13. NOISE

This EIR chapter describes the existing noise environment in the project site vicinity, anticipated changes in that noise environment as a result of proposed project development, and related significant adverse noise impacts and mitigation needs. The EIR acoustical consultants, Illingworth & Rodkin, Inc., conducted the technical analyses for this EIR chapter.

13.1 SETTING

13.1.1 Fundamentals of Acoustics

(a) Definitions of Noise. Noise is defined as unwanted sound. The effects of noise can range from interference with sleep, concentration, and communication, to physiological stress, and at higher noise levels, hearing loss.

(b) Noise Measurement. Sound levels are usually measured and expressed in decibels (dB), with 0 dB corresponding roughly to the threshold of hearing. The term "decibels" and other related technical terms are defined in Table 13.1.

The method commonly used to quantify environmental noise involves measurement of all frequencies of sound, with an adjustment to reflect the fact that human hearing is less sensitive to low and high frequencies than to midrange frequencies. This measurement adjustment is called "A" weighting. A noise level so measured is called an A-weighted sound level (dBA).[1] Examples of typical A-weighted noise levels in the environment and industry are provided in Table 13.2.

Environmental noise fluctuates in intensity over time. Therefore, time-averaged noise level computations are typically used to quantify noise levels and determine impacts. The two average noise level descriptors most commonly used are L_{dn} and CNEL. L_{dn}, the day/night average noise level, is the 24-hour average, with a 10 dBA penalty added for nighttime noise (10:00 PM to 7:00 AM) to account for the greater human sensitivity to noise during this period. CNEL, the community noise equivalent level, is similar to L_{dn}, but adds a five-dBA penalty to evening noise (7:00 PM to 10:00 PM).

One way of anticipating a person's subjective reaction to a new noise is to compare the new noise with the existing noise environment to which the person has become adapted, i.e., the so-called "ambient" noise level. With regard to increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this EIR chapter:

[1] In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve.

Table 13.1
DEFINITIONS OF ACOUSTICAL TERMS

Term	Definitions
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, which is 20 micropascals (20 micronewtons per square meter).
Frequency	The number of complete pressure fluctuations per second above and below atmospheric pressure.
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. *All sound levels in this EIR chapter are A-weighted.*
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.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
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 PM to 10:00 PM and after addition of 10 decibels to sound levels in the night between 10:00 PM and 7:00 AM.
Day/Night Noise Level, L_{dn}	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 PM and 7:00 AM.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
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.
Single-Event Noise Exposure Level (SEL)	The sound exposure level of a single noise event (such as an aircraft flyover or a train passby) measured over the time interval between the initial and final times for which the sound level of the single event exceeds the background noise level.

SOURCE: Illingworth & Rodkin, Inc.

Table 13.2
TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

At a Given Distance from Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100')	130		
Jet Takeoff (200')	120		Pain Threshold
	110	Rock Music Concert	
Pile Driver (50')	100		Very Loud
Ambulance Siren (100')			
	90	Boiler Room	
Freight Cars (50')		Printing Press Plant	
Pneumatic Drill (50')	80	In Kitchen With Garbage Disposal Running	
		Vacuum Cleaner	
Freeway (100')			
	70		Moderately Loud
	60	Data Processing Center	
		Department Store	
Light Traffic (100')	50	Private Business Office	
Large Transformer (200')			
	40		Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

SOURCE: Illingworth & Rodkin, Inc

- except in carefully controlled laboratory experiments, a change of one dBA cannot be perceived.
- outside of the laboratory, a three dBA change is considered a just-perceivable difference.
- a change in noise level of at least five dBA is required before any noticeable change in community response would be expected.
- a 10 dBA increase is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse change in community response.

(c) Structural Attenuation. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed (see subsection 13.1.2 below).

(d) Typical Noise Levels. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, and those facing major roadways and freeways typically need special sound-rated windows and doors, and in severe noise environments modifications to the buildings' walls.

In typical planning practice, noise levels of 60 dB L_{dn}/CNEL are often used as a benchmark when assessing noise levels. Outdoor noise levels that exceed 60 dB L_{dn}/CNEL are generally considered inappropriate in residential areas.

13.1.2 Sleep and Speech Interference

Indoors, the thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn}, and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection, and most jurisdictions apply the same criterion for all residential uses.

13.1.3 Construction Vibration

Groundborne vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several methods are typically used to quantify the amplitude of vibration, including Peak Particle Velocity (PPV) and Root Mean Square (RMS) velocity. PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. RMS velocity is defined as the average of the squared amplitude of the signal. PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration.

The reaction of humans and effects on buildings from continuous levels of vibration is shown in Table 13.3. As discussed in subsection 13.1.1 above, annoyance is a subjective measure, and vibrations may be found to be annoying at much lower levels than those shown in the table, depending on the level of activity or the sensitivity of the individual.

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. In high-noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne noise that induces vibration in exterior doors and windows.

Construction activities can cause vibration that varies in intensity depending on several factors. Pile driving and the use of vibratory compaction equipment typically generate the highest construction-related groundborne vibration levels. Due to the impulsive nature of such activities, the use of the peak particle velocity descriptor (ppv) is used routinely to measure and assess groundborne vibration; the ppv is also used to measure the degree of annoyance for humans and to assess the potential for vibration to induce structural damage.

The two primary concerns with construction-induced vibration--the potential to interfere with the enjoyment of life and the potential to damage a structure--are evaluated against different vibration limits. Studies have shown that the threshold of vibration perception for average persons is in the range of 0.2 to 0.3 millimeters per second (mm/sec) (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 living or working in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as (1) cosmetic, such as minor cracking of building elements, or (2) damage that may threaten the integrity of the building. Safe vibration limits applied to assess the potential for damaging a structure vary by researcher; there is no general consensus as to what amount of vibration may pose a threat for structural damage to a building. However, construction-induced vibration that can be detrimental to a building is very rare and has only been observed in instances where the structure is in a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

<u>13.1.4 Train Vibration</u>

Railroad operations are potential sources of substantial ground vibration, depending on distance, the type and speed of trains, and the type of railroad track. Human response to ground vibration has been correlated best with the velocity of the ground, which 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. The abbreviation "VdB" is used in this document for "vibration decibels," to reduce the potential for confusion with the term for sound decibels (dB).

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 result from 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 13.3
REACTION OF PEOPLE AND DAMAGE TO BUILDINGS FROM CONTINUOUS VIBRATION LEVELS[1]

Velocity Level, PPV (in/sec)[1]	Human Reaction	Effect on Buildings
0.006 to 0.019	Threshold of perception: Possibility of intrusion.	Vibration unlikely to cause damage of any type.
0.08	Vibrations readily perceptible.	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected.
0.10	Level at which continuous vibrations begin to annoy people.	Virtually no risk of "architectural" damage to normal buildings.
0.20	Vibrations annoying to people in buildings.	Threshold at which there is a risk of "architectural" damage to normal dwellings such as plastered walls or ceilings.
0.4 to 0.6	Vibrations considered unpleasant by people subjected to continuous vibrations.	Vibration at this level would cause "architectural" damage and possibly minor structural damage.

SOURCE: Illingworth & Rodkin, Inc.

[1] PPV (in/sec) = peak particle velocity, inches per second.

Developing suitable criteria for groundborne vibration is restricted by the limited research into human response to vibration and human annoyance inside buildings. However, research for transit systems has developed vibration limits that can be used to evaluate human annoyance to groundborne vibration. These criteria are primarily based on experience with passenger train operations, such as rapid transit and commuter rail systems. The main difference between passenger and freight operations is the time duration of individual events; a passenger train lasts a few seconds, whereas a long freight train may last several minutes, depending on speed and length. Although these criteria are based on shorter duration events reflected by passenger trains, they are also used in this EIR chapter to reflect the potential for vibration annoyance on the project site due to large freight train operations.

13.1.5 Existing Noise Environment

The project site is located generally north and west of Railroad Avenue (which includes some commercial storefront establishments), along Bayfront Boulevard (currently undeveloped), and north of Sanderling Drive. The site is bounded by the Union Pacific Railroad (UPRR) to the north and west, residential land uses to the south, and the North Shore Business Park to the

[1]Transportation-Related Earthborne Vibrations, Caltrans, Technical Advisory, TAV-02-01-R9601, February 2002.

east. The dominant noise sources at the site and in the vicinity are local automobile traffic and passenger and freight train pass-bys. Highway traffic noise is a secondary contributor to the noise environment, since Interstate 80 and State Route 4 are at least two-thirds of a mile (approximately 3,500 feet) from the project site.

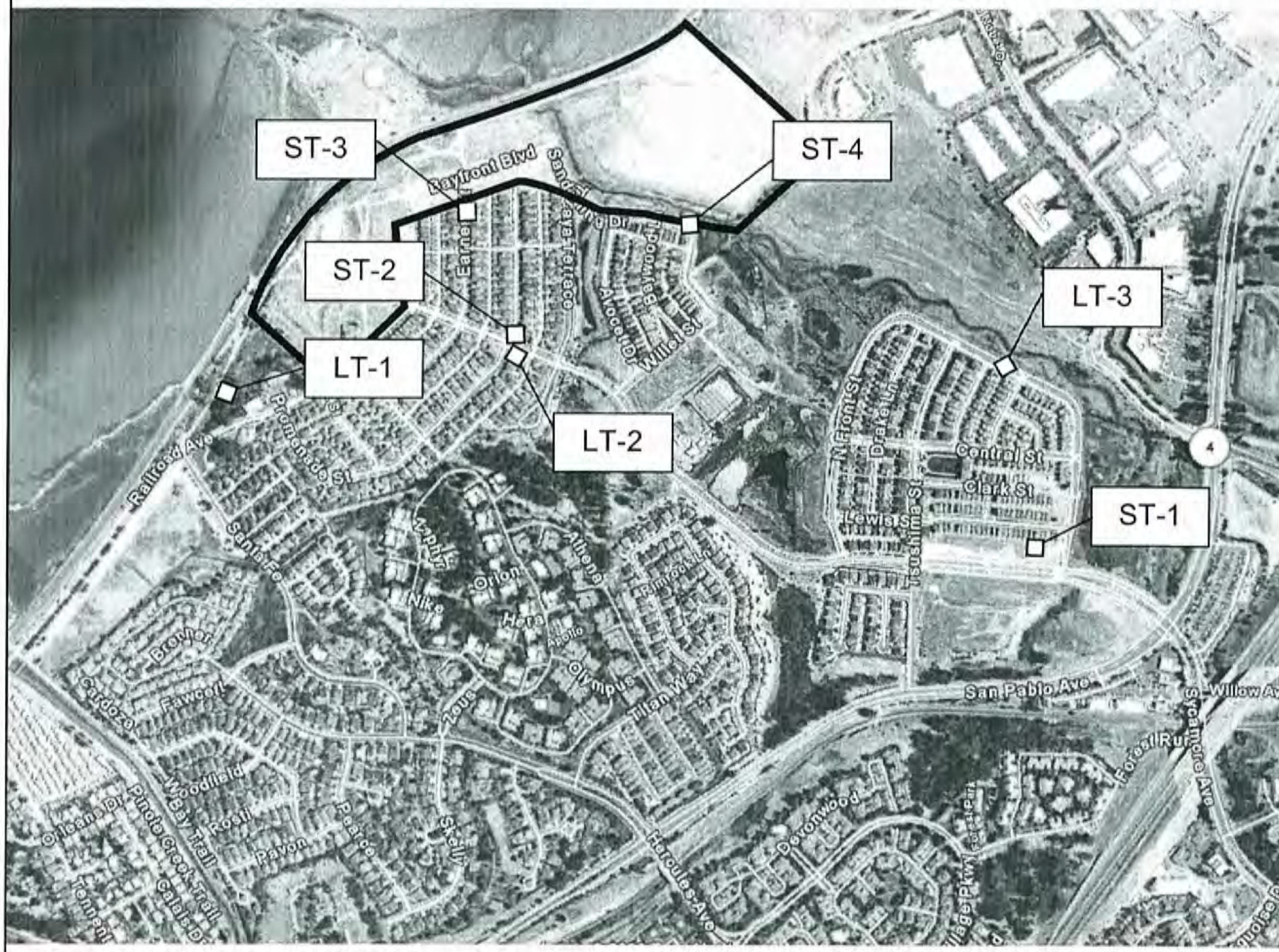
<u>(a) Hercules Bayfront Vicinity Noise Monitoring Survey Results</u>. A noise monitoring survey was conducted by Illingworth & Rodkin, EIR acoustical consultants, from approximately 1:00 PM on Monday, January 26, 2009 to about 12:00 PM on Wednesday, January 28, 2009. Noise levels were measured at noise-sensitive off-site locations in the project site vicinity. The off-site locations in the vicinity were chosen to represent nearby residential land uses. In addition, a noise measurement location along the UPRR right-of-way was selected to represent existing noise levels at the project site. The noise monitoring survey included seven locations in the project site vicinity as shown on Figure 13.1. Three of the noise measurements were 48 hours in duration (long-term: LT-1, LT-2, and LT-3). The other four noise measurements were 10 minutes in duration (short-term: ST-1, ST-2, ST-3, and ST-4). The results of these noise measurements are summarized in Table 13.4 and the long-term measurements are graphed in appendix 22.3.

Long-term measurement LT-1 represents ambient noise levels at the project site. The noise measurement was located about 160 feet from the center of the UPRR tracks along the Bay Trail. Train pass-bys were the major source of noise at this location. Hourly average noise levels typically ranged from approximately 52 to 65 dBA L_{eq} during daytime hours and from about 39 to 67 dBA L_{eq} at night. Hourly average noise levels containing train events, especially at night, controlled the day-night average noise level. The calculated day-night average noise level at location LT-1 was 68 dBA L_{dn}.

Long-term measurement LT-2 represents ambient noise levels at the residences along Sycamore Avenue and Promenade Street. The noise measurement was located approximately 25 feet from the center of Sycamore Avenue at Promenade Street. Vehicular traffic along Sycamore Avenue and distant train pass-bys were the major sources of noise at this location. Hourly average noise levels typically ranged from approximately 58 to 74 dBA L_{eq} during daytime hours and from about 47 to 57 dBA L_{eq} at night. The calculated day-night average noise level at location LT-2 was 61 dBA L_{dn}.

Long-term measurement LT-3 was located at South Front Street near Cabrillo Lane. Local traffic was the primary source of environmental noise at this location. Distant railroad trains also contributed. Hourly average noise levels typically ranged from about 50 to 72 dBA L_{eq} during daytime hours and from about 47 to 58 dBA L_{eq} at night. The calculated day-night average noise level at location LT-3 was 64 dBA L_{dn}.

Short-term measurements ST-1, ST-2, ST-3, and *ST-4* were conducted in 10-minute intervals on Monday, January 26, 2009. Measurement ST-1 was conducted at a distance of about 100 feet from the center of Sycamore Avenue and about 5 feet above the ground; the dominant source of noise was traffic along Sycamore Avenue. Noise measurement ST-2 was made at the northeast corner of Sycamore Avenue and Promenade Street, at a distance of about 25 feet from the center of Sycamore Avenue; the primary source of noise at this location was vehicular traffic along Sycamore Avenue. The third short-term noise measurement (ST-3) was conducted at the intersection of Bayfront Boulevard and Earnest Street, approximately 330 feet from the railroad tracks; the primary noise source at this location was vehicular traffic. The fourth short-



Project Perimeter

NOTES: See Table 13.4

SOURCE: Illingworth & Rodkin, Inc.

Figure 13.1

NOISE MEASUREMENT LOCATIONS IN PROJECT VICINITY

term noise measurement (ST-4) was conducted on Sanderling Drive near Refugio Creek; the primary noise source at this location was traffic. The short-term measurements are summarized in Table 13.4.

Noise levels were measured for the applicant by Charles M. Salter Associates, Inc. (Salter) in 2004.[1] Noise levels were monitored over a period of several days beginning March 31, 2004 and ending April 4, 2004. The referenced measured noise level 40 feet south of the railroad track centerline was 77 to 80 dBA L_{dn}. This correlates well with the measurement conducted by Illingworth & Rodkin in 2009 at Location LT-1 at 160 feet from the railroad tracks, accounting for the difference in distance between the two measurements. Maximum single-event noise levels reached 96 dBA at 40 feet. This also correlates well with the range of maximum noise levels of 75 to 85 dBA measured by Illingworth & Rodkin at 160 feet from the tracks at Location LT-1.

As indicated in the Salter report, project plans indicate the construction of a rail station and platform along the UPRR (as part of the proposed ITC project). Observations at other train stations indicate that the presence of a station may result in the sounding of warning horns in the vicinity of the station. The sounding of warning horns is regulated by the Federal Railroad Administration and the rules of the individual railroad company.

13.2 PERTINENT PLANS AND POLICIES

CEQA requires an EIR to identify the plan and policy setting within which the project is proposed and discuss any inconsistencies between the proposed project and these applicable plans and policies (CEQA Guidelines section 15125[d]). CEQA also indicates that this plan and policy consistency discussion should be limited to the context of evaluation and review of environmental impacts (CEQA Guidelines section 15124[b]).

13.2.1 City of Hercules General Plan

The Noise Element of the City of Hercules General Plan sets forth policies and actions to address community noise in Hercules. Residential areas with noise levels below an Ldn of 60 dBA would be considered normally acceptable as set forth in Policy 1 of the General Plan. The acceptable indoor noise level is established at an L_{dn} of 45 dBA, consistent with State guidelines. Where the City determines that providing an L_{dn} of 60 dBA or lower cannot be achieved after the application of feasible mitigations, an L_{dn} of 65 dBA may be permitted at the discretion of the City Council. If the noise source is a railroad, then the outdoor noise exposure criterion should be 70 dBA L_{dn} for future development. Noise levels in new residential development exposed to an exterior L_{dn} of 60 dBA or greater shall be limited to a maximum instantaneous noise level in bedrooms of 50 dBA. Maximum instantaneous noise levels in all other habitable rooms should not exceed 55 dBA. The typical repetitive maximum instantaneous noise at each particular site would be determined by noise monitoring. Examples would include truck pass-bys on busy streets, train pass-bys, and train warning whistles. Appropriate interior noise levels in commercial, industrial, and office buildings are a function of the use of space and shall be evaluated on a case-by-case basis. Interior noise levels in offices generally should be maintained at 45 dBA L_{eq} or less. General Plan Policy 3 establishes

[1] Draft Hercules Waterfront Environmental Noise and Vibration Feasibility Study, 13 May 2009, prepared by Charles M. Salter Associates, Inc., for Anderson Pacific, LLC. The noise measurements cited in this study were conducted in 2004.

Table 13.4
SUMMARY OF LONG-TERM AND SHORT-TERM NOISE MEASUREMENTS

Site	Location	Duration	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Est. L_{dn}	Primary Noise Sources
LT-1	Pinole Creek Trail ~160 feet from center of AT&SF railroad tracks.	48 hrs	See appendix 22.3					68	Train pass-bys
LT-2	Promenade Street ~ 25 feet from the center of Sycamore Avenue.	48 hrs	See appendix 22.3					61	Vehicular traffic along Sycamore Avenue
LT-3	South Front Street ~Near Cabrillo Lane.	48 hrs	See appendix 22.3					64	Traffic
ST-1	On South Front Street, ~100 feet from the center of Sycamore Avenue.	10 min.	50	58	53	49	46	52	Vehicular traffic along Sycamore Avenue
ST-2	Southeast corner of Sycamore Avenue and Promenade Street.	10 min.	55	67	60	43	36	61	Vehicular traffic along Sycamore Avenue
ST-3	At the intersection of Bayfront Boulevard and Earnest Street. ~330 feet from the railroad Tracks.	10-min.	50	63	53	44	38	65	Traffic along Bayfront Boulevard and Earnest Street
ST-4	On Sanderling Drive near Refugio Creek	10-min.	51	61	52	41	38	64	Vehicular traffic and a motorcycle

significance thresholds for noise from new projects. Policy 6 establishes measures to control construction activities at noise-sensitive land uses.

- *Protect existing noise-sensitive land uses from long-term noise impacts generated by new projects. The city shall use the following criteria to judge the significance of long-term noise impacts on existing noise-sensitive land uses:*

  - *Noise level increases resulting from traffic associated with new projects will be considered significant if: (1) the noise level increase is 5 dBA L_{dn} or greater and the future noise level is less than 60 dBA L_{dn}; or (2) the noise level increase is 3 dBA L_{dn} or greater and the future noise level is 60 dBA L_{dn} or greater.* (Noise Element Policy 3)

- *Control the level of noise at noise-sensitive land uses generated by construction activities through implementation of the following measures:*

  - *For construction near noise-sensitive areas, as determined by the Community and Business Development Department, require that noisy construction activities (including truck traffic) be scheduled for periods, according to the construction permit, to limit impact on adjacent residents or other sensitive receptors.*

  - *Develop a construction schedule that minimizes potential cumulative construction noise impacts and accommodates particularly noise-sensitive periods for nearby land uses (e.g., for schools, churches, etc.).*

- *Where feasible, require that holes for driven piles be pre-drilled to reduce the level and duration of noise impacts.*

- *Where feasible, construct temporary solid noise barriers between source and sensitive receptor(s) to reduce offsite propagation of construction noise. This measure could reduce construction noise by up to 5 decibels.*

- *Require internal combustion engines used for construction purposes to be equipped with a properly operating muffler of a type recommended by the manufacturer. Also, require impact tools to be shielded per manufacturer's specifications.* (Noise Element Policy 6)

13.2.2 City of Hercules Waterfront District Master Plan (WDMP)

The Waterfront District Master Plan (WDMP) contains no policies or other provisions specifically relevant to noise.

13.2.3 State of California Building Code and Guidelines

Environmental noise intrusion into new multifamily housing is regulated by Chapter 12, Section 1208, Sound Transmission Control, of the California Building Code. The Code stipulates that interior noise levels attributable to exterior sources shall not exceed 45 CNEL in any habitable room. The Code further stipulates that multifamily residential structures proposed where the noise level exceeds 60 CNEL shall require an acoustical analysis showing that the proposed design will limit exterior noise to the prescribed allowable interior level.

13.2.4 Federal Transit Agency Ground Vibration Guidelines

The U.S. Department of Transportation has developed vibration impact assessment criteria for evaluating vibration impacts associated with transit projects.[1] The Federal Transit Administration (FTA) has proposed vibration impact criteria, based on maximum overall levels for a single event. The impact criteria for groundborne vibration are shown in Table 13.5. 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).

13.3 IMPACTS AND MITIGATION MEASURES

13.3.1 Significance Criteria

Based on the CEQA Guidelines, the proposed project would be considered in this EIR to have a significant noise impact if it would result in:[2]

(a) exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

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

[2]CEQA Guidelines, Appendix G, Items XI (a-e).

Table 13.5
GROUNDBORNE VIBRATION IMPACT CRITERIA

Land Use Category	Groundborne 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

SOURCE: Illingworth & Rodkin, Inc.; U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006, FTA-VA-90-1003-06.

Notes:

See subsections 13.1.4 and 13.1.5 of this EIR chapter for an explanation of vibration terms.

1. "Frequent Events" are defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" are 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" are 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.

(b) exposure of persons to or generation of excessive groundborne vibration or ground-borne noise levels;

(c) a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; or

(e) for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, or within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

Item (e) regarding aircraft noise is not applicable to this EIR because the proposed project is not subject to an airport land use plan, nor is it within two miles of any airport or private airstrip.

The primary noise issues concerning this project are noise and land use compatibility of the proposed residential and commercial land uses with nearby existing and planned train operations, the potential for permanent noise level increases due to project-generated traffic, and short-term impacts from construction noise and vibration.

A significant impact would be identified if land uses proposed by the project would be exposed to noise levels exceeding the City's established guidelines for noise and land use compatibility. A significant noise impact would also result if noise levels increase substantially at existing noise-sensitive land uses (e.g., residences). Pursuant to Policy 3 of the Hercules General Plan *Noise Element*, a project-related increase in noise level (e.g. traffic noise) of 3 dBA L_{dn} or greater where future projected noise levels would be 60 dBA L_{dn} or greater, or an increase of 5 dBA L_{dn} or greater where future projected noise levels would be less than 60 dBA L_{dn}, would constitute a significant impact.

Construction noise levels would be treated differently because they are temporary and intermittent. Significant noise impacts would result from construction if noise levels were sufficiently high to interfere with speech, sleep, or normal residential activities. Construction-related hourly average noise levels received at noise-sensitive land uses above 60 dBA during the daytime and 55 dBA at night, and at least 5 dBA higher than ambient noise levels, would be considered significant.

13.3.2 Relevant Project Characteristics

The land uses proposed by the project are described in chapter 3, Project Description, and chapter 12, Land Use and Planning, of this Draft EIR. In summary, the project proposes development of:

- up to 1,392 multi-family residential units (125 of which may be replaced with a 125-room hotel);
- up to 115,000 square feet of office uses, which could include commercial or civic space;
- up to 90,000 square feet of retail uses; and

- up to 134,000 square feet of "flex uses" that may be developed as residential, office (including live/work), and/or retail space, of which no more than 67,000 square feet would be retail uses. In addition, if all 134,000 square feet of flex space were developed with residential uses, the maximum number of housing units would be 134.

13.3.3 Impacts and Mitigation Measures

Project Traffic Noise Impacts. The proposed Hercules Bayfront Project would change noise levels in the project vicinity by introducing new development on the project site, with an associated increase in offsite vehicular traffic to and from the project site. The traffic analysis prepared by Fehr & Peers, EIR transportation consultants (see chapter 16), was reviewed by Illingworth & Rodkin, Inc., EIR acoustical consultants, to calculate potential project-related traffic noise level increases along roadways in the project vicinity. Pertinent traffic analysis data included through and turning movement counts at 12 intersections for existing conditions and future through and turning movement projections for project and cumulative conditions. Link volumes were calculated based on the intersection through and turning movement data and compared to existing conditions to calculate the anticipated noise level increase along local roadways under each scenario and the project's contribution under each scenario.

The review of the traffic data indicates that the ***project*** would not substantially increase roadway noise levels at sensitive receivers near the site (e.g., residential frontages). Traffic noise levels in residential areas near the site are not anticipated to increase significantly due to project-generated traffic. The largest anticipated increase in traffic noise would be along Sycamore Avenue west of Tsushima Street, where noise levels are calculated to increase by more than 2 dBA L_{dn} but less than 3 dBA L_{dn} as a result of the project. Project traffic noise increases would be less on all other roadways. Traffic-related noise increases would be considered ***less-than-significant*** because the project would not increase traffic noise levels by 3 dBA L_{dn} (a "just-perceivable difference" as indicated in section 13.1.1[b] herein) or more at sensitive land uses adjoining roadways that serve the site (see criteria [a] and [c] and explanatory text in subsection 13.3.1, "Significance Criteria," above).

Mitigation. No significant adverse environmental impact has been identified; no mitigation is required.

Cumulative Traffic Noise Impacts. Based on common CEQA practice, a project would be considered to make a potentially significant contribution to a cumulative noise impact (an increase of more than 3 dBA L_{dn}) if its contribution would be 1 dBA L_{dn} or greater. Cumulative traffic volumes were reviewed to calculate future buildout traffic noise levels and the project's relative contribution to noise levels along roadway segments where noise levels would be substantially increased. This review indicated that the project would make a "cumulatively considerable" increase in noise (1 dBA L_{dn} or more) to cumulative noise level increases of 3 dBA L_{dn} or more only along a short segment of San Pablo Avenue near John Muir Parkway. No sensitive receptors adjoin this roadway segment. Therefore, the project contribution to this impact is considered ***less-than-significant*** (see criteria [a] and [c] and explanatory text in subsection 13.3.1, "Significance Criteria," above).

Mitigation. No significant adverse environmental impact has been identified; no mitigation is required.

Impact 13-1: Project-Facilitated Construction Period Noise. Construction activities facilitated by the project would include site grading and preparation, building modification and rehabilitation, construction of new buildings, and installation of infrastructure and utilities. These project construction activities could intermittently elevate noise levels at the nearest residences and businesses by more than 5 dBA, resulting in potential intermittent interference with typical existing residential and business activities during project construction periods. This possibility represents a ***potentially significant intermittent and short-term noise impact*** (see criteria [a], [b], and [d] and explanatory text in subsection 13.3.1, "Significance Criteria," above).

Construction activities generate considerable amounts of noise, especially during site grading activities, excavation for foundations, and construction of project infrastructure, when heavy equipment is used. The noise effects resulting from construction would depend on the noise characteristics of selected pieces of construction equipment, the timing and duration of these noise-generating activities, and the distance between these noise sources and noise-sensitive receptors. Noise levels during construction would occur in phases, including grading and excavation, construction of foundations and underground utilities, erection of new structures and infrastructure, and finishing activities.

Table 13.6 presents A-weighted *maximum* noise levels generated by specific pieces of construction equipment at a distance of 50 feet from the source. Table 13.7 presents typical ranges in *hourly average* noise levels at a distance of 50 feet from the source generated during different phases of construction. As shown in Table 13.6, the highest *maximum* noise levels generated by project construction could typically range from approximately 95 to 105 dBA at a distance of 50 feet from the noise source. *Hourly average* noise levels generated by the construction of housing and public works infrastructure would range from about 65 dBA to 88 dBA measured at a distance of 50 feet, depending on the amount of activity at the site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of distance away from the source. Shielding by intervening buildings or terrain typically results in lower construction noise levels at distant receptors.

The nearest noise-sensitive receivers to proposed Hercules Bayfront Project construction activities are single-family residential houses and live-work units located approximately 60 feet southeast of the project site, along Railroad Avenue. Project construction would be expected to generate worst-case hourly average noise levels of about 72 dBA to 88 dBA L_{eq} at the nearest noise-sensitive receivers when construction occurs at the perimeter of the project site. Given the proximity of the houses, construction noise levels would generally exceed 60 dBA L_{eq}, and the ambient noise environment by at least 5 dBA L_{eq}, when construction activities are occurring outside. Construction noise occurring indoors would generate minimal noise at off-site locations. Construction activities associated with the project would expose existing sensitive receptors, and future noise-sensitive land uses built during the earlier phases of construction, to noise levels that are substantially increased over ambient conditions (see subsection 13.3.1). This project-related effect represents a *potentially significant intermittent and short-term noise impact*.

Table 13.6
CONSTRUCTION EQUIPMENT NOISE LEVEL RANGES AT 50 FEET FROM THE SOURCE

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 kilo-volt amperes or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP[4]	85	Continuous

SOURCE: Illingworth & Rodkin, Inc.

Notes:
[1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.
[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
[3] Portable air compressor rated at 75 cubic feet per minute (cfm) or greater and that operates at greater than 50 pounds per square inch (psi).
[4] HP = horsepower.

Table 13.7
TYPICAL NOISE LEVEL RANGES AT 50 FEET, L_{eq} IN DBA AT CONSTRUCTION SITES

Phase	Domestic Housing		Public Works Roads and Highways, Sewers, and Trenches	
	I	II	I	II
Ground Clearing	83	83	84	84
Excavation	88	75	88	78
Foundations	81	81	88	88
Erection	81	65	79	78
Finishing	88	72	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

SOURCE: U.S. EPA, Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

Mitigation 13-1. Reduce project construction period noise impacts on nearby residences by incorporating conditions in project construction contract agreements that stipulate implementation of the following conventional construction period noise abatement measures to the satisfaction of the City:

- *Construction Plan.* Prepare a detailed construction plan identifying the schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with nearby noise-sensitive facilities so that construction activities and the event schedule can be scheduled to minimize noise disturbance.
- *Construction Scheduling.* Ensure that noise-generating construction activities are limited to between the hours of 7:30 AM to 5:00 PM, Monday through Friday, and are approved by written request to the Department of Public Works (based on planned civic activity in the area).
- *Construction Equipment Mufflers and Maintenance.* Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- *Equipment Locations.* Locate stationary noise-generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near the construction site.

(continued)

Mitigation 13-1 (continued):

- *Construction Traffic.* Route all construction traffic to and from the construction sites via designated truck routes where possible. Prohibit construction-related heavy truck traffic in residential areas.

- *Quiet Equipment Selection.* Use quiet construction equipment, particularly air compressors.

- *Temporary Barriers.* Construct solid plywood fences around construction areas to shield residences, operational businesses, or noise-sensitive land uses.

- *Temporary Noise Blankets.* Temporary noise control blanket barriers should be erected, if necessary, along building facades of construction areas. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling. (Noise control blanket barriers can be rented and quickly erected.)

- *Noise Disturbance Coordinator.* The City may choose to require project designation of a "Noise Disturbance Coordinator" who would be responsible for responding to any local complaints about construction noise. The Disturbance Coordinator would determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and institute reasonable measures to correct the problem. Conspicuously post a telephone number for the Disturbance Coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule. (The project sponsor should be responsible for designating a Noise Disturbance Coordinator, posting the phone number, and providing construction schedule notices. The Noise Disturbance Coordinator would work directly with an assigned City staff member.)

Implementation of these measures would reduce this intermittent project construction period noise impact, but--due to the extended construction period of several years--this impact is considered ***significant and unavoidable.***

Impact 13-2: Potential Exposure of Project Development to Interior Noise Levels Exceeding Standards. The existing noise environment throughout the project site is estimated at between 60 dBA and 77 dBA $L_{dn.}$ As shown on Figure 3.6 (Proposed Site Plan) in chapter 3, proposed Hercules Bayfront project Blocks B, D, E, G, K, L, and M would have façades closest to railroad tracks, approximately 100 to 130 feet away. Utilizing the data measured by Salter in 2004 and updated by Illingworth & Rodkin in 2009, residential uses on these blocks would be exposed to noise levels ranging from 68 dBA L_{dn} to as high as 77 dBA L_{dn}. The highest noise exposure levels would exceed the 70 dBA L_{dn} threshold for residential noise exposure adjacent to railroad tracks in the City of Hercules. Project Blocks A, C, F, H, J, N, O, P, Q, and R would be shielded from rail lines and would be approximately 310 to 360 feet from the railroad tracks. All these blocks propose residential units, some in combination with retail space.

These possible long-term adverse noise effects of the proposed project represent a ***potentially significant impact*** (see criteria [a], [c], and [d] and explanatory text in subsection 13.3.1, "Significance Criteria," above).

Future exterior noise levels at the building façades exceeding 60 dBA Ldn would require that residential units be designed to control interior noise levels to 45 dBA L_{dn} or less. Standard residential construction methods with the windows open for ventilation typically provides 15 dBA of noise reduction in interior spaces. With the windows closed, standard residential construction provides approximately 20 to 25 dBA of noise reduction in interior spaces. Proposed residential building façades with an exterior noise level of 77 dBA L_{dn} would be 52 to 57 dBA L_{dn} in the interior with windows closed. The single-event noise would be intrusive in interior spaces. The City of Hercules specifies that maximum instantaneous noise levels be reduced to 50 dBA or less in bedrooms and 55 dBA or less in other habitable rooms. Interior noise levels could exceed the single-event standards by up to 25 dBA in bedrooms and 20 dBA in other rooms.

Observations made in the vicinity of the proposed ITC station site confirmed that railroad trains do not normally sound their horns in the project vicinity. Maximum noise levels were typically 75- 85 dBA L_{max} measured at a distance of 160 feet from the center of the tracks, and sometimes reached 95 dBA. The proposed ITC would introduce new sources of noise into the area. When railroad trains approach a passenger station, they may use their warning horn by sounding a short signal with the horn. Research conducted by Illingworth & Rodkin, EIR acoustical consultants, indicates that operating rules of most North American railroads require warning signals in different circumstances. When giving a warning to people and/or animals, the train engineer is required to produce a succession of sounds with the horn. Trains are required to sound a long signal followed by a short signal when approaching stations, curves, or other points where view may be obscured, and when approaching passenger or freight trains. When passing a standing train, the moving train is required to sound two long signals followed by a short signal followed by a long signal, the same requirement when signaling for at-grade crossings. At the proposed ITC, there would be no at-grade crossings, only a locked at-grade crossing for emergency vehicle access, so the sounding of train horns would not be expected to occur frequently.

Buses would access the proposed ITC from John Muir Parkway/Bayfront Boulevard. According to a study prepared for the ITC, there are a total of 14 local, express, regional, and transbay bus routes currently operated out of the existing Hercules Transit Center, and existing transit service would be re-routed to serve the ITC. This EIR analysis for the Hercules Bayfront project assumes an average headway of 20 minutes during the peak hour for existing bus routes. Based on this assumption, 42 buses could access the transit center during the peak hour. Average noise levels resulting from these buses are calculated to be 49 dBA L_{eq} at 175 feet and 44 dBA L_{eq} at 400 feet. Therefore, bus operations associated with the ITC project would not be expected to substantially increase hourly average noise levels or daily average noise levels over existing conditions.

Mitigation 13-2. For all proposed buildings where the exterior noise level at the facade exceeds 60 dBA L_{dn}, project-specific acoustical analyses consistent with the requirements of the State Building Code (SBC) shall be conducted prior to individual building construction to confirm that individual building designs will reduce interior noise levels to 45 dBA L_{dn} or lower. Building sound insulation requirements may include the provision of sound-rated windows and doors, and forced-air mechanical ventilation for residential units so that windows could be kept closed at the occupant's discretion to control noise. The specific determination of what treatments are necessary shall be conducted on a unit-by-unit basis. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the associated building plans, for review and approval prior to issuance of a building permit.

The final requirements for building noise controls would be determined by the City during the detailed design process, pursuant to SBC requirements. The City shall retain a qualified Acoustical Engineer, at project applicant expense, during the individual project design review process to peer review and verify residential structure noise abatement specifications for all residential units proposed within 200 feet from the railroad tracks.

Implementation of these measures to the satisfaction of the City would reduce the potential impact on new residential uses to a ***less-than-significant level***.

For this EIR, preliminary assessments of building elements were made based strictly on approximated noise levels at building setbacks and typical generic wall/window area ratios. The project-specific analysis identified in this mitigation shall incorporate the effect of locomotive warning horns if information regarding requirements for signaling indicates warning horns will be frequent in the area. Preliminary detailed analyses conducted by the applicant's consultant (Salter) were reviewed. Their analysis indicates that high-performance sound-rated windows and doors with Sound Transmission Class (STC) ratings ranging from 40 to 60 STC would be required for bedrooms located within 100 feet of the nearest railway track centerline. At a distance of 200 feet, STC requirements would range from 35 to 55 STC. STC requirements in other rooms are 5 points lower, reflecting the lower standard for single-event noise. In commercial buildings, STC ratings ranging from 30 to 50 STC would be required in order to mitigate hourly average noise levels to the City's goal of 45 dBA L_{eq} or less. Lower

STC ratings would be acceptable for shielded facades and those located at a greater distance from the tracks.

Impact 13-3: Potential Exposure of Project Outdoor Use Areas to Noise Levels Exceeding Standards. Outdoor areas near residential units are proposed where exterior noise levels would be up to 77 dBA L_{dn} when there is line-of-sight to the railroad (i.e., no barrier). This exceeds the outdoor noise exposure criterion of 70 dBA L_{dn} when railroad noise is the primary source; these areas may be considered "noise-sensitive" outdoor areas. This represents a ***potentially significant impact*** (see criteria [a], [c], and [d] and explanatory text in subsection 13.3.1, "Significance Criteria," above).

Mitigation 13-3. The project design includes a retaining wall (as a shared facility with the ITC project), which would also act as a noise barrier, along the railroad right-of-way. The retaining wall, in combination with building shielding, is anticipated to reduce noise in outdoor residential activity areas to below 70 dBA L_{dn}. The final design for the noise barrier shall be reviewed during the subsequent acoustical analyses required for Title 24 compliance, and incorporated into the final acoustical report for the project design prior to issuance of building permits. If the retaining wall is not built as part of the ITC project prior to development of Hercules Bayfront Project outdoor use areas, the Hercules Bayfront Project shall prepare, to City satisfaction, the acoustical analyses required for Title 24 compliance in order to identify location-specific measures that will reduce noise impacts on outdoor use areas to a less-than-significant level (i.e., below 70 dBA Ldn). The retaining wall, or any other noise barriers as deemed necessary, shall be constructed according to the noise-attenuation specifications identified in the acoustical analyses, subject to City review and approval. Implementation of these measures to the satisfaction of the City would reduce the potential impact to a ***less-than-significant level***.

Impact 13-4: Potential Exposure of Project Development to Groundborne Vibration Levels Exceeding Standards. With trains entering the station, the operation of the proposed ITC adjacent to the Hercules Bayfront Project site would result in future train speeds equal to or lower than existing train speeds through the area. Groundborne vibration levels resulting from railroad train operations are a function of speed, and decrease with decreasing train speed. The presence of the ITC would, therefore, result in similar or lower future groundborne vibration levels than currently exist in the area.

These possible long-term adverse groundborne vibration levels at the project site would represent a ***potentially significant impact*** (see criteria [a], [c], and [d] and explanatory text in subsection 13.3.1, "Significance Criteria," above).

Ground vibration measurements were made during railroad train pass-bys by Charles M. Salter Associates, Inc. in March and April 2004.[1] Measurements were conducted at two locations selected to determine ground attenuation rates with distance from the rail lines. Vibration levels resulting from five freight train pass-bys and 15 Amtrak pass-bys were monitored. The measurements were made 25 feet and 100 feet south of the nearest line. The 2004 Salter report concluded that maximum vibration levels would be approximately 83 VdB at a distance of 60 feet from the track and 78 VdB at a distance of 85 feet from the track. Salter then conducted a refined analysis of the vibration data in their May 2009 report per the FTA Guidelines. Railroad train vibration levels were calculated to exceed the FTA Guidelines at a distance of 55 feet or less from the railroad tracks. No buildings are proposed within 55 feet of the railroad tracks. Vibration amplification due to floor resonance was assumed to be predominant in the 16 Hz and 20 Hz 1/3 octave band (consistent with the FTA's prediction for wood-frame structures). The Salter report recommends, and the peer review concurs, that care should be taken in the structural design of buildings located adjacent to the railroad tracks to ensure that adequate floor stiffness makes this assumption appropriate.

[1]Draft Hercules Waterfront Environmental Noise and Vibration Feasibility Study, 13 May 2009, prepared by Charles M. Salter Associates, Inc., for Anderson Pacific, LLC.

Mitigation 13-4. To reduce the potential for vibration amplification in residential buildings within 100 feet of the nearest railroad track, span lengths should be kept as short as feasible and joist depths need to be analyzed and increased as necessary. Building vibration-stiffening treatments, such as increased sub-flooring thickness and special construction techniques, shall be analyzed and incorporated as necessary. A qualified acoustical consultant shall be retained to provide additional input on the structural system as the design evolves. Also, a structural engineer shall verify that all designs meet building code standards.

Also, prospective buyers shall be notified of the potential for noticeable vibration through a full disclosure statement.

Implementation of these measures to the satisfaction of the City would reduce the potential impact to a ***less-than-significant level***.

Project-Facilitated Groundborne Vibration Levels. Project construction and operation would not generate groundborne vibration levels exceeding acceptable limits. Construction activities such as pile driving could generate groundborne vibration, which would attenuate with distance. The nearest existing sensitive receptors are located more than 500 feet from where pile driving might occur (i.e., at the tallest building sites near Block M). At a distance of 500 feet, pile driving and groundborne vibration levels would typically fall below ambient levels resulting from local sources, such as traffic. Therefore, groundborne vibration resulting from project construction activities would result in a ***less-than-significant impact***.

Mitigation. No significant impact has been identified; no mitigation is required.