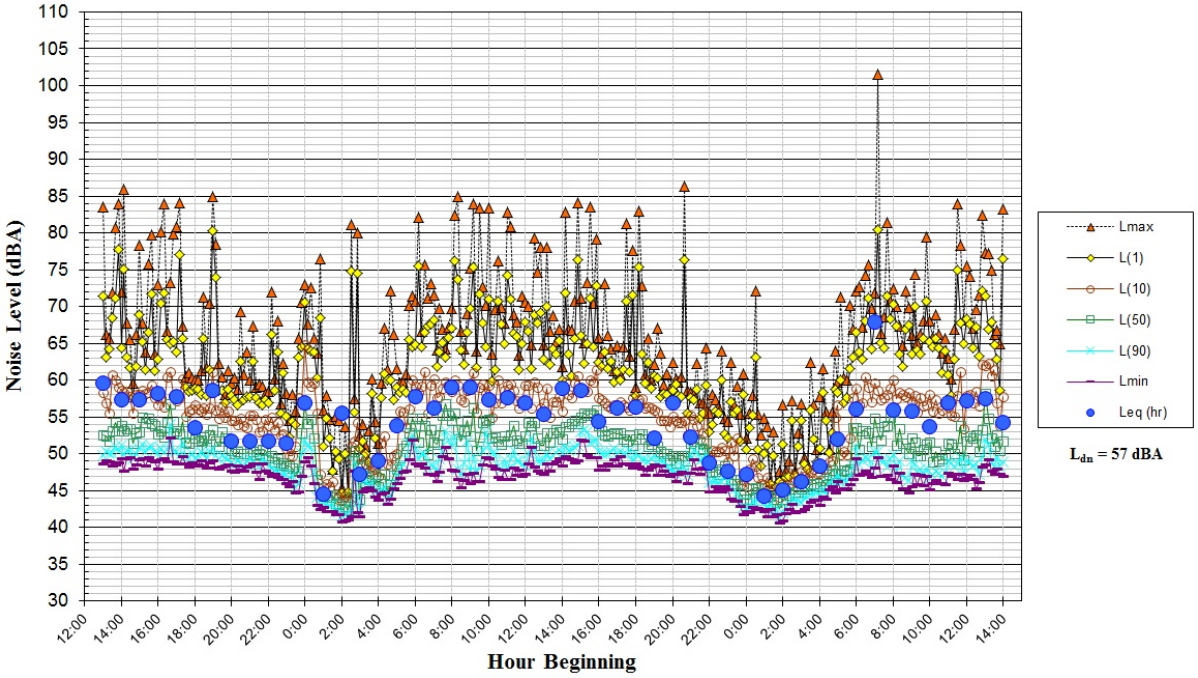


FIGURE 6 Noise Levels at LT-4, ~100 feet West of the Nearest UPRR Track, from May 26 through 28, 2015

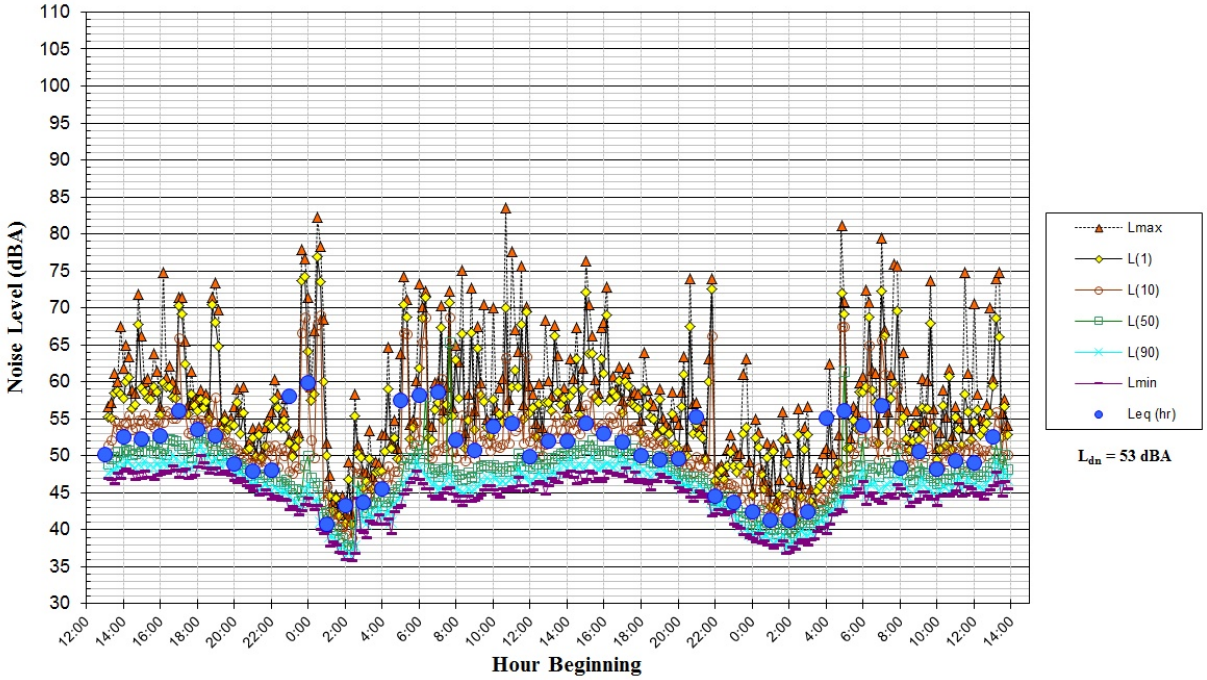


FIGURE 7 Noise Levels at LT-5, ~35 feet West of the Centerline of Old Warm Springs Boulevard, from May 26 through 28, 2015

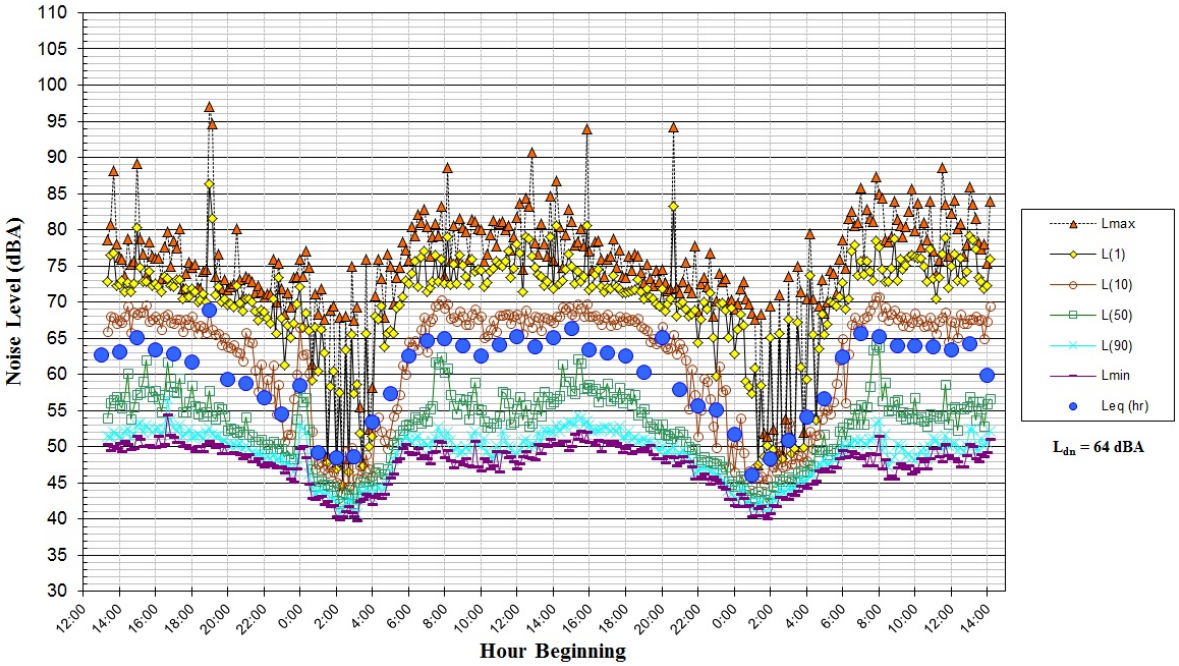


FIGURE 8 Noise Levels at LT-6, Along the Northern Property Line of the Project Site, from May 26 through 28, 2015

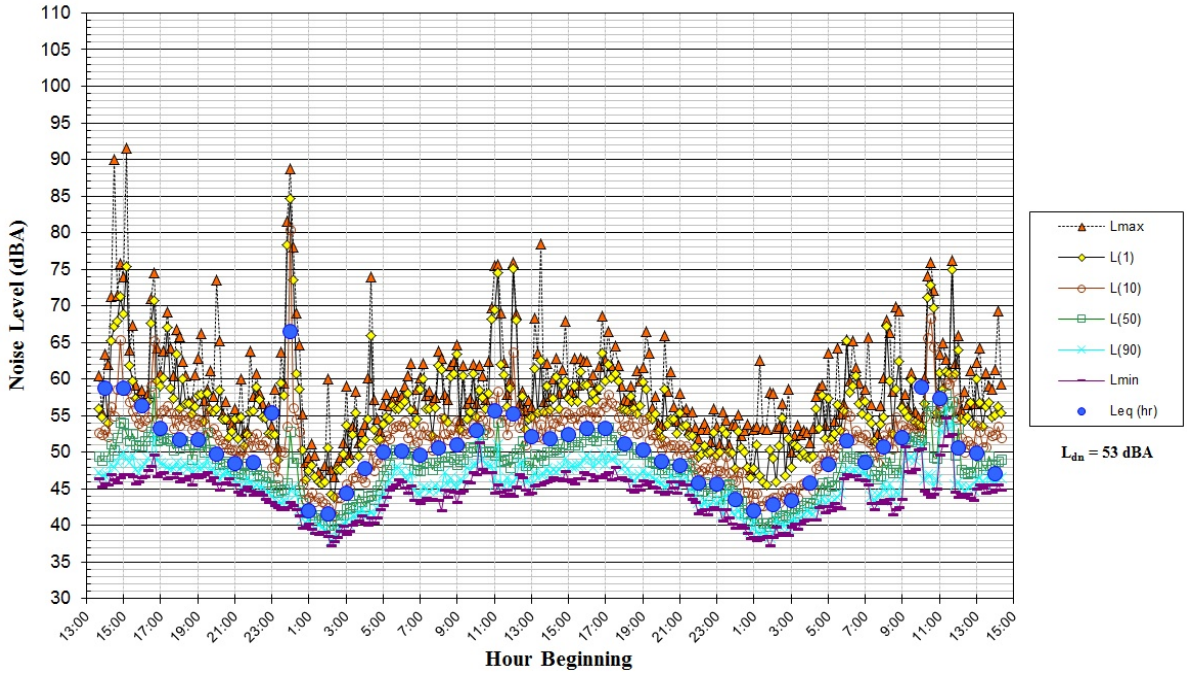


TABLE 4 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$	L_{dn}*
ST-1: ~75 feet south of the centerline of South Grimmer Boulevard (5/26/2015, 14:10-14:20)	76	71	66	59	52	62	63
ST-2: ~165 feet north of the centerline of South Grimmer Boulevard (5/26/2015, 14:30-14:40)	64	62	58	54	51	55	56

*Note: L_{dn} approximated by correlating to corresponding period at long-term site.

Existing Vibration Environment

Existing ground-borne vibration at the project site would result from railroad train pass-bys along the adjacent UPRR tracks. Vibration measurements were attempted on Tuesday, May 26, 2015, between 12:30 p.m. and 3:00 p.m., on Thursday, May 28, 2015, between 9:30 a.m. and 3:00 p.m., and on Thursday, July 30, 2015, between 6:30 p.m. and 12:00 a.m.; however, during these three separate time periods, no train pass-bys were observed. A fourth attempt was made on Wednesday, August 5, 2015, between 3:00 p.m. and 8:30 p.m. In this time period, one train was observed. Vibration measurements were made at two locations, V-1 and V-2, which were approximately 100 and 150 feet, respectively, from the center of the UPRR tracks. The locations are shown in Figure 2.

The instrumentation used to make the vibration measurements included an Edirol Solid State Audio Recorder and seismic grade, low noise accelerometers firmly fixed to the ground. This system is capable of accurately measuring very low vibration levels. Vibration levels measured on the site are representative of vibration levels at ground level (i.e., vibration levels that would enter the building foundation).

On Wednesday, August 5, 2015, between 3:00 p.m. and 8:30 p.m., one freight train pass-by was observed passing the project site. The train was headed in the southbound direction, passing the site at approximately 6:40 p.m. at a speed of approximately 13 mph. The train had three engines, dozens of cars, and took approximately five minutes to complete the pass-by. Maximum overall vibration levels from this event were 61 VdB at V-1 and below 60 VdB at V-2.

Future Exterior Noise Environment

The future noise environment at the project site would be dominated by vehicular traffic along Fremont Boulevard and South Grimmer Boulevard, train traffic along the adjacent UPRR tracks, and BART trains on the extension project, which is currently under construction. Under the conditions of the proposed project, several access roadways would be constructed on the site. Without a traffic study for the proposed project, the traffic study conducted for the Warm Springs/South Fremont Community Plan EIR[1] would provide the most accurate future traffic projections attributable to the planned growth in the project site vicinity. Based on a review of the data contained in the Community Plan EIR, traffic noise levels along Fremont Boulevard north of South Grimmer Boulevard would increase by 2 dBA L_{dn} by the year 2035 (including construction of the proposed project) compared to existing conditions. The future traffic noise level increase predicted for the segment of South Grimmer Boulevard between Fremont Boulevard and Old Warm Springs Boulevard would be 4 dBA L_{dn}, while east of Old Warm Springs Boulevard, the expected increase would be 6 dBA L_{dn} compared to existing conditions. Future traffic noise along the segment of Old Warm Springs Boulevard north of South Grimmer Boulevard is expected to increase by 5 dBA L_{dn} compared to existing conditions.

While the train activity along the UPRR tracks is expected to remain similar to existing conditions in the future, a BART extension project is under construction. The BART track would be located approximately 75 feet to the east of the nearest UPRR tracks. In 2003, a noise and vibration assessment for the BART extension project at Warm Springs was conducted by *HMMH*[2]. According to this study, the operating times of the BART Warm Springs Extension will be between 4:00 a.m. and 12:00 a.m., with peak hours between 4:00 a.m. and 7:00 p.m. The train speeds for that study were assumed to range from 50 to 70 mph, and the cumulative noise increase calculated for a train traveling at 70 mph at the proposed project site was 2 dBA L_{dn} at a distance of 200 feet from the tracks. While these speeds may not be accurate for pass-bys at the proposed project site due to the close proximity of the station to the site, this increase would represent the worst-case scenario for assessing the future noise environment. Projected maximum noise level measured at approximately 200 feet during a future BART pass-by would be 77 dBA L_{max}, assuming a speed of 70 mph.

As shown in Figure 2, the proposed project site is divided into Parcels 1, 2, 3A, 3B-1, 3B-2, 3B-3, and 4. At the time of this study, limited information regarding building layouts and elevations was provided. However, future exterior noise levels were calculated based on general information and assumptions.

Proposed Hotel and Restaurant

Parcel 1 would consist of a hotel and restaurant located in the northwestern corner of the intersection at South Grimmer Boulevard and Old Warm Springs Boulevard. From Figure 2, there are two outdoor use areas at the proposed hotel: the pool area located on the interior of the site and the restaurant/lounge that may include an outdoor dining area located in the southeast corner of Parcel 1. The pool area is shielded from traffic along Old Warm Springs Boulevard and partially shielded from traffic along South Grimmer Boulevard; however, this outdoor use area would have direct line-of-sight to South Grimmer Boulevard along the western boundary of Parcel 1. The nearest setback from the centerline would be approximately 175 feet. At this distance, and with the partial shielding provided by the proposed hotel façade, the future exterior noise levels would be 64 dBA L_{dn}. According to Table 10-4 in the City's General Plan, the exterior noise threshold for hotels is 65 dBA L_{dn}. The future noise environment at the proposed pool area would meet the City's threshold and not require mitigation.

The proposed restaurant/lounge outdoor dining area would be positioned along the east side of the building along Old Warm Springs Boulevard and away from the intersection of Old Warm Springs Boulevard and South Grimmer Boulevard. This outdoor use area would have direct line-of-sight to Old Warm Springs Boulevard and the intersection of Old Warm Springs Boulevard and South Grimmer Boulevard. This commercial outdoor use area would be set back from the centerline of Old Warm Springs Boulevard by 45 to 100 feet and would be at least 80 feet from

[2] Draft Noise and Vibration Impact Assessment for the San Francisco Bay Area Rapid Transit District (BART) Warm Springs Extension Project, HMMH, Inc., February 2003.

the center of the intersection. At these distances, the future exterior noise levels would range from 68 to 69 dBA L_{dn}. Since the City's "normally acceptable" exterior noise threshold for commercial uses is 70 dBA L_{dn}, future noise levels would not exceed the City's threshold and would not require mitigation.

Proposed Residential/Mixed-Use Land Uses

Parcel 3A, which is located to the north of South Grimmer Boulevard between Old Warm Springs Boulevard and the UPRR tracks, would include apartments with a parking garage, as well as some retail shops at the corner of South Grimmer Boulevard and Old Warm Springs Boulevard. Figure 2 shows five courtyard areas and one plaza area (Inspiration Plaza) that could be used for outdoor uses. The two courtyards on the southern half of Parcel 3A are completely shielded from vehicular traffic along the surrounding roadways and from train traffic on the adjacent tracks by the proposed apartment complex. Assuming that the apartment/retail shop building is continuous with no openings that would expose the courtyards to direct line-of-sight to the roadways and/or the train tracks, both of these courtyards would have future exterior noise levels below 60 dBA L_{dn}, with building heights of one or more floors. According to the long-term noise measurement data taken at LT-4, the maximum instantaneous noise levels taken 100 feet from the UPRR tracks would be 84 dBA L_{max}, and according to the *HMMH*[2] study, the maximum instantaneous noise levels taken 200 feet from the future BART tracks would be 77 dBA L_{max}. Therefore, at the courtyard nearest the UPRR tracks, maximum instantaneous noise levels are expected to be below 65 dBA L_{max} during both UPRR and the future BART pass-by events. While each of the courtyards on the northern half of Parcel 3A would be shielded from the train tracks, two of the three courtyards would have direct line-of-sight to Tavis Place. The future exterior noise levels along Tavis Place would be 62 dBA L_{dn} at a distance of 15 feet from the centerline. At 75 feet from the centerline, which would be the location of the nearest courtyard, the future exterior noise levels would be below 60 dBA L_{dn} for all three courtyards, with maximum instantaneous noise levels at the northeastern courtyard below 65 dBA L_{max}. Inspiration Plaza is an open space area on private property that is accessible to the public from Old Warm Springs Boulevard. Located between the proposed buildings, the plaza would be shielded from traffic noise along South Grimmer Boulevard but would have direct line-of-sight to Old Warm Springs Boulevard. The plaza appears to be a circular outdoor use area surrounded by a walking path. The center of the courtyard is set back from the centerline of the roadway by approximately 100 feet. At this distance, the future exterior noise level would be 64 dBA L_{dn}. The City's "normally acceptable" threshold for parks is 65 dBA L_{dn}; therefore, this would not be an impact and would not require mitigation.

All three Parcel 3Bs consist of townhomes and flats with individual garages. The buildings adjacent to Old Warm Springs Boulevard, along the northern and southern boundaries of Parcel 3B-1, and along the southern boundary of Parcel 3B-2 would be shopkeeper buildings, which have garages, lobbies, and office/retail space on the first floors and residential living space on the second floors. The mixed-use residential parcels would include plazas, which are identified in Figure 9 by orange ovals. These plazas would not be used for formal, active outdoor uses;

therefore, they would not be subject to the exterior noise threshold established in the City's General Plan. All three Parcel 3Bs have open space or courtyard areas that would be subject to the exterior noise threshold. These are identified in Figure 9 by green rectangles. The townhomes would not have backyards or private outdoor use areas. Porches, patios, and balconies are typically not considered outdoor use areas and would not require noise mitigation.

FIGURE 9 Outdoor Use Areas Identified for the Townhomes Located on all Parcel 3Bs

There are four courtyards and an open space area located on the 3B parcels, each of which is located between townhome buildings. The courtyard on Parcel 3B-1 would be set back from South Grimmer Boulevard by approximately 205 feet, and the courtyard on Parcel 3B-2 would be set back from Old Warm Springs Boulevard by approximately 165 feet. Both courtyards on Parcel 3B-3 would have setbacks from Fremont Boulevard ranging from approximately 480 to 500 feet, while the courtyard on the southern part of the parcel would also be set back from South Grimmer Boulevard by approximately 255 feet. Due to these setbacks and the shielding provided by the surrounding buildings, future exterior noise levels at each of the courtyards would be less than 60 dBA L_{dn}. The open space located on Parcel 3B-3, which is shown in

Figure 9, would be shielded from traffic noise along South Grimmer Boulevard by the proposed townhomes on the parcel and existing office and commercial uses to the south of the parcel. The proposed office building and parking garage on Parcel 4 would provide partial shielding from the traffic noise along Fremont Boulevard, but this common outdoor use area would have direct line-of-sight to Fremont Boulevard and Old Warm Springs Boulevard. The setback from the centerline of Fremont Boulevard would range from 480 to 765 feet, and the setback from the centerline of Old Warm Springs Boulevard would range from 695 to 1,060 feet. At these distances, the future exterior noise levels would be at or below 60 dBA L_{dn}. This would meet the City's 60 dBA L_{dn} threshold for residential outdoor use areas and would not require mitigation.

Proposed Office Buildings

Located to the north of Parcel 1 along Old Warm Springs Boulevard is Parcel 2, which would consist of shared office space with at-grade parking. The noise environment for this parcel would be dominated by traffic along Old Warm Springs Boulevard. At a setback of 35 feet from the centerline, future exterior noise levels would be 69 dBA L_{dn}, which would meet the City's threshold of 70 dBA L_{dn} for exterior noise environments at office buildings. Therefore, any potential outdoor use area proposed at Parcel 2 would be compatible for this land use.

Parcel 4, which is located along Fremont Boulevard just north of the existing office buildings, would consist of office buildings with an adjacent parking garage. Figure 2 shows an outdoor use area on Parcel 4 located to the east of the proposed buildings. While heights of neither the proposed office buildings nor parking garage were available at the time of this study, both structures would provide partial shielding from traffic along Fremont Boulevard and South Grimmer Boulevard. Assuming each structure is at least one story tall, the future exterior noise levels at the outdoor use area would be below the 70 dBA L_{dn} threshold. No mitigation measure would be required at either office building parcel.

Future Interior Noise Environment

Proposed Hotel

The City of Fremont requires that interior noise levels be maintained at 45 dBA L_{dn} or less for hotels.

For the hotel on Parcel 1, the southern façade of the building is setback from the centerline of South Grimmer Boulevard by 60 to 65 feet. At these distances, the hotel rooms would be exposed to exterior noise levels of 74 dBA L_{dn}. The eastern façade would have setbacks from South Grimmer Boulevard ranging from 130 to 300 feet and setbacks from Old Warm Springs Boulevard ranging from 50 to 115 feet. The rooms along this building façade would be exposed to exterior noise levels ranging from 67 to 70 dBA L_{dn}. The rooms along the western side of the proposed hotel would have setbacks from the centerline of South Grimmer Boulevard ranging from 60 to 340 feet, and at these distances, the exterior noise exposure would range from 63 to 74 dBA L_{dn}. The northern façade would be exposed to traffic noise from Old Warm Springs

Boulevard and would have setbacks from the centerline ranging from 50 to 265 feet. At these distances, the exterior noise levels would range from below 60 to 67 dBA L_{dn} at the building exterior.

Projected interior noise levels for the proposed hotel on Parcel 1 would potentially be as high as 54 dBA L_{dn} at the rooms adjacent to South Grimmer Boulevard. Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard commercial hotel construction provides approximately 20 to 25 dBA of exterior-to-interior noise reduction, assuming windows are closed. For exterior noise environments ranging from 65 to 70 dBA L_{dn}, interior noise levels can typically be maintained below 45 dBA L_{dn} with the incorporation of an adequate forced-air mechanical ventilation system in each hotel room, allowing the windows to be closed. In noise environments of 70 dBA L_{dn} or greater, a combination of forced-air mechanical ventilation and sound-rated construction methods are often necessary to meet the interior noise level limit.

Proposed Residential Land Uses

The City of Fremont requires that interior noise levels be maintained at 45 dBA L_{dn} or less for residential land uses. Additionally, typical maximum instantaneous noise levels should not exceed 50 dBA L_{max} in bedrooms during nighttime hours and 55 dBA L_{max} in bedrooms during daytime hours, as well as in other rooms during daytime and nighttime hours.

The southern façade of the apartment complex on Parcel 3A would have setbacks from the centerline of South Grimmer Boulevard ranging from 80 to 105 feet, and at these distances, the apartments would be exposed to exterior noise levels ranging from 73 to 74 dBA L_{dn}. Along the eastern façade of the apartment complex, the apartments would be exposed to exterior noise from train pass-bys along the UPRR and future BART tracks, as well as from traffic along South Grimmer Boulevard. South of the parking garage, the apartments would be setback from South Grimmer Boulevard by 105 to 245 feet. The setbacks from the UPRR and BART tracks would be approximately 135 and 205 feet, respectively. The exterior noise exposure at these apartments would range from 68 to 73 dBA L_{dn} and have maximum instantaneous noise levels up to 82 dBA L_{max}. The apartments along the eastern façade of the building located north of the parking garage would have setbacks of 375 to 535 feet from the centerline of South Grimmer Boulevard and of 130 and 185 feet from the UPRR and future BART tracks, respectively. At these setbacks, the apartments would be exposed to future exterior noise levels ranging from below 62 to 65 dBA L_{dn} with maximum instantaneous noise levels up to 82 dBA L_{max}. The western façade of the apartment building would be exposed to exterior noise levels ranging from 68 dBA L_{dn} in the northwestern corner of the parcel, which is dominated by traffic noise along Old Warm Springs Boulevard, to 74 dBA L_{dn} in the southwestern corner of the parcel, which is dominated by traffic along South Grimmer Boulevard. The apartments along the northern façade, which would be setback from the centerline of Tavis Place by approximately 25 to 65 feet, would have exterior noise exposure at or below 60 dBA L_{dn}, as would the apartments located on the interior of Parcel 3A.

The shopkeeper buildings adjacent to South Grimmer Boulevard on Parcel 3B-1 would consist of office/retail uses on the first floors and residential uses on the second floors. The proposed residences would be exposed to exterior noise levels of 73 dBA L_{dn}. Along the western boundary, the buildings would consist of residential land uses with setbacks from the centerline of South Grimmer Boulevard ranging from 175 to 295 feet. At these distances, both floors of the residences would be exposed to exterior noise levels ranging from 64 to 68 dBA L_{dn}. The townhomes along the eastern boundary of Parcel 3B-1 would be setback from the centerline by approximately 160 to 265 feet, and at these distances, both floors would be exposed to exterior levels ranging from 65 to 68 dBA L_{dn}. Due to setbacks from Old Warm Springs Boulevard being 350 feet or more and shielding from South Grimmer Boulevard provided by the proposed buildings on Parcel 3B-1, the residential spaces located on the upper floors of the shopkeeper buildings on the northern boundary of the parcel, as well as the townhomes located on the interior of the parcel would be exposed to exterior levels at or below 60 dBA L_{dn}.

For the residential uses located on the upper floors of the shopkeeper buildings adjacent to Old Warm Springs Boulevard on Parcel 3B-2, the residences would be exposed to exterior noise levels up to 67 dBA L_{dn}. Along the northern boundary, the building setbacks would range from 95 to 425 feet from the centerline of Old Warm Springs Boulevard. At these distances, the residences would be exposed to future exterior noise levels ranging from below 60 to 64 dBA L_{dn}. Due to setbacks and shielding provided by intervening buildings, the remaining residential uses on Parcel 3B-2 would be exposed to exterior noise levels at or below 60 dBA L_{dn}.

The first row of townhomes located along the southern and eastern boundary of Parcel 3B-3 with direct line-of-sight to South Grimmer Boulevard would be exposed to exterior noise levels up to 66 dBA L_{dn}. The rest of the townhomes on this parcel would be exposed to exterior levels at or below 60 dBA L_{dn}.

Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA L_{dn}, the inclusion of adequate forced air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA L_{dn}, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant’s discretion.

Proposed Office Buildings

The State of California requires that wall and roof-ceiling assemblies exposed to the adjacent roadways have a composite Sound Transmission Class (STC)[3] rating of at least 50 or a composite Outdoor-Indoor Transmission Class (OITC) rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the commercial property falls within the 65 dBA L_{dn} noise contour for an expressway. According to the Warm Springs/South Fremont Community Plan EIR[1], Parcels 2 and 4 fall within the 65 dBA L_{dn} 2035 contour lines for Old Warm Springs Boulevard and Fremont Boulevard, respectively. The State also requires interior noise levels to be maintained at 50 dBA $L_{eq(1\text{-}hr)}$ or less during hours of operation at the proposed office building on both parcels.

The proposed office building on Parcel 2 would be set back from the centerline of Old Warm Springs Boulevard by approximately 60 feet. At this distance, the nearest façade would be exposed to future exterior noise levels ranging from 61 to 71 dBA $L_{eq(1\text{-}hr)}$ during daytime hours of operation. The nearest façade of the proposed office building located on Parcel 4 would be setback from the centerline of Fremont Boulevard by approximately 85 feet. At this distance, the building façade would be exposed to future exterior noise levels ranging from 64 to 73 dBA $L_{eq(1\text{-}hr)}$ during daytime hours of operation. A wall assembly with an STC rating of at least 50 and window assemblies with an STC rating of at least 40 would provide at least 35 to 40 dBA of noise reduction in interior spaces. The inclusion of adequate forced-air mechanical ventilation systems is normally required so windows may be kept closed at the occupant's discretion. The sound-rated construction materials established in the Cal Green Code in combination with forced-air mechanical ventilation would satisfy the threshold for the both office buildings.

Mitigation Measure to Reduce Interior Noise Levels

The implementation of MM NOI-2 and NOI-5a and 5b would allow all vibration and noise levels to be compliant with City of Fremont noise standards.

Detailed building floor plans and elevations were not provided at the time of this analysis; however, preliminary calculations indicated that the implementation of MM NOI-5a and 5b through the following recommendations could be incorporated into the proposed project to reduce interior noise levels:

- Parcel 1: An adequate forced-air mechanical ventilation system would be required in each room to control interior noise and achieve the interior noise standards. Additionally, sound-rated windows and wall assemblies with a minimum STC rating of 31 would be required for the rooms facing South Grimmer Boulevard and for the rooms along the

[3] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

eastern and western façades that are within 130 feet of the centerline of South Grimmer Boulevard.

- Parcel 3A: Sound-rated windows and wall assemblies (STC 31 or greater) would be satisfactory for the apartments with direct line-of-sight to the UPRR and future BART tracks (eastern façade) in order to achieve 45 dBA L_{dn}, as well as meet the 50 dBA L_{max} standard for bedrooms and the 55 dBA L_{max} for other rooms. Along the southern façade, minimum STC ratings of 31 would be required to meet the interior noise standards at the multi-family residential land uses. Minimum STC ratings of 28 to 31 would be required along the northern façade. For the apartments along the western façade, minimum STC ratings of 28 would be required to meet the interior requirements. Standard residential construction materials with an adequate forced-air mechanical ventilation system would be required for the apartments located on the interior of the parcel.

- Parcel 3B-1: Sound-rated windows and doors (STC 31 or greater) would be satisfactory for the townhomes adjacent to the South Grimmer Boulevard in order to achieve 45 dBA L_{dn}. For the townhomes located on the eastern and western boundaries of Parcel 3B-1, residential construction materials with a minimum STC rating of 28 would be required to meet the interior threshold. Standard residential construction with forced-air mechanical ventilation would be adequate for the townhomes on the rest of the parcel.

- Parcel 3B-2: For the townhomes located in the buildings adjacent to Old Warm Springs Boulevard, sound-rated windows and doors with a minimum STC rating of 28 would be required to meet the City's interior threshold. Standard residential construction materials with an adequate forced-air mechanical ventilation system would be required for the townhomes along the northern boundary nearest to Old Warm Springs Boulevard, and standard residential construction materials would be adequate for the rest of the parcel.

- Parcel 3B-3: Sound-rated windows and doors with a minimum STC rating of 26 to 28 would be required for the first row of townhomes on Parcel 3B-3. Standard residential construction materials with an adequate forced-air mechanical ventilation system would be required for the rest of the townhomes on the parcel.

- A qualified acoustical consultant shall review the final site plan, building elevations, and floor plans prior to issuance of building or grading permits and recommend building treatments to reduce interior noise levels at the hotel to 45 dBA L_{dn} or lower and ensure that the 50 dBA L_{max} standard for bedrooms and the 55 dBA L_{max} for other rooms is met, as well. At the proposed office buildings on Parcels 2 and 4, the consultant should ensure that the interior noise levels are at or below 50 dBA $L_{eq(1\text{-}hr)}$.

The above recommendations would be adequate to achieve the interior noise thresholds for each land use; however, these are preliminary recommendations only and would need to be examined

in more detail once detailed layouts and elevations are available as part of the acoustical analysis required by MM NOI-5a prior to issuance of building or grading permits.

Future Exterior Vibration Environment

The City of Fremont has adopted the U.S. Department of Transportation, Federal Transit Administration's (FTA) vibration impact assessment criteria[4] for use in evaluating vibration impacts associated with development within 150 feet of rail lines. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria for ground-borne vibration are shown in Table 5. Note that there are criteria for frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

The future vibration environment at the project site would be dominated by freight trains along the UPRR tracks and by passenger trains along the future BART tracks. The train activity along the UPRR tracks is expected to be unaltered under future conditions, but the addition of the future BART extension would increase the daily train pass-bys. The *HMMH*[2] study did not provide an approximate number of trips per day, but most rapid transit lines have more than 70 events per day, which is assumed for the worst-case scenario in this study.

The future vibration levels due to UPRR freight trains would remain 61 VdB at 100 feet. At 130 to 135 feet, which is the distance from the UPRR tracks to the nearest building façade, the maximum future vibration levels would be 60 VdB. From the noise and vibration survey conducted for this project, the daily freight trains along the UPRR tracks would be fewer than 30 and fall into the "infrequent events" category in Table 5. For residential land uses, the threshold would be 80 VdB, which would not be exceeded under future conditions. These results are in accordance with the findings in the Warm Springs/South Fremont Community Plan EIR[1]. No further impact would result from the proposed project.

In the *HMMH*[2] study, the maximum project vibration level expected for a train passing the project site at 70 mph would be 55 VdB at approximately 230 feet. The eastern façade of the apartments on Parcel 3A would have setbacks from the future BART tracks of 185 to 205 feet. At these distances, the future vibration levels would be 56 VdB. According to Table 5, the vibration impact level for "frequent events," which would include most rapid transit lines, would be 72 VdB for residential land uses. The future vibration levels from the BART line would not exceed this threshold at the nearest building façade on Parcel 3A. No further impact would result from the proposed project. Persons at rest may perceive the vibration; however, vibration controls are not required.

[4]U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006, FTA-VA-90-1003-06.

TABLE 5 Ground-borne Vibration Impact Criteria

Land Use Category	Ground-borne Vibration Impact Levels (VdB re 1 µinch/sec, RMS)		
	Frequent Events[1]	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:

1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
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 should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

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Please feel free to contact us with any questions on the analysis or if we can be of further assistance.

Sincerely,

Carrie J. Janello
Consultant
Illingworth & Rodkin, Inc.