VIBRATION TECHNICAL REPORT

Introduction

This section evaluates vibration impacts that would be generated by construction and operation of the Proposed Sunset & Everett Project on the east side of Sunset Boulevard north of Everett Street in the City of Los Angeles. The analysis compares these impacts to applicable regulations and thresholds of significance. Vibration calculation worksheets are included in the Technical Appendix.

Fundamentals of Vibration

Characteristics of Vibration. Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, and acceleration. Unlike noise, vibration is not a common environmental problem, as it is unusual for vibration from vehicle sources to be perceptible. Common sources of vibration include trains, construction activities, and certain industrial operations.

Vibration Definitions. This analysis discusses vibration in terms of Peak Particle Velocity (PPV). PPV is commonly used to describe and quantify vibration impacts to buildings and other structures. PPV levels represent the maximum instantaneous peak of a vibration signal and are usually measured in inches per second.[1] This analysis also discusses the vibration of events in decibel scale, known as Vibration Decibels (VdB), which is a unitless measure of vibration that is expressed on a logarithmic scale.

Effects of Vibration. High levels of vibration may cause physical personal injury or damage to buildings. However, groundborne vibration levels rarely affect human health. Instead, most people consider groundborne vibration to be an annoyance that can disrupt concentration or disturb sleep. Groundborne vibration can also interfere with certain types of highly sensitive equipment and machines, especially imaging devices used in medical laboratories.

Perceptible Vibration Changes. Unlike noise, groundborne vibration is not an environmental issue that most people experience every day. Background vibration levels in residential areas are usually well below the threshold of perception for humans, approximately 0.01 inches per second.[2] Perceptible indoor vibrations are most often caused by sources within buildings themselves, such as slamming doors or heavy footsteps. Common outdoor sources of groundborne vibration include construction equipment, trains, and traffic on rough or unpaved roads. Traffic vibration from smooth and well-maintained roads is typically not perceptible.

1 California Department of Transportation, Transportation and Construction Vibration Guidance Manual, April 2020; https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tcvgm-apr2020-a11y.pdf.

2 Ibid.

Regulatory Framework

Federal

Federal Transit Administration (FTA). In 2018, the FTA published the Transit Noise and Vibration Impact Assessment Manual to aid in the estimation and analysis of vibration impacts. Typically, potential building and structural damages are the foremost concern when evaluating the impacts of construction-related vibrations. Table 1 summarizes FTA's vibration guidelines for building and structural damage. While these are reference values for vibration levels at 25 feet of distance, this analysis uses logarithmic equations to determine whether building damage would occur regardless of actual distance between construction activity and nearby buildings.

Table 1
FTA Vibration Damage Potential Threshold Criteria

Structure and Condition	Threshold Criteria (in/sec PPV) at 25 Feet
I. Reinforced-concrete, steel or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12
Source: Federal Transit Administration "Transit Noise and Vibration Impact Assessment Manual", September 2018.	

The FTA Assessment Manual also cites criteria for cases where more detailed analysis may be required. For buildings consisting of concrete wall and floor foundations, masonry or concrete walls, or stone masonry retaining walls, continuous vibrations of 0.3 inches per second PPV can be damaging. For buildings consisting of steel or reinforced concrete, such as factories, retaining walls, bridges, steel towers, open channels, underground chambers and tunnels with and without concrete alignment, continuous vibrations of 0.5 inches per second PPV can be damaging.

State

California's Civil Code Section 832 protects adjacent properties when excavation of a site occurs.

> *Each coterminous owner is entitled to the lateral and subjacent support which his land receives from the adjoining land, subject to the right of the owner of the adjoining land to make proper and usual excavations on the same for purposes of construction or improvement, under the following conditions:*
>
> *1. Any owner of land or his lessee intending to make or to permit an excavation shall give reasonable notice to the owner or owners of adjoining lands and of buildings or other structures, stating the depth to which such excavation is intended to be made, and when the excavating will begin.*
>
> *2. In making any excavation, ordinary care and skill shall be used, and reasonable precautions taken to sustain the adjoining land as such, without regard to any building or other structure which may be thereon, and there shall be no liability for*

damage done to any such building or other structure by reason of the excavation, except as otherwise provided or allowed by law.

3. If at any time it appears that the excavation is to be of a greater depth than are the walls or foundations of any adjoining building or other structure, and is to be so close as to endanger the building or other structure in any way, then the owner of the building or other structure must be allowed at least 30 days, if he so desires, in which to take measures to protect the same from any damage, or in which to extend the foundations thereof, and he must be given for the same purposes reasonable license to enter on the land on which the excavation is to be or is being made.

4. If the excavation is intended to be or is deeper than the standard depth of foundations, which depth is defined to be a depth of nine feet below the adjacent curb level, at the point where the joint property line intersects the curb and if on the land of the coterminous owner there is any building or other structure the wall or foundation of which goes to standard depth or deeper then the owner of the land on which the excavation is being made shall, if given the necessary license to enter on the adjoining land, protect the said adjoining land and any such building or other structure thereon without cost to the owner thereof, from any damage by reason of the excavation, and shall be liable to the owner of such property for any such damage, excepting only for minor settlement cracks in buildings or other structures.

Caltrans has identified building damage significance guidance that provides thresholds for different categories of structures, including historic buildings that may not be considered extremely fragile (Table 2).

Table 2
Caltrans Vibration Damage Potential Threshold Criteria

Structure and Condition	Significance Thresholds (in/sec PPV)	
	Transient Sources	Continuous/ Frequent/ Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5
Source: California Department of Transportation, 2013.		

City of Los Angeles. The Los Angeles Municipal Code (LAMC) governs construction-related vibration issues and public notification. LAMC Section 91.3307 adopts the California Building Code's regulations Section 3307, protecting adjoining property and includes the following subsection.

SEC.91.3307.1. PROTECTION REQUIRED.

"Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities.

For excavations, adjacent property shall be protected as set forth in Section 832 of the Civil Code of California.

Prior to the issuance of any permit, which authorizes an excavation where the excavation is to be of a greater depth than are the walls or foundation of any adjoining building or structure and located closer to the property line than the depth of the excavation, the owner of the site shall provide the Department of Building and Safety with evidence that the adjacent property owner or owners have been given a 30-day written notice of the intent to excavate. This notice shall state the depth to which the excavation is intended to be made and when the excavation will commence. This notice shall be by certified mail, return receipt requested."

LAMC addresses how underpinning is designed, ensuring that temporary shoring standards protect the integrity of soils under adjacent properties while allowing for incremental stressing. LAMC Section 91.3307.2.1 states that "[i]n constructing underpinning, all portions of the structure shall be supported so that no structural material is stressed beyond the yield point."

LAMC Section 91.3307.2.2 addresses closure of open spaces in foundations, requiring that "[a]*ll spaces between the existing footing and the underpinning shall be packed full of mortar conforming to the provisions of CBC Section 2103 and having no slump when tested by the method specified in ASTM C 143."*

LAMC Section 91.3307 regulates structural protections for adjoining property, including underpinning and lateral support requirements.

LAMC Sections 91.3307.3.1 and 91.3307.3.2 address issues relating to adjacent properties.

SEC.91.3307.3.1. GENERAL (TEMPORARY EXCAVATIONS AND SHORING).

Excavations shall not remove the lateral support from a public way, from an adjacent property or from an existing structure. For the purpose of this section, the lateral support shall be considered to have been removed when any of the following conditions exist:

1. The excavation exposes any adverse geological formations, which would affect the lateral support of a public way, an adjacent property or an adjacent structure.

2. The excavation extends below a plane extending downward at an angle of 45 degrees from the edge of the public way or an adjacent property."

Exception: Normal footing excavations not exceeding two feet in depth will not be construed as removing lateral support.

3. The excavation extends below a plane extending downward at an angle of 45 degrees from the bottom of a footing of an existing structure.

SEC.91.3307.3.2. REMOVAL OF LATERAL SUPPORT.

Approval of the Department of Public Works shall be obtained prior to the issuance of a permit for any excavation that would remove the lateral support from a public way.

The slopes of excavations adjacent to an existing structure, an adjacent property or public way may exceed one horizontal to one vertical where either:

1. A soil report recommending that the slope may be in excess of one to one has been approved by the Department and the Department of Public Works when the excavation is adjacent to a public way.

When justified by the soils engineer, the Department may approve the use of the proposed building and/or shoring to support an adjacent structure on an adjoining property in lieu of underpinning, provided:

(i) Evidence is submitted that the adjoining property owner has been notified in advance of the proposed excavation in compliance with Section 832 of the Civil Code of California.

(ii) The owner of the site records a sworn affidavit with the Office of the County Recorder, which will inform future owners of the site that the lateral support of a portion of the building footings on the adjoining property is provided by the subterranean walls of the building on the site.

2. Underpinning is designed to support adjacent structures, temporary shoring is designed to support the excavation, and plans are approved and permits are issued by the Department.

Temporary shoring shall be designed for an earth pressure equivalent to that exerted by a fluid weighing not less than 30 pounds (13 kg) per cubic foot plus all surcharge loads or as recommended by a soils engineer and approved by the Department.

Soils bearing values shall be those specified in Division 18, Article 1, Chapter IX of the LAMC or those recommended by a soils engineer and approved by the Department.

The design of the required temporary shoring and necessary underpinning shall include a sequence of construction and installation.

Allowable stresses used in the design of temporary shoring may be increased 33-1/3% for structural and reinforcing steel and 25% for wood. No increase will be permitted for concrete. Other values shall be those prescribed by this Code.

Methodology

Construction Vibration. Ground-borne vibration impacts during construction activities were evaluated for both on-site and off-site construction activities by identifying potential vibration sources (e.g., construction equipment), estimating the vibration levels at off-site structures, and comparing the proposed impacts against applicable vibration significance thresholds.

Operational Vibration. As with many non-industrial projects, the Proposed Project does not include land uses that would generate high levels of ground-borne vibration. Instead, any vibration related to operation of the Proposed Project would involve vehicle activity traveling to and from the Project Site. However, vibration from vehicle activities using rubber-tired wheels is unlikely to be perceptible by people. Rubber-tired vehicles traveling at a distance of 50 feet typically generate groundborne vibration of approximately 63.5 VdB.[3] The typical threshold of perception for groundborne vibration is approximately 65 VdB.[4] As such, operational impacts on ground-borne vibration are not analyzed further.

Threshold of Significance

Groundborne Vibration Thresholds. There are no adopted City standards or other applicable regulations that would govern the Project's vibration impacts. In assessing impacts related to noise and vibration in this section, the City uses Appendix G as the thresholds of significance. The FTA's criteria in its 2018 Transit Noise and Vibration Impact Assessment manual will be used where applicable and relevant to assist in analyzing the Appendix G thresholds. In addition, Caltrans' thresholds for historic buildings will be used when structures are not Category IV structures considered extremely susceptible to vibration damage.

Existing Conditions

Existing Ambient Vibration Levels

The Project Site is currently vacant of any improvements. As such, there are no sources of groundborne vibration on the Project Site.

The primary source of groundborne vibration near the Project Site is vehicle travel. For example, Sunset Boulevard carries 3,250 and 3,122 vehicles at Beaudry Avenue in the A.M. and P.M. peak hours, respectively.[5] The blend of passenger vehicles, trucks, delivery trucks, transit buses, and other light-, medium-, and heavy-duty vehicles that travel this and other local roadways generate minimal levels of vibration. As noted by federal guidance, "[i]t is unusual for vibration from sources

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3 Federal Transportation Administration, Transit Noise and Vibration Impact Assessment Manual; Generalized Ground Surface Vibration Equations (Table 6-10); September 2018.

4 Ibid.

5 Fehr & Peers, Draft Transportation Assessment – Sunset + Everett Project; October 2023.

such as buses and trucks to be perceptible…"[6] As such, vehicle movement generates imperceptible ground vibration, with the occasional exception of heavy-duty vehicles that travel over speed bumps, potholes, and other street irregularities.

There are several buildings near the Project Site that could be exposed to groundborne vibration during construction and operation of the proposed development that include:

- Residential Structures, Everett Street (west side); one- and two-story structures as close as five feet east of the Project Site. These homes and structure would be considered Category III structures (non-engineered timber and masonry) under FTA guidelines.

- Residential Structures, 1251 Sunset Boulevard; five feet north of the Project Site. These bungalow structures would be considered Category III structures (non-engineered timber and masonry) under FTA guidelines.

- Residential and Commercial Structures, Sunset Boulevard (west side) as close as 100 feet west of the Project Site. These residences and commercial structures would be considered Category III structures (non-engineered timber and masonry) under FTA guidelines.

Analysis of Project Impacts

a. Generation of excessive groundborne vibration or groundborne noise levels?

Less Than Significant Impact.

Construction

Building Damage Vibration Impact – On-Site Sources

Construction equipment can produce groundborne vibration based on equipment and methods employed. While this spreads through the ground and diminishes in strength with distance, buildings on nearby soil can be affected. This ranges from no perceptible effects at the lowest levels, low rumbling sounds and perceptible vibration at moderate levels, and slight damage at the highest levels. Table 3 summarizes vibratory levels for common construction equipment.

Table 3
Vibration Source Levels for Construction Equipment

Equipment	Approximate PPV at 25 feet (in/sec)
Pile Driver (impact)	0.644
Pile Drive (sonic)	0.170
Clam shovel drop (slurry wall)	0.202
Hydromill (slurry wall)	0.008
Vibratory Roller	0.210

[6] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, September 2018.

Hoe Ram	0.089
Large Bulldozer	0.089
Caisson Drilling	0.089
Loaded Truck	0.076
Jackhammer	0.035
Small Bulldozer	0.003
Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, 2018.	

Groundborne vibration would be generated by a number of construction activities at the Project site. As a result of equipment that could include on-site bulldozer operations or the vibrational equivalent, vibration velocities of up to 0.191 inches per second PPV are projected to occur at all three structures. These impacts are below the 0.2 in/sec PPV thresholds of significance for Category III structures. Other potential construction activities would produce less vibration and have lesser potential impacts on nearby sensitive receptors. As a result, construction-related structural vibration impacts would be considered less than significant.

Table 4
Building Damage Vibration Levels – On-Site Sources

Off-Site Receptor Location	Distance to Project Site (feet)	Vibration Velocity Levels at Off-Site Sensitive Receptors from Construction Equipment (in/sec PPV)					Significance Criterion (PPV)	Potentially Significant Impact?
		Large Bulldozer	Caisson Drilling	Loaded Trucks	Jack-hammer	Small Bulldozer		
FTA Reference Vibration Level (25 Feet)	N/A	0.089	0.089	0.076	0.035	0.003	--	--
Residential Structures, Everett St.	15	0.191	0.191	0.164	0.075	0.006	0.20[a]	No
Residential Structures, 1251 Sunset Bl.	15	0.191	0.191	0.164	0.075	0.006	0.20[a]	No
Residential and Commercial Structures, Sunset Bl. (west side)	110	0.020	0.020	0.017	0.008	0.001	0.20[a]	No

[a] FTA criterion for Category III (non-engineered timber and masonry buildings)
Includes ten feet of buffer from Project Site property line to allow for equipment maneuverability.
Source: DKA Planning, 2022.

Construction of the Project would protect adjacent properties during the excavation process by complying with California Civil Code Section 832. It would also comply with LAMC Section 91.3307 and applicable subsections that govern the protection of adjoining property.

Building Damage Vibration Impact – Off-Site Sources

Construction of the Project would generate trips from large trucks including haul trucks, concrete mixing trucks, concrete pumping trucks, and vendor delivery trucks. Regarding building damage,

based on FTA data, the vibration generated by a typical heavy-duty truck would be approximately 63 VdB (0.006 PPV) at a distance of 50 feet from the truck.[7] According to the FTA "[i]t is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads." Nonetheless, there are buildings along the Project's anticipated haul route on Sunset Boulevard, Beaudry Avenue, Temple Street, and other local roadways to the US-101 that are situated away from the right-of-way and would be exposed to groundborne vibration levels of approximately 0.006 PPV. This estimated vibration generated by construction trucks traveling along the anticipated haul route(s) would be well below the most stringent building damage criteria of 0.12 PPV for buildings extremely susceptible to vibration. The Project's potential to damage roadside buildings and structures as the result of groundborne vibration generated by its truck trips would therefore be considered less than significant.

Operation

During operation of the commercial development, there would be no significant stationary sources of groundborne vibration, such as heavy equipment or industrial operations. Operational groundborne vibration in the Project Site's vicinity would be generated by its related vehicle travel on local roadways. However as previously discussed, road vehicles rarely create vibration levels perceptible to humans unless road surfaces are poorly maintained and have potholes or bumps. As a result, the Project's long-term vibration impacts would be less than significant.

Cumulative Impacts

Construction

On-Site Construction Vibration

During construction of the Project, vibration impacts are generally limited to buildings and structures located near the construction site (i.e., within 15 feet as related to building damage). As noted earlier, the Project's potential to damage nearby buildings is less than significant. However, nearby structures could be subject to cumulative vibration impacts if concurrent construction and vibration activities were to occur within close proximity. Any such projects would need to limit or avoid use of pile drivers or other impacting equipment for any shoring of structures.

There are nine potential related projects identified by the City of Los Angeles within 0.5 miles of the Proposed Project (Table 5).[8] Of these, two are completed (Nos. 1 and 4) and one (No. 3) is under construction and would be completed and operational by the time the Project breaks ground in 2025.

[7] Federal Transit Administration, "Transit Noise and Vibration Impact Assessment," May 2006, Figure 7-3.

[8] City of Los Angeles, Related Projects Summary from Case Logging and Tracking System, February 3, 2023.

Table 5
Related Projects Within 0.5 Miles of Project Site

#	Address	Distance from Project Site	Use	Size	Status
1	418 Firmin Street	1,450 feet southwest	Apartments	64 units	Completed in 2022.
2	2000 Stadium Way	2,050 feet north	Medical	80,545 sf	To be constructed.
3	1013 Everett Street	150 feet north	Apartments	49 units	Framed as of 2023.
4	1246 Court Street	2,225 feet southwest	Apartments	54 units	Completed in 2021.
5	765 College Street	1,775 feet east	Medical	100,000 sf 62 beds	To be constructed.
6	1274 Sunset Blvd	240 feet northwest	Hotel Restaurant	8 rooms 1,470 sf	To be constructed.
7	1275 Sunset Blvd	260 feet north	Apartments	77 units	To be constructed.
8	1111 Sunset Blvd	275 feet south	Apartment Hotel Office Commercial	737 units 180 rooms 48,000 sf 95,000	To be constructed.
9	1251 Sunset Blvd	5 feet north	Apartment	74 units	To be constructed.

Source: Related Projects List, Related Projects Summary from Case Logging and Tracking System Los Angeles Department of Transportation, February 3, 2023.

As illustrated in Table 5, all potential related projects are over 150 feet away from the Project Site with no possibility of cumulative impacts on any of the same sensitive receptors, except for No. 9 (1251 Sunset), which is 5 feet north of the Site. This location was also considered a sensitive receptor since it contains existing residential buildings that are vacant but could be re-occupied. As shown in Table 4 above, this location would not be subject to vibration impacts that exceed the threshold for building damage. As noted above, vibration impacts are limited to within 15 feet of the source of vibration. With the necessary distance for equipment manueverability, the sources of vibration would be 15 feet from any sensitive receptor. As such, there are no identified or reasonably foreseeable related projects that could generate cumulative vibration impacts when the Proposed Project begins construction in late 2024. As such, there is no potential for a cumulative construction vibration impact that subjects nearby buildings to vibration levels that exceed the FTA's vibration damage criteria.

Off-Site Construction Vibration

While haul trucks from any related projects and other concurrent construction projects could generate additional vibration along haul routes, the potential to damage buildings is extremely low. The FTA finds that "[i]t is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads." The vibration generated by a typical heavy truck would be approximately 0.00566 in/sec PPV at a distance of 50 feet.

As discussed above, there are buildings near the right- of-way of the anticipated haul route for the Project (e.g., Sunset Boulevard, Beaudry Avenue). These buildings are anticipated to be exposed to groundborne vibration levels that are far less than the levels recommended by FTA as potential thresholds for building damage. Trucks from any related projects that would contribute truck trips to Sunset Boulevard, Beaudry Avenue, and other streets along the Project's haul route are expected

to generate similar groundborne vibration levels. Therefore, the vibration levels generated from off-site construction trucks associated with the Project and other related projects along the anticipated haul route(s) would be below the most stringent building damage threshold of 0.12 PPV for buildings extremely susceptible to vibration. Therefore, potential cumulative vibration impacts with respect to building damage from off-site construction would be less than significant.

Summary of Cumulative Construction Vibration Impacts

Due to the rapid attenuation characteristics of groundborne vibration and the proximity of major development proposed in the Victor Heights and Angelino Heights neighborhoods, there is no potential for a cumulative construction vibration impact with respect to building damage associated with groundborne vibration from on-site sources. In addition, potential cumulative vibration impacts with respect to building damage from off-site construction would be less than significant. Therefore, on-site and off-site construction activities associated with the Project and one or more potential related projects would not generate excessive groundborne vibration levels with respect to building damage.

Operation

The Project Site and surrounding Sunset Boulevard corridor have been developed with commercial, residential, and other uses that will continue to generate minimal groundborne vibration. Similar to the Project, any related projects in the vicinity of the Project Site could generate vibration from ongoing day-to-day operations. However, given the commercial and residential zoning along Sunset Boulevard, and adjacent residential neighborhoods, any related projects would not be typically associated with excessive groundborne vibration from on-site sources. However, each project would produce traffic volumes that are capable of generating roadway vibration impacts.

On-Site Operation Vibration

During operation of the Project, vibration impacts are generally limited to buildings and structures located near the construction site (i.e., within 15 feet as related to building damage). In general, related projects in this corridor would be commercial retail, hotel, or residential land uses that do not operate impact equipment and operations and would not generate substantial vibration. As a result, operation of new cumulative development in the area would have no potential to exceed FTA vibration damage standards at off-site receptors.

Off-Site Operation Vibration

Like the Project, any concurrent development near the Project Site would contribute normal passenger vehicle traffic that would generate negligible changes to roadway vibration. Use of larger heavy-duty trucks for delivery of goods and materials would be intermittent and not result in significant, cumulative increases in groundborne vibration on Sunset Boulevard other local roadways. Therefore, potential cumulative vibration impacts with respect to building damage from off-site operations would be less than significant.

Summary of Operational Construction Vibration Impacts

Due to the rapid attenuation characteristics of groundborne vibration and the proximity of major development proposed in this part of the Hollywood community, there is no potential for a cumulative operations vibration impact with respect to building damage associated with groundborne vibration from on-site sources. In addition, potential cumulative vibration impacts with respect to building damage from off-site construction would be less than significant. Therefore, on-site and off-site operations activities associated with the Project and one or more potential related projects would not generate excessive groundborne vibration levels with respect to building damage.

TECHNICAL APPENDIX

DouglasKim+Associates,LLC

Sunset & Everett Project

Construction Vibration

Receptor: Residential Structures, Everett St.
Equipment: Large Bulldozer, Auger Drill Rig

Source PPV (in/sec)	0.089
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.191**

Receptor: Residential Structures, Everett St.
Equipment: Loaded Trucks

Source PPV (in/sec)	0.076
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.164**

Receptor: Residential Structures, 1251 Sunset Bl.
Equipment: Large Bulldozer, Auger Drill Rig

Source PPV (in/sec)	0.089
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.191**

Receptor: Residential Structures, 1251 Sunset Bl.
Equipment: Loaded Trucks

Source PPV (in/sec)	0.076
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.164**

Receptor: Residential and Commercial Structures, Sunset Bl.
Equipment: Large Bulldozer, Auger Drill Rig

Source PPV (in/sec)	0.089
Reference Distance (ft)	25
Ground Factor (N)	1
Distance (ft)	110
Vibration Level (in/sec)	**0.020**

Receptor: Residential and Commercial Structures, Sunset Bl. (west side)
Equipment: Loaded Trucks

Source PPV (in/sec)	0.076
Reference Distance (ft)	25
Ground Factor (N)	1
Distance (ft)	110
Vibration Level (in/sec)	**0.017**

Sunset & Everett Project

Receptor: Residential Structures, Everett St.
Equipment: Small Dozer-Type Equipment

Source PPV (in/sec)	0.003
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.006**

Receptor: Residential Structures, Everett St.
Equipment: Jackhammer

Source PPV (in/sec)	0.035
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.075**

Receptor: Residential Structures, 1251 Sunset Bl.
Equipment: Small Dozer-Type Equipment

Source PPV (in/sec)	0.003
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.006**

Receptor: Residential Structures, 1251 Sunset Bl.
Equipment: Jackhammer

Source PPV (in/sec)	0.035
Reference Distance (ft)	25
Ground Factor (N)	1.5
Distance (ft)	15
Vibration Level (in/sec)	**0.075**

Receptor: Residential and Commercial Structures, Sunset Bl.
Equipment: Small Dozer-Type Equipment

Source PPV (in/sec)	0.003
Reference Distance (ft)	25
Ground Factor (N)	1
Distance (ft)	110
Vibration Level (in/sec)	**0.001**

Receptor: Residential and Commercial Structures, Sunset Bl. (west side)
Equipment: Jackhammer

Source PPV (in/sec)	0.035
Reference Distance (ft)	25
Ground Factor (N)	1
Distance (ft)	110
Vibration Level (in/sec)	**0.008**

Sources

California Department of Transportation (Caltrans), *Transportation and Construction Vibration Guidance Manual*,
Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment*, September 2018