Section 3.4

Noise and Vibration

3.4.1 Introduction

This section identifies and evaluates noise and vibration sensitive receptors in the project area and describes the potential noise and vibration effects that would be attributable to construction and operation of the proposed project. The analysis that follows includes a description of the existing conditions of the project site and surrounding area, the regulatory framework that guides the decision-making process, thresholds for determining if the proposed project would result in a significant impact, potential noise and vibration impacts, mitigation measures where necessary to reduce the severity of potentially significant impacts, and the level of significance after mitigation. Detailed calculations are provided in Appendix D, *Noise and Vibration Calculations*, to this Environmental Impact Report (EIR).

3.4.1.1 Noise

Sound is mechanical energy characterized by the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level (amplitude). The human ear experiences sound as pressure on the ear. The sound pressure level is the logarithmic ratio of that pressure to a reference pressure, and is expressed in decibels (dB). Approximately zero dB corresponds to the threshold of human hearing.

Environmental sounds are measured with the A-weighted scale of a sound level meter. The A-scale simulates the frequency response of the human ear by giving more weight to the middle frequency sounds and less to the low and high frequency sounds. A-weighted sound levels are designated as dBA. **Table 3.4-1** shows the range of sound levels of common indoor and outdoor activities, in dBA.

Because sounds in the environment usually vary with time, they cannot simply be described with a single number. One method used to describe variable sounds is the equivalent noise level, which is derived from a large number of moment-to-moment A-weighted noise level measurements. The equivalent noise level (L_{eq}) is the constant sound level that in a given period has the same sound energy level as the actual time-varying sound pressure level. L_{eq} provides a methodology for combining noise from individual events and steady state sources into a measure of cumulative noise exposure.

To evaluate community noise impacts, the day-night average noise level (L_{dn}) was developed to account for human sensitivity to nighttime noise. L_{dn} represents the 24-hour average noise level with a 10-dBA penalty (addition) applied to noise levels between 10:00 p.m. and 7:00 a.m. The L_{dn} is a useful metric of community noise impact because people in their homes are much more sensitive to noise at night than during the daytime. In the State of California, the community equivalent noise level (CNEL) is widely used. The CNEL is also a 24-hour cumulative noise descriptor that considers the sensitivity of humans to noise at night. However, in addition to the

10-dBA penalty between 10:00 p.m. and 7:00 a.m., the CNEL adds a 5-dBA penalty for nighttime hours between 7:00 p.m. and 10:00 p.m.

Table 3.4-1 Typical Noise Levels for Common Events

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet	105	
	100	
Gas lawnmower at 3 feet	95	
	90	
Diesel truck at 50 feet at 50 mph	85	Food blender at 3 feet
	80	Garbage disposal at 3 feet
Noisy urban area, daytime	75	
Gas lawnmower, 100 feet	70	Vacuum cleaner at 10 feet
Commercial area	65	Normal speech at 3 feet
Heavy traffic at 300 feet	60	
	55	Large business office
Quiet urban daytime	50	Dishwasher in next room
	45	
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime	35	
	30	Library
Quiet rural nighttime	25	Bedroom at night, concert hall (background)
	20	
	15	Broadcast/recording studio
	10	
	5	
Lowest threshold of human hearing	0	Lowest threshold of human hearing

Source: California Department of Transportation (Caltrans) 2013a.

Key:
dBA = A-weighted decibels
mph = miles per hour

Several statistical descriptors are also often used to describe noise, including L_{max}, L_{min}, and L_x. L_{max} and L_{min} are, respectively, the highest and lowest A-weighted sound levels that occur during a noise event.

A key concept in evaluating potential noise impacts is the perceived effect of incremental increases in existing noise levels. Human perception of noise has no simple correlation with acoustical energy. Due to subjective thresholds of tolerance, the annoyance of a given noise source is perceived very differently from person to person. Two noise sources do not “sound twice as loud” as one source. A doubling of noise sources results in a noise level increase of 3 dBA. For example, 60 dB plus 60 dB equals 63 dB, 80 dB plus 80 dB equals 83 dB. However, where ambient noise levels are high in comparison to a new noise source, there will only be a small change in noise levels. For example, when 70 dB ambient noise levels are combined with a 60 dB noise source, the resulting noise level equals 70.4 dB.

It is widely accepted that (1) the average healthy ear can barely perceive changes of a 3 dBA increase or decrease; (2) a change of 5 dBA is readily perceptible; and (3) an increase (or decrease) of 10 dBA sounds twice (or half) as loud (California Department of Transportation [Caltrans] 2013a). The generally accepted level at which a change in community noise levels becomes "barely perceptible" typically occurs at values greater than 3 dBA. Changes of 5 dBA are defined as "readily perceptible" and 10 dBA is considered twice as loud.

Noise, often described as unwanted sound, is known to have several adverse effects on humans. These noise effects may include hearing loss (not a factor with typical community noise), communication interference, and annoyance. Hearing loss is generally not a concern in community noise problems, even very near a major airport or a major freeway. Environmental noise does not have an effect on hearing threshold levels particularly due to the fact that environmental noise does not approximate occupational noise exposures in heavy industry, very noisy work environments with long-term exposure, or certain very loud recreational activities such as target shooting, motorcycle or automobile racing, etc. Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud to cause hearing loss.

From the source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise level as the distance from the source increases. The manner in which noise reduces with distance depends on many factors.

Sound from a small localized source (a "point" source) attenuates or drops off at a rate of 6 dBA for each doubling of distance (i.e., if the noise level is 70 dBA at 25 feet, it is 64 dBA at 50 feet and 58 dBA at 100 feet) for point sources. The movement of vehicles makes the source of the sound appear to emanate from a line (line source) rather than a point. The sound level attenuates or drops off at a rate of 3 dBA per doubling of distance from line sources (Caltrans 2013a).

To account for ground-effect attenuation (absorption), two types of site conditions are commonly used in noise prediction: soft site and hard site conditions. Hard sites, such as parking lots or smooth bodies of water, provide no additional ground attenuation, and the changes in noise levels with distance (drop-off rate) are simply the geometric spreading of the source. Soft sites are sites that have an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees, and provide additional ground attenuation at 1.5 dBA per doubling of distance (Caltrans 2013a).

A large object in the line of sight between a noise source and a receiver can significantly attenuate noise levels at that receiver location. The amount of attenuation provided by this "shielding" depends on the size of the object and the frequencies of the noise levels. Natural terrain features (e.g., hills and dense woods) and man-made features (e.g., buildings and walls) can noticeably attenuate noise levels. For a noise barrier to work, it must be high enough and long enough to block the view from the receiver to the noise source (e.g., a road).

Noise-sensitive locations include areas where an excessive amount of noise would interfere with normal operations or activities and where a high degree of noise control may be necessary. Examples include schools, hospitals, and residential areas. Recreational areas may be considered noise-sensitive where quiet and solitude may be an important aspect of the specific recreational experience.

3.4.1.2 Vibration

Vibration is the periodic movement of mass over time. Construction of the proposed project has the potential to generate vibration that would be experienced by nearby structures and their occupants. Operation of heavy construction equipment (such as pavement breakers) creates seismic waves that radiate along the surface of the earth and downward into the earth. These surface waves can be felt as ground vibration. Vibration from operation of this equipment can result in effects ranging from annoyance to damage to buildings. Damage to buildings could include structural damage (e.g., cracking of floor slabs, foundations, columns, beams, or wells) or cosmetic architectural damage (e.g., cracked plaster, stucco, or tile).

Construction that can result in significant levels of ground vibration generally falls into two categories that are best characterized by the cause of the vibration and its duration. Vibration that is steady-state and more or less continuous can be caused by vibratory compaction of soil, movement of large equipment, and other sources. In contrast, vibration that is more transient in nature and intermittent due to impulsive forces can be caused by pile driving and blasting.

Ground vibration can also be a source of annoyance to people. The primary effect of perceptible vibration is often a concern. However, secondary effects, such as the rattling of a china cabinet, can also occur, even when vibration levels are well below perception. Any effect (primary perceptible vibration, secondary effects, or a combination of the two) can lead to annoyance. The degree to which a person is annoyed depends on the activity in which they are participating at the time of the disturbance. For example, someone sleeping or reading will be more sensitive than someone who is running on a treadmill. Reoccurring primary and secondary vibration effects often lead people to believe that the vibration is damaging their home, even when vibration levels may be well below minimum thresholds for damage potential (Caltrans 2013b).

Vibration levels are estimated using peak particle velocity (ppv), which is defined as the maximum instantaneous positive or negative peak of the vibration signal, usually measured in inches per second (in/sec). Since it is related to the stresses that are experienced by buildings, ppv is often used in monitoring blasting vibration and the vibration of heavy construction equipment. Vibration is also described in decibel units, expressed as VdB to distinguish from noise level decibels. This unit is often used to evaluate human annoyance to vibration.

Construction vibration is generally associated with pile driving and rock blasting (which would not be utilized during construction of the proposed project). However, large bulldozers, vibratory compactors, and loaded trucks can cause perceptible vibration levels at close proximity. For example, a large bulldozer can generate vibration levels of 0.089 ppv in/sec at 25 feet. Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. High-frequency vibrations reduce much more rapidly than low frequencies so that low frequencies tend to dominate the spectrum at large distances from the source. Discontinuities in the soil strata can also cause diffractions or channeling effects that affect the propagation of vibration over long distances. When vibration encounters a building, a ground-to-foundation coupling loss will usually reduce the overall vibration level.

Vibration-sensitive receptors are generally considered to be (1) persons who may be annoyed by the vibration; (2) persons who are engaged in activities that may be subject to significant interference from vibration, such as working with delicate instruments; and (3) structures that are susceptible to damage from vibration (e.g., older fragile buildings).

3.4.2 Environmental Setting

As shown in Figure 2-2, the project site is located within an urban area, south of the Foothill Freeway (I-210) and east of South Arroyo Parkway (I-110) in the western portion of the City. The project site comprises the entire block bounded by Marengo Avenue to the west, Holly Street to the north, Garfield Avenue to the east, and Union Street to the south. The project site is located within an urban area that is mostly surrounded by governmental facilities and commercial, with some residential and religious uses to the north and west. Land uses near the project site include the First Baptist Church of Pasadena (across Marengo Avenue to the west), Memorial Park and the Memorial Park Station of the Los Angeles County Metropolitan Transportation Authority (Metro) Gold Line (one and a half blocks northwest), the five-story Centennial Place residential facility (across Holly Street to the north; also known as the historic YMCA), Pasadena Public Library (two blocks north), Pasadena City Hall (across Garfield Avenue to the east/northeast), the Civic Center Financial District (starting half a block south), and Paseo Colorado (one block south). Surrounding land uses are discussed in detail in Section 2.4, *Surrounding Land Uses*. The project site is located within, and contributing to, the Pasadena Civic Center Historic District, which is listed in the National Register of Historic Places and is adjacent to several other historic structures in the District, most notably Pasadena City Hall. Additional information on the historic nature of the area is discussed in Section 3.1, *Cultural Resources*.

Noise sensitive receptors located in close proximity to the project site include the First Baptist Church of Pasadena, approximately 110 feet to the west across Marengo Avenue and residences within Centennial Place, approximately 210 feet to the north across Holly Street. If the proposed hotel were to be constructed, the guest rooms would also be noise-sensitive land uses.

The proposed project would entail renovation of the existing building (i.e., the former YWCA) on the project site as well as construction of a new building adjacent to the existing building. Due to its age, the former YWCA building is a vibration-sensitive structure. Off-site vibration-sensitive land uses include the following:

- First Baptist Church of Pasadena, located approximately 110 feet west of the existing YWCA building;
- Centennial Place, located approximately 210 feet north of the existing YWCA building;
- Pasadena City Hall, located approximately 285 feet east of the existing YWCA building; and
- Loweman Building, located approximately 50 feet south of the existing YWCA building.

The primary source of noise in the project area is vehicle traffic on Marengo Avenue and other surrounding streets. Based on the noise contours in the General Plan (City of Pasadena 2002a), the ambient (background) noise level in the area is estimated to be 60 dBA.

3.4.3 Regulatory Framework

3.4.3.1 Federal

The Noise Control Act of 1972 and the Quiet Communities Act of 1978 promote protection of human health and welfare from excessive noise. Title IV – Noise Pollution, of the Clean Air Act established the Office of Noise Abatement and Control (ONAC) to coordinate all federal noise control activities and investigations. However, in response to decisions made by the Administration in 1981, the U.S. Environmental Protection Agency (USEPA) phased out ONAC's funding to shift noise control responsibilities to state and local governments. The Noise Control Act of 1972 and the Quiet Communities Act of 1978 remain in effect today but are not funded.

3.4.3.2 State

The California Office of Noise Control (CONC) was established under the California Noise Control Act of 1972. The CONC is a division of the California Department of Public Health Services and is responsible for developing model noise ordinances for urban, suburban, and rural environments; developing criteria and guidelines for use in setting standards for human noise exposure; and assisting local governments in developing and implementing noise abatement procedures (California Health and Safety Code Division 28).

Title 24 of the California Code of Regulations (CCR), also known as the California Building Standards Code, establishes building standards applicable to all occupancies throughout the state. Section 1207.4 of the 2013 code, as amended by the Supplement effective July 1, 2015, requires that certain dwellings, including hotels, be designed to prevent the intrusion of exterior noise so that the interior noise attributable to exterior sources shall not exceed 45 dBA CNEL in any habitable room (California Department of Housing and Community Development 2014; California Department of Housing and Community Development 2015).

3.4.3.3 Local

Noise within the City is regulated by the City's Noise Ordinance, which is found in the City's municipal code (Chapter 9.36 - Noise Restrictions). The Noise Ordinance states that it is the policy of the City to "prohibit unnecessary, excessive and annoying noises from all sources pursuant to its police power" (City of Pasadena Code of Ordinance Section 9.36.020). The Noise Ordinance prohibits generation of noise that exceeds the existing actual measured ambient noise at the property line of any property by more than 5 decibels (City of Pasadena Code of Ordinance Section 9.36.050A and 9.36.090), with adjustments made for steady audible tones, repeated impulsive noise, and noise occurring for limited time periods. The Noise Ordinance also prohibits any person to make or continue any loud noises that disturb the peace or quiet of any neighborhood. The level of noise, the proximity of noise to residential sleeping facilities, and the time of day or night the noise occurs are considered in determining whether a violation exists (City of Pasadena Code of Ordinance Section 9.36.050B).

Amplified sound is regulated by Section 9.36.160. This section limits the operation of sound amplifying equipment between the hours of 10:00 p.m. and 8:00 a.m. Monday through Saturday; no use is permitted for commercial purposes on Sundays or legal holidays. Sound amplifying equipment may not be operated within 200 feet of a church or city building without written consent from the church or city. Moreover, sound levels emanating from sound amplifying equipment shall not exceed continuously the maximum noise level of 15 decibels above the ambient noise level when measured at the outside property line. The Municipal Code also requires that the volume of sound be controlled so that it will not be unreasonably loud, raucous, jarring, disturbing, or a nuisance to reasonable persons of normal sensitiveness within the area of audibility.

This Noise Ordinance also limits construction activity to between 7:00 a.m. and 7:00 p.m. on weekdays and between 8:00 a.m. and 5:00 p.m. on Saturdays within a residential district or within a radius of 500 feet therefrom. Construction is prohibited on Sundays and holidays (City of Pasadena Code of Ordinance Section 9.36.070) within a residential district or within a radius of 500 feet therefrom. Maximum noise levels of any powered construction equipment are limited to 85 dBA at 100 feet from the noise source (City of Pasadena Code of Ordinance Section 9.36.080).

The General Plan Noise Element for the City (City of Pasadena 2002a; City of Pasadena 2002b) provides noise management goals, objectives, policies, and programs for the City to achieve and incorporate in the land use compatibility matrix shown in **Table 3.4-2**. This matrix is used to help the City determine the appropriate land use and mitigation measures based on the existing or anticipated ambient noise levels.

Table 3.4-2 Land Use Compatibility for Community Noise Environments (L_{dn} or CNEL in dBA)

Land Use	Clearly Acceptable[1]	Normally Acceptable[2]	Conditionally Acceptable[3]	Normally Unacceptable[4]
Residential - low density single family, duplex, mobile homes	Below 60	55 to 70	70 to 75	Above 75
Residential - multi-family and mixed commercial/residential use	Below 65	60 to 70	70 to 75	Above 75
Transient lodging - motels, hotels	Below 65	60 to 70	70 to 80	Above 80
Schools, libraries, churches, hospitals, nursing homes	Below 65	60 to 70	70 to 80	Above 80
Auditoriums, concert halls, amphitheaters	--	Below 70	Above 65	--
Sports arena, outdoor spectator sports	--	Below 75	Above 70	--
Playgrounds, neighborhood parks	Below 70	--	67 to 75	Above 72
Golf courses, riding stables, water recreation, cemeteries	Below 75	--	70 to 80	Above 80
Office buildings, business commercial and professional	Below 70	67 to 77	Above 75	--
Industrial, manufacturing, utilities, agriculture	Below 75	70 to 80	Above 80	--

Source: City of Pasadena 2002a.

Notes:

1. Clearly Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
2. Normally Acceptable: New construction or development should be undertaken after an analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.
3. Conditionally Acceptable: If new construction or development proceeds, an analysis of the noise reduction requirements should be made and needed noise insulation features included in the design.
4. Normally Unacceptable: New construction or development should generally not be undertaken, unless it can be demonstrated that an interior level of 45 dBA can be achieved.

The 60 dBA average ambient noise level (the CNEL) condition at the project site falls in the "normally acceptable" range for transient lodging, including hotels and motels. New construction that falls in the "normally acceptable range" should be undertaken after an analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. An acceptable interior noise level in habitable rooms is 45 dBA L_{dn}. The following standard mitigation measures are listed in the Noise Element (City of Pasadena 2002b):

1. If a 15-20 dBA reduction is needed, the following may suffice:
   a. Air conditioning or a mechanical ventilation system;
   b. Windows and sliding glass doors should be double-paned glass and mounted in low air infiltration rate frames (0.5 cubic feet per minute [cfm] or less, per American National Standard Institute [ANSI] specifications); and
   c. Solid core exterior doors with perimeter weather stripping and threshold seals.

2. If a 20-25 dBA reduction is needed, the following may suffice:
    a. Same as No. 1a-c;
    b. Exterior walls consist of stucco or brick veneer. Wood siding with a one-half inch minimum thickness fiberboard underlayer may also be used;
    c. Glass in both windows and doors should not exceed 20 percent of the floor area in a room; and
    d. Roof or attic vents facing the noise source should be baffled.
3. If a 25-30 dBA reduction is needed, the following may suffice:
    a. Same as No. 2a-d;
    b. The interior sheetrock of exterior wall assemblies should be attached to studs by resilient channels. Staggered studs or double walls are acceptable alternatives; and
    c. Window assemblies should have a laboratory-tested Sound Transmission Class (STC) rating of 30 or greater (Windows that provide superior noise reduction capability and that are laboratory-tested are sometimes called "sound-rated" windows. In general, these windows have thicker glass and/or increased air space between panes. In contrast, standard energy conservation double-pane glazing with a one-eighth inch or one-quarter inch air space may be less effective in reducing noise from some noise sources than single pane glazing).

For new construction in the "normally acceptable" range, the Noise Element notes that conventional construction, with closed windows and fresh air supply systems or air conditioning, will normally suffice for purposes of noise insulation.

Policies to minimize excessive noise levels and to encourage mixed-use development in the Central District of the City were established for each major noise source and are listed in the City's General Plan Noise Element. Policies include promoting noise-compatible land uses, alternative transportation modes and noise attenuating design, and limiting construction activities near sensitive noise receptors.

3.4.4 Methodology

Noise and vibration are produced during construction and operation of a project. The methodology used to evaluate each is described below.

3.4.4.1 Noise Methodology

Variation in power is an element in characterizing the noise source level from construction equipment and is accounted for by describing the full power or maximum noise level and the duty cycle. The duty cycle is the percent of time that the equipment is operating at full power. Typical maximum noise levels at 100 feet and duty cycles of representative types of equipment to be used during construction of the proposed project are listed in **Table 3.4-3**. Construction equipment noise would not be constant because of the variations of power, cycles, and equipment location. The construction noise analysis compares the maximum noise level of the loudest piece of equipment at a distance of 100 feet that would be used during construction to the construction threshold below. For informational purposes, the noise level generated during each phase of construction is estimated at a distance of 100 feet.

Table 3.4-3 Typical Maximum Noise Levels and Acoustical Use Factors for Construction Equipment

Equipment Description	Impact Device?	Typical Duty Cycle	L_{max} at 100 ft (dBA)[1]
Tractors/Loaders/Backhoes	No	40%	72
Compressor (air)	No	40%	72
Crane	No	16%	75
Dozer	No	40%	76
Dump Truck	No	40%	70
Rough Terrain Forklifts/Skid Steer Loaders	No	40%	73
Generator	No	50%	75
Graders	No	40%	79
Forklifts	No	20%	69
Paver/Paving Equipment	No	50%	71
Roller	No	20%	74
Cement and Mortar Mixers	No	20%	74
Welder/Torch	No	40%	68

Source: Federal Highway Administration (FHWA) 2006.

Notes:

1. The L_{max} values presented in the table are the actual measured values summarized in the Roadway Construction Noise Model User's Guide (FHWA 2006) unless the actual is unavailable, in which case the equipment specifications were used.

Table 3.4-4 summarizes the equipment mix that is assumed to be operated during each phase of construction. The fleet mix was estimated using the California Emission Estimator Model (CalEEMod), Version 2013.2.2, which was used to complete the air quality analysis in the Initial Study(See Appendix A, *Initial Study and Scoping Comments*). Detailed calculations are provided in Appendix D, *Noise and Vibration Calculations.*

Table 3.4-4 Equipment Fleet Mix

Construction Phase	Equipment Description	Number of Equipment
Site Preparation	Air Compressors	3
	Graders	1
	Rollers	1
	Rough Terrain Forklifts	3
	Skid Steer Loaders	2
	Tractors/Loaders/Backhoes	1
Grading	Graders	1
	Rubber Tired Dozers	1
	Tractors/Loaders/Backhoes	1
Building Construction	Cranes	1
	Forklifts	1
	Generator Sets	1
	Tractors/Loaders/Backhoes	1
	Welders	3
Paving	Cement and Mortar Mixers	1
	Pavers	1
	Paving Equipment	1
	Rollers	1
	Tractors/Loaders/Backhoes	1
Architectural Coatings	Air Compressors	1

Source: CDM Smith 2015.

For operational noise impacts, traffic data prepared by the Pasadena Department of Transportation were used to estimate the project-related increase in roadway noise. Additionally, onsite noise sources could include mechanical equipment (e.g., heating, ventilating, and air conditioning [HVAC] units and swimming pool pumps); landscape maintenance equipment; and outdoor activities in the patio and swimming pool areas. Onsite noise sources were reviewed for compliance with the City's regulations governing stationary sources and outdoor activities.

3.4.4.2 Vibration Methodology

Some construction equipment can generate groundborne noise or vibration that may affect nearby structures or residents. Operation of heavy construction equipment creates seismic waves that radiate along the surface of the earth and downward into the earth. These surface waves can be felt as ground vibration. Large bulldozers, vibratory rollers, and loaded trucks are examples of equipment that could be used during project construction. Vibration levels were estimated for large bulldozers, loaded trucks, and other similar equipment using peak ppv levels in in/sec published by the FHWA (2006) adjusted for distance to the nearest sensitive receptor.

Human annoyance is calculated in terms of vibration decibels (VdB) to compress the range of numbers used to describe vibration. Because a reference distance of 25 feet is used to describe the vibration levels of individual pieces of equipment and there are no sensitive receptors within 25 feet of the construction site, it was necessary to adjust the reference vibration levels to the actual distance of the sensitive receptors. Distance attenuation was calculated following the equations described in Chapter 12 of the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment guidance (2006). Total vibration exposure from all sources was estimated using a logarithmic formula (i.e., values were not simply added) (see FTA 2006).

Operation of the proposed project would not generate groundborne vibration, therefore, operational vibration is not addressed further in this section.

The methodology for evaluating construction-related vibration impacts relies upon guidance developed by the FTA and Caltrans. Both FTA and Caltrans have criteria for damage to structures from construction vibration as well as human annoyance resulting from vibration.

Criteria for Evaluating Vibration Impacts to Structures

FTA has developed a guidance manual presenting procedures for predicting and assessing noise and vibration impacts of proposed mass transit projects that are applicable to other types of construction. The procedures act as a screening process and include impact criteria that are used to assess the magnitude of predicted impacts. The FTA construction vibration damage criteria are provided in **Table 3.4-5**. These criteria are measured in ppv, which is related to the stresses that are experienced by buildings.

Table 3.4-5 FTA Construction Vibration Damage Criteria

Building Category	PPV (in/sec)	Approximate L_v[1]
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: Federal Transit Administration (FTA) 2006.

Note:
1. Root Mean Square (RMS) velocity in decibels (VdB), where the reference velocity is 1 micro-inch per second.

Key:
PPV = peak particle velocity
in/sec = inches per second
L_V = vibration velocity level (also written as VdB)

Caltrans has also developed guidance and procedures for addressing vibration issues associated with construction (Caltrans 2013b). The guidance is intended to be used as a screening for assessing the potential for adverse effects related to human perception and structural damage. The guidance is not an official policy or regulation; its content is for informational purposes only. The guidance manual includes potential threshold criteria for vibration damage. These criteria are provided in **Table 3.4-6**.

Table 3.4-6 Caltrans Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources[1]	Continuous/Frequent Intermittent Sources[2]
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: Caltrans 2013b.

Notes:
1. Transient sources create a single isolated vibration event, such as blasting or drop balls.
2. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Key:
PPV = peak particle velocity
in/sec = inches per second

Criteria for Evaluating Human Annoyance Resulting from Vibration

The FTA's guidelines for evaluating human response to vibration are shown in **Table 3.4-7**.

Table 3.4-7 FTA Ground-Borne Vibration Impact Criteria for Human Annoyance

Land Use Category	Vibration Impact Level for Frequent Events (VdB)[1]	Vibration Impact Level for Occasional Events (VdB)[2]	Vibration Impact Level for Infrequent Events (VdB)[3]
Category 1: Buildings where vibration would interfere with interior operations	65	65	65
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime use	75	78	83

Source: Federal Transit Administration (FTA) 2006.

Notes:
1. "Frequent Events" is defined as more than 70 vibration events of the same source per day.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.

Key:
VdB = vibration decibels

3.4.5 Thresholds of Significance

The City uses thresholds derived from Appendix G of the State CEQA Guidelines as its thresholds of significance for impacts associated with noise. The proposed project would have a significant noise impact if it would result in:

- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

  This threshold addresses noise associated with construction equipment. The City's Noise Ordinance prohibits the operation of individual pieces of construction equipment that would generate noise in excess 85 dBA at a distance of 100 feet (City of Pasadena Code of Ordinance Section 9.36.080). For the purposes of this EIR, noise impacts would be significant if construction equipment were to produce noise that exceeds 85 dBA L_{max} at a distance of 100 feet.

- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

  This threshold addresses noise associated with operations of the project following completion of construction. The City prohibits generation of noise in excess of 5 dBA at the property line over the existing ambient noise level, including noise generated by machinery, equipment, pumps, fans, air conditioning units, or similar devices (City of Pasadena Code of Ordinance Sections 9.36.050A and 9.36.090), with adjustments made for steady audible tones, repeated impulsive noise, and noise occurring for limited time periods. For the purposes of this EIR, operational noise impacts would be significant if project operations were to produce noise for more than 15 minutes in an hour that exceeds existing ambient exterior 1-hour L_{eq} noise levels by 5 dBA or more at a sensitive receptor site (with the adjustments specified in the City's Noise Ordinance).

- 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.

- Exposure of persons to, or generation of, excessive groundborne vibration or groundborne noise levels.

  Due to the historic nature of the buildings on and adjacent to the project site and their potential vulnerability to vibration impacts, a vibration level of 0.12 ppv in/sec is used in this analysis as a conservative threshold for potentially significant structural vibration damage impacts to existing historic structures. This value corresponds to the FTA construction vibration damage criteria for extremely susceptible buildings, as presented in Table 3.4-5. This value lies between Caltrans' "Historic and Some Old Buildings" classification and the "Fragile" classification for continuous/frequent intermittent sources (presented in Table 3.4-6), but tends towards the "Fragile" classification. (Continuous/frequent intermittent construction sources are the source types that would be associated with construction of the proposed project; these criteria are also more conservative than criteria associated with transient sources.) Therefore, for the purposes of this EIR, vibration impacts would be significant if project construction or operation were to expose historic structures to vibration levels that exceed 0.12 in/sec. For non-historic structures, a vibration level of 0.25 ppv in/sec (Caltrans' "Historic and Some Old Buildings" in Table 3.4-6) is considered an appropriate threshold for a potentially significant structural damage vibration impact.

FTA estimates that vibration levels of 72 VdB and 80 VdB for frequent and infrequent events, respectively, could annoy a person in his or her residence, while vibration levels of 75 to 83 could annoy a person at institutional land uses with primarily daytime use (Table 4.3-7). Therefore, vibration impacts would be significant if project construction or operation were to expose vibration-sensitive receptors to vibration levels that exceed 72 VdB for residential land uses or 75 VdB for commercial land uses.

3.4.6 Project Impacts

Impact NOISE-1. Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

The project would cause a temporary increase in noise levels during construction. The primary noise sources during typical construction activities are diesel engines of construction equipment and activities such as pile driving, blasting, and jackhammering. No pile driving or blasting would occur during construction of the proposed project. However, nearby receptors would be exposed to occasional high noise levels associated with the operation of heavy equipment during construction, including air compressors, cement and mortar mixers, cranes, forklifts, generator sets, graders, pavers, paving equipment, rollers, rough terrain forklifts, rubber tired dozers, skid steer loaders, tractors/loaders/backhoes, and welders. Construction activities would be limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 8:00 a.m. to 5:00 p.m. Saturday, as required by the Pasadena Municipal Code. As indicated above in Section 3.4.5, use of any single piece of construction equipment that produces noise that exceeds 85 dBA L_{max} at a distance of 100 feet would result in a significant impact. Typical maximum noise levels at 100 feet and duty cycles of representative types of equipment to be used during construction of the proposed project are listed in Table 3.4-3 above. As presented in Table 3.4-3, noise generated from each piece of construction equipment assumed to be used during project construction would not exceed 85 dBA L_{max} at 100 feet. Therefore, noise impacts during construction would be less than significant.

Although not required by the City's construction Noise Ordinance, average noise levels at a distance of 100 feet have been estimated for construction activities by phase for informational purposes, as shown in **Table 3.4-8**. The noisiest phase of construction would be site preparation, which would occur for approximately 120 days. The primary noise sources would be the operation of air compressors, graders, rollers, rough terrain forklifts, skid steer loaders, and backhoes. Following site preparation, there would be less use of heavy equipment and noise levels would be lower. Construction equipment noise would not be constant because of the variations of power, cycles, and equipment location.

Table 3.4-8 Construction Noise Levels by Phase

Construction Phase	Type of Equipment[1]	Average Noise Level at 100 Feet (Leq)
Site Preparation	Air Compressors (3) Graders (1) Rollers (1) Rough Terrain Forklifts (3) Skid Steer Loaders (2) Tractors/Loaders/Backhoes (1)	80 dBA
Grading	Graders (1) Rubber Tired Dozers (1) Tractors/Loaders/Backhoes (1)	77 dBA
Building Construction	Cranes (1) Forklifts (1) Generator Sets (1) Tractors/Loaders/Backhoes (1) Welders (3)	76 dBA
Paving	Cement and Mortar Mixers (1) Pavers (1) Paving Equipment (1) Rollers (1) Tractors/Loaders/Backhoes (1)	75 dBA
Architectural Coatings	Air Compressors (1)	68 dBA

Source: CDM Smith 2015.

Notes:

1. Construction equipment and schedule are from the air quality analysis in the Initial Study (City of Pasadena 2015; included in Appendix A) and represent CalEEMod defaults.

In addition to on-site activities, construction activities could include the import or export of excavated soils and other materials using large diesel trucks. As indicated in Table 3.4-3, a dump truck would generate a noise level of 70 dBA at a distance of 100 feet, which is below the City's construction noise limit of 85 dBA at 100 feet. Therefore, impacts associated with construction-related trucks would be less than significant and no mitigation is required.

Mitigation Measures

Impacts associated with construction noise would be less than significant and no mitigation is required.

Residual Impacts

Construction noise impacts would be less than significant. Recommended Conditions of Approval (COA-NOISE-1 and COA-NOISE-2) would further protect surrounding sensitive receptors from construction-related noise.

Conditions of Approval

While construction noise impacts would be less than significant, the following Conditions of Approval are recommended as part of the City's entitlement process to further protect surrounding sensitive receptors from construction-related noise:

COA-NOISE-1: Noise-Generating Construction Hours

Prior to issuance of grading and/or building permits, contractor specifications shall include a note indicating that noise-generating construction activities shall be limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 8:00 a.m. to 5:00 p.m. Saturday. On Sundays and holidays,[5] no noise-generating construction activities shall be permitted.

COA-NOISE-2: Construction Noise Reduction Measures

Prior to approval of grading plans and/or prior to issuance of demolition, grading and building permits, the following noise-reduction measures shall be included in the construction plans or specifications:

- The construction contractor shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with manufacturer's standards.
- The construction contractor shall place all stationary construction equipment so that the equipment is as far as reasonably feasible from noise-sensitive receptors and so emitted noise is directed away from noise-sensitive receptors.
- The construction contractor shall locate equipment staging in areas that will create the greatest distance between staging area noise sources and noise-sensitive receptors.

Impact NOISE-2. Would the project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The proposed project would contribute operational (post-construction) noise to the existing environment through (1) the addition of traffic on local streets, (2) on-site stationary sources, and (3) on-site outdoor activities.

Project-Related Traffic

The proposed project would generate approximately 3,194 average daily trips (ADT) along surrounding roadways in the project vicinity. Because there would be no on-site parking, guests would be dropped off on Marengo Avenue in front of the hotel; from the drop-off turnout, a valet would deliver cars to an offsite parking garage. At present, three parking garage locations are under consideration for this purpose:

- AT&T garage located at 177 East Colorado Boulevard;
- Holly Street garage located at 150 East Holly Street; and
- Ramona garage located at 240 Ramona Avenue.

[5] Holidays are defined as New Year's Day, Martin Luther King Jr. Day, Lincoln's Birthday, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving, and Christmas (City of Pasadena Code of Ordinance Section 9.36.070E).

The increase in traffic volumes on surrounding streets would vary, depending on the parking garage. Project-related increases in average daily traffic on the streets adjacent to the project site are identified in **Table 3.4-9**. Because of the logarithmic nature of noise, a doubling of traffic would result in a 3 dBA increase in noise levels, which would be barely perceptible to the human ear. Traffic would need to be increased at least three times for increased noise to exceed the City's threshold of 5 dBA. As indicated in Table 3.4-9, the greatest increase in traffic would occur on Garfield Avenue with use of the Holly Street Garage or the Ramona Garage. In both instances, ADT would increase by 81 percent on Garfield Avenue. Traffic increases on other roads surrounding the project site would be lower than on Garfield Avenue and, depending on the parking garage, would range from 0 percent to 55 percent. As traffic would increase at a level that is less than double existing volumes, the resulting noise increases on all of the surrounding roads would be less than 3 dBA. This would not result in a substantial increase in ambient noise levels in the project vicinity; therefore, the impact would be less than significant and no mitigation is required.

Table 3.4-9 Project-Related Increase in Average Daily Traffic on Surrounding Roadways

	Existing ADT	AT&T Garage		Holly Street Garage		Ramona Garage	
		Project Volume + Valet	Vehicular Increase in ADT	Project Volume + Valet	Vehicular Increase in ADT	Project Volume + Valet	Vehicular Increase in ADT
Marengo Avenue	16,234	3,194	20%	3,194	20%	3,194	20%
Holly Street	1,444	0	0%	798	55%	0	0%
Garfield Avenue	3,953	239	6%	3,194	81%	3194	81%
Union Street[1]	7,327	NA	NA	NA	NA	NA	NA

Source: Pasadena Department of Transportation 2015.

Note:

1. Union Street was not analyzed. However, if it were assumed that 100% of project-related ADT were to occur on Union Street, then the increase in ADT would be 44%.

Key:
ADT = average daily traffic
NA = not analyzed

On-Site Noise Sources

Operational noise sources associated with the proposed project would include, but would not be limited to, mechanical equipment (e.g., HVAC units and swimming pool pumps); landscape maintenance equipment; and outdoor activities in the patio and swimming pool areas.

Stationary Sources

HVAC units, swimming pool pumps, and other stationary equipment would be used on the project site, and would generate noise. This equipment would be selected and installed to comply with Section 9.36.090 of the City Noise Ordinance, which requires all such equipment to be operated such that the noise level at the property line would not exceed the ambient noise level by more than 5 dBA. By complying with the City's Noise Ordinance, noise impacts from stationary sources would be less than significant.

Outdoor Activities

Noise from landscape maintenance equipment would be similar to noise currently generated by the same activities on the project site and would not result in a substantial increase in noise above existing noise levels. Noise impacts from use of landscape maintenance equipment would be less than significant.

The roof level above the existing gymnasium and pool complex would be structurally strengthened and converted into an outdoor, rooftop pool area (third floor of existing YWCA building). Noise would be generated at the swimming pool area, which would be approximately 250 feet from the Centennial Place residential facility, which is the nearest sensitive receptor to the pool area. Noise from exuberant children's play and similar activities in the daytime may be heard by nearby residents because the character of the noise would be different than the existing traffic noise. The magnitude of the pool area noise at the adjacent residences is calculated based on the following scenario:

- Yelling children: children making noise of 70 dBA measured at a distance of 5 feet for 10 minutes in an hour;
- Loud talking: assumed as five people talking simultaneously, each making noise of 65 dBA measured at a distance of 5 feet for 30 minutes in an hour; and/or
- Noise may be generated throughout the pool area, which would have an east-west length of approximately 50 feet. The average location of the above noise sources would be at the center of the pool area, and the distance from the center of the pool area to the Centennial Place residential facility would be approximately 290 feet.

Assuming a level of 70 dBA (caused by yelling children), the noise from the pool area would be approximately 35 dBA L_{eq} at the Centennial Place residential facility, which is 290 feet away. Because the ambient daytime noise level is assumed to be 60 dBA (see Section 3.4.2), activities at the pool area would not cause an increase in noise levels at the Centennial Place residential facility. Therefore, noise from the swimming pool area day time activities described above would not exceed the ambient noise level by 5 dBA. The impact would be less than significant.

Noise from the pool area would not exceed the ambient noise level by 5 dBA. Ambient noise levels during late night and early morning hours are typically at their lowest and noisy activities, including pool use, would be more noticeable, which may disturb the peace or quiet of the neighborhood or cause annoyance to residents of Centennial Place. Nighttime noise within the outdoor patio along Holly Street and outdoor dining area along North Marengo Avenue could be similarly disturbing, as would use of personal amplified equipment in outdoor areas. Based on the Noise Ordinance (Pasadena Code of Ordinances §9.36.020 and §9.36.050), the city prohibits unnecessary, excessive, and annoying noises from all sources, and the hotel would be required to comply with the Noise Ordinance. Therefore, with adherence to the Noise Ordinance, impacts associated with hotel noise from the pool area and outdoor patio and dining areas would be less than significant.

Noise from amplified music operated by the hotel at any time in the outdoor dining, outdoor patio, or pool area could be disturbing to adjacent residents. The City's Noise Ordinance (Pasadena Code of Ordinances §9.36.160E.) prohibits noise that disturbs persons of normal sensitiveness residing in the area. In accordance with the Noise Ordinance, use of amplified equipment is prohibited between the hours of 10:00 p.m. and 8:00 a.m., as well as all day on Sundays or legal holidays. With adherence to the Noise Ordinance, impacts associated with hotel-operated amplified equipment would be less than significant.

Mitigation Measures

Impacts associated with changes in ambient noise levels during daytime and nighttime activities would be less than significant and no mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact NOISE-3. Would the project expose persons to, or generate, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Traffic Noise Impacts to Proposed Project Uses

As discussed in Section 3.4.2, the existing ambient noise level at the project site is estimated at 60 dBA. The greatest increase in traffic on surrounding roads would occur on Garfield Avenue, where traffic would increase by 81 percent with use of the Holly Street Garage or the Ramona Garage. This would result in an increase in existing noise levels of less than 3 dBA, for a future noise level of less than 65 dBA.

As shown in Table 3.4-2, the future noise environment (less than 65 dBA) for a hotel use is classified as follows:

NORMALLY ACCEPTABLE: New construction or development should be undertaken after an analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.

As required by the California Building Standards Code, the interior noise level for hotel guest rooms is required to be 45 dBA CNEL or less (see Section 3.4.3.2). Thus, the building construction must result in a reduction of the estimated 60 dBA CNEL exterior noise level by at least 15 dBA. The proposed hotel would have conventional air conditioning as required by the California Building Code. The use of conventional building techniques for hotels, including air conditioning in the guest rooms, may reduce noise levels by the required amount. The City of Pasadena Noise Element provides the following guidance:

If a 15-20 dBA reduction is needed, the following may suffice:

a. Air conditioning or a mechanical ventilation system;

b. Windows and sliding glass doors should be double-paned glass and mounted in low air infiltration rate frames (0.5 cfm or less, per ANSI specifications); and

c. Solid core exterior doors with perimeter weather stripping and threshold seals.

The building design would comply with the California Building Standards Code, which requires the interior noise level for hotel guest rooms to be 45 dBA CNEL or less. With adherence to the code, this impact would be less than significant.

Other Noise Impacts to Proposed Project Uses

The proposed project would be located in the Central District (CD)-2 zoning district (Civic Center/ Midtown). The primary purpose of CD-2 is to be the governmental center of the City by supporting civic, cultural, and public service institutions (City of Pasadena Code of Ordinance Section 17.300.020). Governmental functions, such as City Hall, the Post Office, the Pasadena Police Department, and the Court House, are located near the proposed project. Unusual noises, such as police sirens and protests at City Hall, could occasionally occur near the project site; however, these types of noise events would not be of the frequency or magnitude to result in a CNEL exceeding 70 dBA, the upper limit of the Normally Acceptable noise exposure category (Table 3.4-2). Therefore, impacts to future occupants, users and employees of the hotel would be less than significant and no mitigation is required.

Compliance with Existing Standards

As discussed in the second threshold above, with implementation of mitigation measures and compliance with the City's Noise Ordinance, noise generated from stationary sources would not exceed the ambient level by more than 5 dBA at the property line and impacts associated with amplified sound would be controlled per Noise Ordinance Section 9.36.160. In addition, construction would be conducted in compliance with the Noise Ordinance (Section 9.36.070 and 0.36.080) and would be limited to the hours specified therein (COA-NOISE-1). Moreover, the proposed project would meet the requirements for noise levels in guest rooms in accordance with the California Building Standards Code (24 CCR Section 1207.11.2/ Section 1207.04) and would comply with the City's Noise Element land use compatibility criteria. For these reasons, the proposed project would not expose persons to, or generate, noise levels in excess of any established state or local standards and impacts would be less than significant.

Mitigation Measures

Noise levels would not be in excess of standards established in the Noise Ordinance or the California Building Standards Code. Impacts would be less than significant and no mitigation is required.

Residual Impacts

Impacts would be less than significant.

Conditions of Approval

COA-NOISE-1 and COA-NOISE-2, listed in Impact NOISE-2 above, would further ensure consistency with City standards and protect surrounding sensitive receptors from project-related noise.

Impact NOISE-4. Would the project expose persons to, or generate, excessive groundborne vibration or groundborne noise levels?

Construction of the proposed project has the potential to generate vibration that would be experienced by nearby structures and their occupants. Construction of the proposed project would not involve pile driving or blasting, which are generally the sources of the most severe vibration. Moreover, vibratory compactors would not be used during project construction. However, conventional heavy construction equipment, such as large bulldozers, would be used during construction.

There are five buildings that could be subject to vibration impacts from construction of the proposed project. The proposed project would involve rehabilitation of the YWCA building, located on the project site, as well as construction of a new building immediately adjacent. Other nearby buildings include City Hall, located across Garfield avenue to the east/northeast, the First Baptist Church of Pasadena, located across Marengo Avenue to the west, the Centennial Place residential facility, located across Holly Street to the north, and the Loweman Building, located across Union Street to the south. With the exception of the Loweman Building, all of these buildings are designated historic buildings. Although the Loweman Building has not been designated as a historic building, it may be eligible for listing in the National Register as a contributor to the historic Civic Center Financial District. Due to the historic nature of the buildings and their potential vulnerability to vibration impacts, a vibration level of 0.12 ppv in/sec is used in this analysis to identify potentially significant structural vibration damage impacts to these buildings.

The evaluation of potential impacts to on-site and nearby structures is based on typical vibration levels during construction presented in **Table 3.4-10**. Vibration levels at 25 feet are based on measured data compiled by the FTA. The table also includes calculated approximate vibration levels at other distances. An evaluation of the implications of these vibration levels to the on-site and nearby structures is provided below.

Table 3.4-10 Vibration Source Levels for Construction Equipment – Structural Damage Assessment

Equipment	PPV at 40 ft (in/sec)	PPV at 30 feet (in/sec)	PPV at 25 feet (in/sec)	PPV at 20 feet (in/sec)	PPV at 10 feet (in/sec)
Vibratory roller	0.104	0.160	0.210	0.293	0.830
Large bulldozer	0.044	0.068	0.089	0.124	0.352
Loaded trucks	0.038	0.058	0.076	0.106	0.300
Small bulldozer	0.001	0.002	0.003	0.004	0.012

Source: Federal Transit Administration (FTA) 2006.

Key:
PPV = peak particle velocity
in/sec = inches per second

The results of the vibration assessment for human annoyance are summarized in **Table 3.4-11**.

Table 3.4-11 Human Annoyance Assessment (VdB)

Equipment Description	VdB at Reference Distance (25 feet)	VdB at First Baptist Church of Pasadena (125 feet)[1]	VdB at Centennial Place (210 feet)	VdB at City Hall (205 feet)	VdB at Loweman Building (50 feet)
Rollers	94	73	66	67	85
Rubber Tired Dozers	87	66	59	60	78
Skid Steer Loaders	58	37	30	31	49
Tractors/Loaders/Backhoes	58	37	30	31	49
Total[2]	**95**	**74**	**67**	**67**	**86**
Threshold	N/A	75	72	75	75
Significant?	**N/A**	**No**	**No**	**No**	**Yes**

Source: CDM Smith 2015.

Notes:

1. Although the First Baptist Church of Pasadena is approximately 110 feet west of the project site, the distance to the closest source of construction-related vibration is estimated to be 125 feet.
2. Total VdB is logarithmically derived.

Key:
N/A = not applicable
ft = feet
VdB = vibration decibels

YWCA Building

The proposed project would involve renovation of the historic YWCA building. In addition, construction of the new building would occur immediately adjacent to the YWCA building. As shown in Table 3.4-9, if large bulldozers or similar equipment were to operate within 20 feet of the existing YWCA building, the vibration level could exceed the 0.12 ppv in/sec significance threshold for damage. Use of vibratory rollers or similar equipment could exceed the 0.12 ppv in/sec threshold if used at distances of less than 40 feet from the existing YWCA building. Because the exact limits of equipment use, types of equipment to be used, and soil conditions are not known at this time, it is assumed that vibration generated during construction could result in structural damage to the YWCA building. This would be a significant impact. A human annoyance assessment was not completed for the YWCA building because the building would not be occupied during construction.

City Hall

City Hall is located approximately 205 feet east of the future building limits. As indicated in Table 3.4-10 above, vibration levels generated during construction would not approach or exceed the 0.12 ppv in/sec (structural) threshold value beyond 40 feet from the source. Furthermore, as shown in Table 3.4-11, vibration levels would not exceed 75 VdB (the human annoyance threshold for commercial land uses). Therefore, vibration impacts relating to structural damage to City Hall and annoyance to City Hall occupants would be less than significant.

First Baptist Church of Pasadena

The First Baptist Church of Pasadena is located approximately 110 feet west of the proposed project site across Marengo Avenue. As indicated in Table 3.4-10 above, at this distance, maximum vibration levels would not approach or exceed the 0.12 ppv in/sec (structural) threshold value. Moreover, construction activities would not exceed 75 VdB (human annoyance threshold for commercial land uses) (see Table 3.4-11). Therefore, impacts associated with vibration would be less than significant.

Centennial Place

The residences within Centennial Place are located approximately 210 feet to the north across Holly Street. The potential for vibration impacts resulting in structural damage to the Centennial Place residential facilities is similar to that for the First Baptist Church of Pasadena; construction activities would not occur within 40 feet of the building. Therefore, impacts associated with vibration-related structural damage would be less than significant. As shown in Table 3.4-11, vibration levels would be approximately 67 VdB at Centennial Place and, therefore, impacts associated with human annoyance resulting from vibration would be less than significant.

Loweman Building

The Loweman Building is located approximately 50 feet south of the proposed project site across Union Street. The potential for vibration impacts resulting in structural damage to the Loweman Building is similar to that for the First Baptist Church of Pasadena; construction activities would not occur within 40 feet of the building. Therefore, impacts associated with vibration-related structural damage would be less than significant. However, due to its proximity to the proposed project site, construction activities could potentially exceed the 75 VdB threshold for human annoyance at commercial land uses (see Table 3.4-11). This would be a potentially significant impact.

Mitigation Measures

The following mitigation measures have been identified to reduce potentially significant construction-related vibration impacts to the YWCA Building and the Loweman Building.

MM-NOISE-1: Consult with Structural Engineer and Project Historical Architect

Prior to approval of grading plans and/or prior to issuance of demolition, grading and building permits, the Applicant shall retain a team to include a Professional Structural Engineer with experience in structural vibration analysis and monitoring for historic buildings and a Project Historical Architect (PHA) to perform the following tasks:

- Review the project plans for demolition and construction;
- Survey the project site and the existing YWCA building, including geological testing, if required; and
- Prepare and submit a report to the Director of Planning and Community Development to include, but not be limited to, the following:
    - Any survey information obtained from the survey identified above;

- Any modifications to the estimated vibration level limits based on building conditions, soil conditions, and planned demolition and construction methods to ensure that vibration levels would remain below the potential for damage to the existing YWCA building;
- Specific measures to be taken during construction to ensure the vibration level limits identified by the Professional Structural Engineer (or 0.12 ppv in/sec in lieu of such specified limits) are not exceeded, including modeling calculations that demonstrate the vibration levels following implementation of the identified measures; and
- A monitoring plan to be implemented during demolition and construction that includes post-construction and post-demolition surveys of the existing YWCA building and documentation demonstrating that the measures identified in the report have been implemented.

Examples of measures that may be specified for implementation during demolition or construction include, but are not limited to, the following:

- Prohibition of certain types of construction equipment;
- Requirement for lighter tracked or wheeled equipment;
- Specifying demolition by non-impact methods, such as sawing concrete;
- Phasing operations to avoid simultaneous vibration sources; and
- Installation of vibration measuring devices to guide decision making for subsequent activities.

MM-NOISE-2: Post-Construction Survey and Repairs

At the conclusion of vibration-causing activities, in the unanticipated event of discovery of vibration-caused damage, the Structural Engineer and the PHA shall document any damage to the existing YWCA building and shall recommend necessary repairs. The Applicant shall be responsible for any repairs associated with vibration-caused damage. Repairs shall be undertaken and completed, as required, to conform to the Secretary of the Interior's *Guidelines for the Treatment of Historic Properties* (36 Code of Federal Regulations Part 68) and any other codes, if applicable, such as the California Historical Building Code (24 CFR Part 8).

Residual Impacts

With implementation of Mitigation Measures MM-NOISE-4 and MM-NOISE-5, vibration impacts would be 0.12 ppv in/sec or lower. As a result, vibration-related structural impacts to the YWCA building would be reduced to a level that is less than significant.

As noted above, with implementation of mitigation, vibration impacts at the proposed project site would be 0.12 ppv in/sec or lower. As shown in Table 3.4-5, 0.12 ppv in/sec is approximately equal to 90 VdB. Given the distance to the Loweman Building, with implementation of the construction measures in MM-NOISE-4, vibration levels at the Loweman Building would be reduced to 72 VdB. This would be below the threshold of significance for human annoyance related to vibration and the impact would be reduced to a level that is less than significant.

3.4.7 Cumulative Impacts

Growth in the study area from future development projects in the vicinity has the potential to increase ambient noise levels. There are only three planned projects within 1,000 feet of the proposed project site. The Union Street Condominiums Project is located at 254 East Union Street, approximately 50 feet from the project site; the planned redevelopment of the former Macy's building at Paseo Colorado is located at 260-386 East Colorado Boulevard, approximately 550 feet from the project site; and the expansion of All Saint's Church is located at 132 North Euclid, approximately 650 northeast of the project site. There are no sensitive noise receptors located between the proposed project site and these three planned developments. As a result, the proposed project, in combination with these and other development projects in the City, does not have the potential to result in a significant cumulative temporary or permanent noise impacts.

The geographic scope of vibrational impacts is very limited, given the rate of vibrational attenuation. Even for the most intensive vibration activity on-site (expected to be vibrational rollers or similar equipment), vibration levels would be measured at 0.104 in/sec at 40 feet, which would not exceed to the significance threshold of 0.12 in/sec for historic structures (see Table 3.4-10). Both the proposed project and the All Saint's Church project are located greater than 40 feet, in opposite directions, from City Hall, which is a vibration-sensitive receptor. Because the two projects are not in proximity to one another, and are both greater than 40 feet from City Hall, cumulative vibration-related impacts would be less than significant.

Another nearby vibration-sensitive receptor is the Loweman Building, which is located at the southeast corner of Marengo Avenue and Union Street. The Loweman Building is located approximately 50 feet from the project site (approximately 65 feet from the closest point on the project site where construction activities would occur that would generate vibration), and is adjacent to the Union Street Condominiums Project. Due to the proximity of the proposed project and the Union Street Condominiums Project to the Loweman Building, and the fact that the two projects could undergo construction during a similar timeframe, it is possible that cumulative vibration impacts associated with construction of the two projects could exceed thresholds of significance for structural damage and/or human annoyance at the Loweman Building. Similarly, as both projects are located in proximity to the YWCA building, cumulative vibration impacts associated with construction of the two projects could exceed thresholds of significance for structural damage and/or human annoyance at the YWCA building. These cumulative impacts would be potentially significant.

Mitigation Measures

The following mitigation measure has been identified to reduce potentially significant cumulative construction-related vibration impacts to the YWCA Building and the Loweman Building from construction associated with the proposed project in conjunction with construction of the Union Street Condominiums Project.

MM-NOISE-3: Coordination of Scheduled Construction Activities

The City of Pasadena will coordinate with developers of the YWCA Kimpton Hotel Project and the Union Street Condominiums Project to ensure that construction activities that have the potential to generate cumulatively significant vibration, namely excavation and grading/compaction, would be scheduled so as not to occur simultaneously.

Residual Impacts

With implementation of Mitigation Measure MM-NOISE-3, potential cumulative vibration impacts on the YWCA building and the Loweman building would be reduced to a level that is less than significant.

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