# 3.10 NOISE

This section includes a summary of applicable regulations related to noise and vibration, a description of ambient-noise conditions, and an analysis of potential short-term construction and long-term operational noise impacts associated with the 2035 Master Plan. Mitigation measures are recommended as necessary to reduce significant noise and vibration impacts.

In March 2019, AMBIENT Air Quality & Noise Consulting conducted an ambient noise survey of existing conditions. This EIR section incorporates noise monitoring data from this survey to establish the existing conditions. Project-specific noise modeling was done based on updated project details, including anticipated development and traffic information. All modeling data and assumptions are included in Appendix F and methods described in more detail below.

No comments regarding noise or vibration were received in response to the Notice of Preparation (NOP).

This analysis uses the following noise and vibration descriptors:

- **Equivalent Continuous Sound Level ($L_{eq}$):** $L_{eq}$ represents an average of the sound energy occurring over a specified period. In effect, $L_{eq}$ is the steady-state sound level containing the same acoustical energy as the time-varying sound level that occurs during the same period (Caltrans 2013a:2-48). For instance, the 1-hour equivalent sound level, also referred to as the hourly $L_{eq}$, is the energy average of sound levels occurring during a 1-hour period and is the basis for noise abatement criteria used by the California Department of Transportation (Caltrans) and Federal Transit Administration (FTA) (Caltrans 2013a:2-47; FTA 2018).
- **Percentile-Exceeded Sound Level ($L_X$):** $L_X$ represents the sound level exceeded for a given percentage of a specified period (e.g., $L_{10}$ is the sound level exceeded 10 percent of the time, and $L_{90}$ is the sound level exceeded 90 percent of the time) (Caltrans 2013a:2-16).
- **Maximum Sound Level ($L_{max}$):** $L_{max}$ is the highest instantaneous sound level measured during a specified period (Caltrans 2013a:2-48; FTA 2018).
- **Day-Night Level ($L_{dn}$):** $L_{dn}$ is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10-decibel (dB) "penalty" applied to sound levels occurring during nighttime hours between 10 p.m. and 7 a.m. (Caltrans 2013a:2-48; FTA 2018).
- **Community Noise Equivalent Level (CNEL):** CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10-dBA penalty applied to sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m. and a 5-dBA penalty applied to the sound levels occurring during evening hours between 7 p.m. and 10 p.m., to account for added human sensitivity to noise during these periods (Caltrans 2013a:2-48).
- **Vibration Decibels (VdB):** VdB is the vibration velocity level in decibel scale (FTA 2018:Table 5-1).
- **Peak Particle Velocity (PPV):** PPV is the peak signal value of an oscillating vibration waveform. Usually expressed in inches/second (FTA 2018:Table 5-1).

## 3.10.1 Regulatory Setting

### FEDERAL

#### Federal Transit Administration

To address the human response to ground vibration, the FTA has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses. These guidelines are presented in Table 3.10-1.

**Table 3.10-1 Groundborne Vibration Impact Criteria for General Assessment**

| Land Use Category | GVB Impact Levels (VdB re 1 micro-inch/second) Frequent Events[1] | GVB Impact Levels (VdB re 1 micro-inch/second) Occasional Events[2] | GVB Impact Levels (VdB re 1 micro-inch/second) Infrequent Events[3] |
|---|---|---|---|
| *Category 1:* Buildings where vibration would interfere with interior operations. | 65 [4] | 65 [4] | 65 [4] |
| *Category 2:* Residences and buildings where people normally sleep. | 72 | 75 | 80 |
| *Category 3:* Institutional land uses with primarily daytime uses. | 75 | 78 | 83 |

Notes: GBV = groundborne vibration.

VdB = vibration decibels referenced to 1 µ inch/second and based on the root mean square (RMS) velocity amplitude.

[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 source per day.

[4] This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define acceptable vibration levels.

Source: FTA 2018

# STATE

## California General Plan Guidelines

The State of California General Plan Guidelines, published by the California Governor's Office of Planning and Research (2017), provides guidance for the compatibility of projects within areas of specific noise exposure. Acceptable and unacceptable community noise exposure limits for various land use categories have been determined to help guide new land use decisions in California communities. In many local jurisdictions, these guidelines are used as the basis for local noise standards and guidance. Citing U.S. Environmental Protection Agency materials and the state Sound Transmissions Control Standards, the state's general plan guidelines recommend interior and exterior CNEL of 45 and 60 dB for residential units, respectively (OPR 2017:378).

## California Department of Transportation

In 2013, Caltrans published the Transportation and Construction Vibration Manual (Caltrans 2013b). The manual provides general guidance on vibration issues associated with construction and operation of projects in relation to human perception and structural damage. Table 3.10-2 presents recommendations for levels of vibration that could result in damage to structures exposed to continuous/frequent intermittent sources of vibration.

**Table 3.10-2 Caltrans Recommendations Regarding Levels of Vibration Exposure**

| Structure and Condition | 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 |

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

Source: Caltrans 2013b

## California State University

Cal Poly Administrative Policies

General Policy. Section 141.3.2.1 of the "Campus Administrative Policies" states the following:

> Outdoor events and activities that involve amplified music or speech are limited to the hours of: 7:00 a.m. to 10:00 p.m., Monday through Sunday, and University scheduling protocols must be followed (see sections 144.4 and 141.3.2.2)
>
> Outdoor events and activities that do not require use of amplified sound (for speech or music) may be held between 7:00 a.m. and midnight, Monday through Sunday. Use of the University's scheduling protocols is encouraged, to facilitate coordination with other events and among potential campus service providers. Regardless of the time they are held, events and activities must be conducted in a manner consistent with Section 141.3.1 (General Limitations) and in conformity with any additional guidelines pertinent to a particular venue.

General Policy. Section 141.3.1 of the "Campus Administrative Policies" states the following:

> All campus events and activities shall be conducted consistent with Federal and State law, with existing University policies, with the orderly conduct of University business, with preservation of the campus learning environment, with the preservation of public safety, with maintenance of University property and with the free flow of pedestrian and vehicular traffic. Entrances to campus facilities shall not be obstructed. No individual or group shall abridge, halt or disrupt the right of others to present their views. In addition, plans for outdoor events and activities should address potential impacts on residential communities, on and off campus.

# LOCAL

Cal Poly, as a state entity, is not subject to municipal regulations of local governments for uses on property owned or controlled by Cal Poly that are in furtherance of the University's education purposes. However, Cal Poly may consider, for coordination purposes, aspects of local plans and policies for the communities surrounding the campus when it is appropriate and feasible, but it is not bound by those plans and policies in its planning efforts. The campus is bordered by unincorporated San Luis Obispo County to the north and the east and by the city of San Luis Obispo to the south and the west. Therefore, this EIR considers and includes below both San Luis Obispo County and City of San Luis Obispo plans and policies.

## San Luis Obispo County General Plan

The Noise Element of the San Luis Obispo County General Plan establishes the following standards and policies that are relevant to the analysis of the noise effects of the project:

- **Policy 3.3.2**. New development of noise-sensitive land uses (see Section 1.5 – Definitions) shall not be permitted in areas exposed to existing or projected future levels of noise from transportation noise sources which exceed 60 dB $L_{dn}$ or CNEL (70 $L_{dn}$ or CNEL for outdoor sports and recreation) unless the project design includes effective mitigation measures to reduce noise in outdoor activity areas and interior spaced to or below the levels specified for the given land use in Table 3-1 [Table 3.10-3 in this section].
- **Policy 3.3.3.** Noise created by new transportation noise sources, including roadway improvement projects, shall be mitigated so as not to exceed the levels specified in Table 3-1 [Table 3.10-3 in this section] within the outdoor activity areas are interior spaces of existing noise-sensitive land uses.

**Table 3.10-3 Maximum Allowable Noise Exposure - Transportation Noise Sources**

| Land Use | Outdoor Activity Areas ($CNEL/L_{dn}$)[1,2] dBA | Interior Space ($CNEL/L_{dn}$)[2] dBA | Interior Space ($L_{eq}$)[2] dBA |
|---|---|---|---|
| Residential (except temporary dwellings and residential accessory uses) | 60 | 45 | — |
| Bed and Breakfast Facilities, Hotels and Motels | 60 | 45 | — |
| Hospitals, Nursing and Personal Care | 60 | 45 | — |
| Public Assembly and Entertainment (except Meeting Halls) | — | — | 35 |
| Offices | 60 | — | 45 |
| Churches, Meeting Halls | — | — | 45 |
| Schools-Preschool to Secondary, College and University, Specialized Education and Training Libraries and Museums | — | — | 45 |
| Outdoor Sports and Recreation | 70 | — | — |

Notes: dBA=A-weighted decibel.

[1] Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.

[2] As determined for a typical worst-case hour during period of use.

[3] For other than residential uses, where an outdoor activity area is not proposed, the standard shall not apply. Where it is not possible to reduce noise in outdoor activity areas to 60 dB $L_{dn}$/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

Source: County of San Luis Obispo 1992

- **Policy 3.3.4.** New development of noise-sensitive land uses shall not be permitted where the noise level due to existing stationary noise sources will exceed the noise level standards of Table 3-2 [Table 3.10-10 in this section], unless effective noise mitigation measures have been incorporated into the design of the development to reduce noise exposure to or below the levels specified in Table 3-2 [Table 3.10-4 in this section].
- **Policy 3.3.5.** Noise created by new proposed stationary noise sources or existing stationary noise sources which undergo modifications that may increase noise levels shall be mitigated as follows and shall be the responsibility of the developer of the stationary noise source:

  a) Noise from agricultural operations conducted in accordance with accepted standards and practices is not required to be mitigated.

  b) Noise levels shall be reduced to or below the noise level standards in Table 3-2 [Table 3.10-4 in this section] where the stationary noise source will expose an existing noise-sensitive land use (which is listed in the Land Use element as an allowable use within its existing land use category) to noise levels which exceed the standards in Table 3-2 [Table 3.10-14 in this section]. When the affected noise-sensitive land use is Outdoor Sports and Recreation, the noise level standards in Table 3-2 [Table 3.10-4 in this section] shall be increased by 10 dB. Where the noise source is one of the following electrical substations which is not modified so as to increase noise levels, the noise standards shall instead be fifty dB between 10 p.m. and 7 a.m. and fifty-five dB between 7 a.m. and 10 p.m., determined at the property line of the receiving land use: the Cholame, San Miguel, Templeton, Cambria, Perry, Cayucos, Baywood, State Route 1 (SR 1) between Morro Bay and the California Men's Colony, Goldtree, Foothill, San Luis Obispo, Oceano, Mesa, Union Oil, Callender, and Mustang electrical substations.

  c) Noise levels shall be reduced to or below the noise level standards in Table 3-2 [Table 3.10-4 in this section] where the stationary noise source will expose vacant land in the Agriculture, Rural Lands, Residential rural, Residential Suburban, Residential Single-Family, Residential Multi-Family, Recreation, Office and Professional, and Commercial Retail land use categories to noise levels which exceed the standards in Table 3-2 [Table 3.10-4 in this section]. Where the noise source is one of the following electrical substations which is not modified so as to increase noise levels, the noise standards shall instead be fifty dB between 10 p.m. and 7 a.m. and fifty-five dB between 7 a.m. and 10 p.m., determined at the property line of the receiving land use:

the Cholame, San Miguel, Templeton, Cambria, Perry, Cayucos, Baywood, SR 1 between Morro Bay and the California Men's Colony, Goldtree, Foothill, San Luis Obispo, Oceano, Mesa, Union Oil, Callender, and Mustang electrical substations. This policy may be waived when the Director of Planning and Building determines that such vacant land is not likely to be developed with a noise-sensitive land use.

d) For new proposed resource extraction, manufacturing or processing noise sources or modifications to those sources which increase noise levels: where such noise sources will expose existing noise-sensitive land uses (which are listed in the Land Use Element as allowable uses within their land use categories) to noise levels which exceed the standards in Table 3-2 [Table 3.10-4 in this section], best available control technologies shall be used to minimize noise levels. The noise levels shall in no case exceed the noise level standards in Table 3-2 [Table 3.10-4 in this section].

**Table 3.10-4 Maximum Allowable Noise Exposure – Stationary Noise Sources[1]**

| Duration | Day (7 a.m. to 10. p.m.) | Night (10 p.m. to 7 a.m.)[2] |
|---|---|---|
| Hourly ($L_{eq}$) dBA | 50 | 45 |
| Maximum ($L_{max}$) dBA | 70 | 65 |
| Impulsive ($L_{max}$) dBA | 65 | 60 |

Notes: dBA= A-weighted decibels.

[1] As determined at the property line of the receiving land use. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property line noise mitigation measures.

[2] Applies only where the receiving land use operates or is occupied during nighttime hours.

Source: County of San Luis Obispo 1992

## San Luis Obispo County Municipal Code

### 22.10.120 - Noise Standards

B. Exterior noise level standards. The exterior noise level standards of this Section are applicable when a land use affected by noise is one of the following noise-sensitive uses: residential uses listed in Section 22.06.030 (Allowable Land Uses and Permit Requirements), except for residential accessory uses and temporary dwellings; health care services (hospitals and similar establishments only); hotels and motels; bed and breakfast facilities; schools (pre-school to secondary, college and university, specialized education and training); churches; libraries and museums; public assembly and entertainment; offices, and outdoor sports and recreation.

1. No person shall create any noise or allow the creation of any noise at any location within the unincorporated areas of the county on property owned, leased, occupied or otherwise controlled by the person which causes the exterior noise level when measured at any of the preceding noise-sensitive land uses situated in either the incorporated or unincorporated areas to exceed the noise level standards in Table 3.10-5. When the receiving noise-sensitive land use is outdoor sports and recreation, the noise level standards in Table 3.10-5 shall be increased by 10 dB.

2. In the event the measured ambient noise level exceeds the applicable exterior noise level standard in Subsection B.1, the applicable standard shall be adjusted so as to equal the ambient noise level plus one dB.

3. Each of the exterior noise level standards specified in Subsection B.1 shall be reduced by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises

4. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the exterior noise level standards.

**Table 3.10-5 Maximum Allowed Exterior Noise Levels**

| Category | Daytime (7 a.m. to 10 p.m.) | Nighttime (10 p.m. to 7 a.m.) |
|---|---|---|
| Hourly Average ($L_{eq}$) dBA | 50 | 45 |
| Maximum Level ($L_{max}$) dBA | 70 | 65 |

Notes: Applies only where the receiving land use operates or is occupied during nighttime hours; dBA=A-weighted decibels.

Source: County of San Luis Obispo 1992

C. Interior noise level standards (Table 3.10-6). The interior noise level standards of this Section are applicable when the land use which is the source of noise and the land use which is affected by noise are both residential uses as listed in Section 22.06.030 (Allowable Land Uses and Permit Requirements), except for residential accessory uses and temporary dwellings.

1. No person shall operate or cause to be operated a source of noise within a residential use in any location in the unincorporated areas of the county or allow the creation of any noise which causes the noise level when measured inside a residential use located in either the incorporated or unincorporated area to exceed the interior noise level standards in the following table.
2. In the event the measured ambient noise level exceeds the applicable interior noise level standard in Subsection C.1, the applicable standard shall be adjusted so as to equal the ambient noise level plus one dB.
3. Each of the interior noise level standards specified in Subsection C.1 shall be reduced by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.
4. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the interior noise level standards.

**Table 3.10-6 Maximum Allowed Interior Noise Levels**

| Category | Daytime (7 a.m. to 10 p.m.) | Nighttime (10 p.m. to 7 a.m.) |
|---|---|---|
| Hourly Average ($L_{eq}$) dBA | 40 | 35 |
| Maximum Level ($L_{max}$) dBA | 60 | 55 |

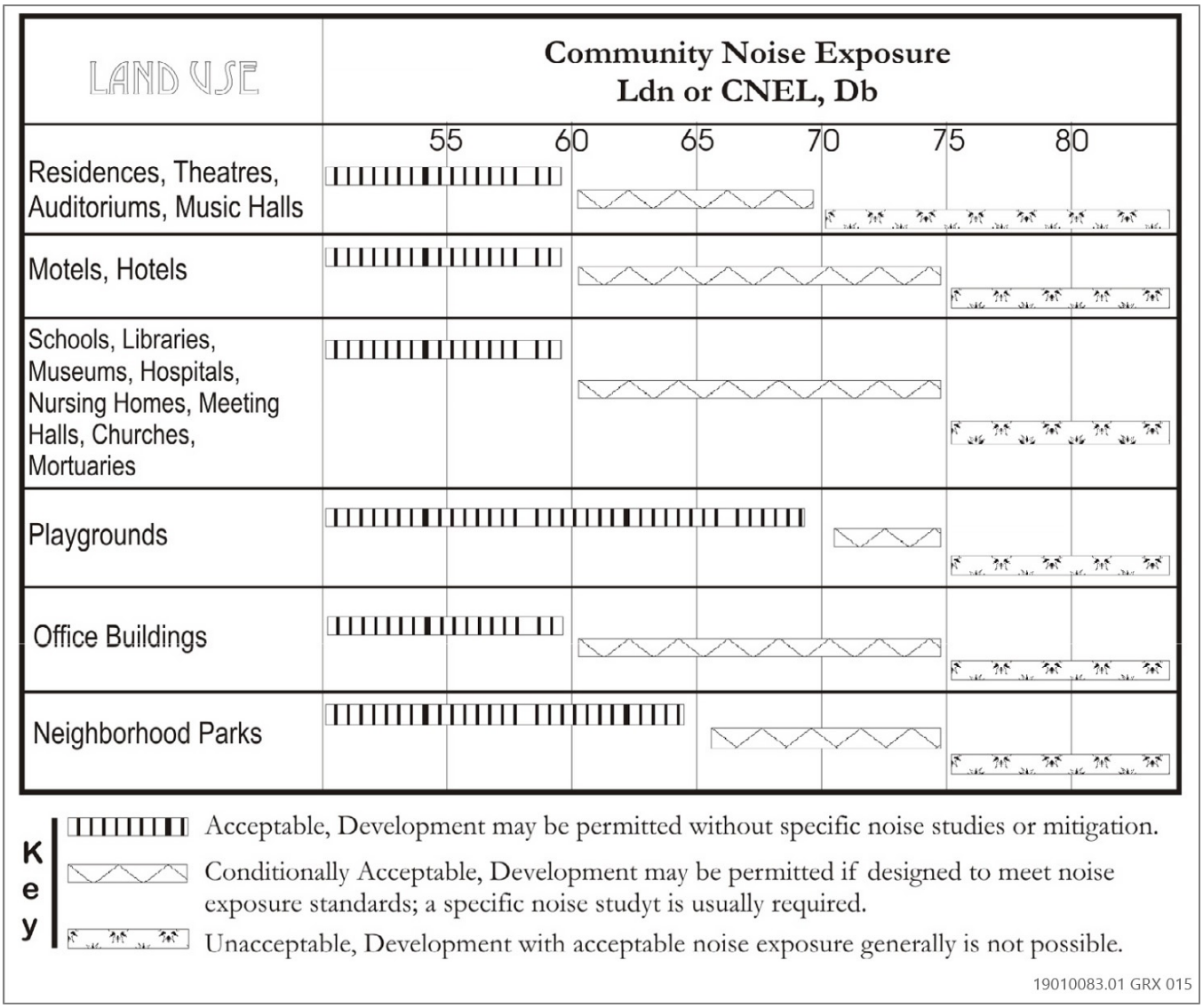
Note: dBA=A-weighted decibels.

Source: County of San Luis Obispo 1992

## City of San Luis Obispo General Plan

The Noise Element of the City of San Luis Obispo General Plan establishes the following standards and policies that are relevant to the analysis of the noise effects of the project:

- **Policy 1.2. Land Use and Transportation Noise Sources:** Figure 1 [Figure 3.10-1 in this section] shall be used to determine the appropriateness of designating land for noise-sensitive uses, considering noise exposure due to transportation sources. Figure 1 [Figure 3.10-1 in this section] shows the ranges of noise exposure, for various noise-sensitive land uses, which are considered to be acceptable, conditionally acceptable, or unacceptable.
  - In acceptable noise environments, development may be permitted without requiring specific noise studies or specific noise-reducing features.
  - In conditionally acceptable noise environments, development should be permitted only after noise mitigation has been designed as part of the project, to reduce noise exposure to the levels specified by the following policies. In these areas, further studies may be required to characterize the actual noise exposure and appropriate means to reduce it.
  - In unacceptable noise environments, development in compliance with the policies generally is not possible.




Source: City of San Luis Obispo 1996

Figure 3.10-1 Noise Exposure

- Policy 1.3. New Development Design and Transportation Noise Sources: New noise-sensitive development shall be located and designed to meet the maximum outdoor and indoor noise exposure levels of Table 1 [Table 3.10-7 in this section].
- Policy 1.4. New Transportation Noise Sources: Noise created by new transportation noise sources, including road, railroad, and airport expansion projects, shall be mitigated to not exceed the levels specified in Table 1 [Table 3.10-7 in this section] for outdoor activity areas and indoor spaces of noise-sensitive land uses which were established before the new transportation noise source.
- Policy 1.5. Traffic Growth: The noise level standards in Table 1 [Table 3.10-7 in this section] should be used as criteria for limiting traffic growth on:
  - Residential Collector streets, as designated by the Circulation Element;
  - Local Streets, as designated by the Circulation Element, which extend through areas designated for residential uses.

**Table 3.10-7 Maximum Noise Exposure for Noise-Sensitive Uses Due to Transportation Noise Sources**

| Land Use | Outdoor Activity Areas ($CNEL/L_{dn}$)[1,2] dBA | Interior Space $CNEL/L_{dn}$[2] dBA | Interior Space $L_{eq}$[2] dBA | Interior Space $L_{max}$[3] dBA |
|---|---|---|---|---|
| Residences, hotels, hospitals, nursing homes | 60 | 45 | -- | 60 |
| Theaters, auditoriums, music halls | -- | -- | 35 | 60 |
| Schools, libraries, museums | 60 | -- | 45 | -- |
| Neighborhood parks | 65 | -- | 45 | 60 |
| Playgrounds | 70 | -- | -- | -- |

Notes: dBA=A-weighted decibels.

[1] If the location of outdoor activity areas is not shown, the outdoor noise standard shall apply at the property line of the receiving land use.

[2] As determined for a typical worst-case hour during period of use.

[3] $L_{max}$ indoor standard applies only to railroad noise at location south of Orcutt Road.

Source: City of San Luis Obispo 1996

- **Policy 1.6. New Development and Stationary Noise Sources:** New development of noise-sensitive land uses may be permitted only where location or design allow the development to meet the standards of Table 2 [Table 3.10-8 in this section], for existing stationary noise sources.
- **Policy 1.7. New or Modified Stationary Noise Sources:** Noise created by new stationary; noise sources, or by existing stationary noise sources which undergo modifications that may increase noise levels, shall be mitigated to not exceed the noise level standards of Table 2 [Table 3.10-8 in this section], for lands designated for noise-sensitive uses. This policy does not apply to noise levels associated with agricultural operations.

**Table 3.10-8 Maximum Noise Exposure for Noise-Sensitive Uses Due to Stationary Noise Sources**

| Duration | Day (7 a.m. to 10. p.m.) | Night (10 p.m. to 7 a.m.) |
|---|---|---|
| Hourly ($L_{eq}$)[1,2] dBA | 50 | 45 |
| Maximum ($L_{max}$) [1,2] dBA | 70 | 65 |
| Impulsive ($L_{max}$) [1,3] dBA | 65 | 60 |

Notes: dBA= A-weighted decibels.

[1] As determined at the property line of the receiver. When determining effectiveness of noise mitigation measures, the standards may; be applied on the receptor side of noise barriers or other property-line noise mitigation measures.

[2] Sound level measurements shall be made with slow meter response.

[3] Sound level measurements shall be made with fast meter response.

Source: City of San Luis Obispo 1996

## City of San Luis Obispo Municipal Code

The City of San Luis Obispo Noise Control Ordinance contained in Chapter 9.12 of the Municipal Code establishes the following standards and policies that are relevant to the analysis of the noise effects of the project:

### 9.12.050 Prohibited Acts

6. Construction/Demolition.

   a. Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekday hours of seven p.m. and seven a.m., or any time on Sundays or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real property line, except for emergency work of public service utilities or by exception issued by the community development department. (This section shall not apply to the use of domestic power tools as specified in subsection B 10 of this section.

   b. Noise Restrictions at Affected Properties. Where technically and economically feasible, construction activities shall be conducted in such a manner that the maximum noise levels at affected properties will not exceed those listed in the Tables 3.10-9 and 3.10-10.

**Table 3.10-9 Maximum Noise Levels for Nonscheduled, Intermittent, Short-Term Operation (Less than 10 Days) of Mobile Equipment**

| Zoning Category | Time Period | Noise Level (dBA) |
|---|---|---|
| Single-Family Residential | Daily 7:00 a.m. to 7:00 p.m., except Sundays and legal holidays | 75 |
| Multi-Family Residential | | 80 |
| Mixed Residential/Commercial | | 85 |
| Single-Family Residential | 7:00 p.m. to 7:00 a.m., all day Sunday and legal holidays | 60 |
| Multi-Family Residential | | 65 |
| Mixed Residential/Commercial | | 70 |

Source: City of San Luis Obispo 2019a

**Table 3.10-10 Maximum Noise Levels for Repetitively Scheduled, Relatively Long-Term Operation (10 Days or More) of Stationary Equipment**

| Zoning Category | Time Period | Noise Level (dBA) |
|---|---|---|
| Single-Family Residential | Daily 7:00 a.m. to 7:00 p.m., except Sundays and legal holidays | 60 |
| Multi-Family Residential | | 65 |
| Mixed Residential/Commercial | | 70 |
| Single-Family Residential | 7:00 p.m. to 7:00 a.m., all day Sunday and legal holidays | 50 |
| Multi-Family Residential | | 55 |
| Mixed Residential/Commercial | | 60 |

Source: City of San Luis Obispo 2019a

7. Vibration. Operating or permitting the operation of any device that creates a vibration which is above the vibration perception threshold of an individual at or beyond the property boundary of the source if on private property or at one hundred fifty feet (forty-six meters) from the source if on a public space or public right-of-way.

9.12.060 Exterior Noise Limits

A. Maximum Permissible Sound Levels at Receiving Land Use.

1. The noise standards for the various categories of land use identified by the noise control office(r) as presented in Table 1 of Section 9.12.070 [Table 3.10-8 in this section] shall, unless otherwise specifically indicated, apply to all such property within a designated zone.

2. No person shall cause or allow to cause, any source of sound at any location within the incorporated city or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any other property, either incorporated or unincorporated, to exceed:

   a. The noise standard for that land use as specified in Table 1 of Section 9.12.070 [Table 3.10-11 in this section] for a cumulative period of more than thirty minutes in any hour; or

   b. The noise standard plus 5 dB for a cumulative period of more than fifteen minutes in any hour; or

   c. The noise standard plus 10 dB for a cumulative period of more than five minutes in any hour; or

   d. The noise standard plus 15 dB for a cumulative period of more than one minute in any hour; or

   e. The noise standard plus 20 dB for any period of time.

**Table 3.10-11 Exterior Noise Limits**

| Zoning Designation | Time Period | Maximum Acceptable Noise Level (dBA) |
|---|---|---|
| Low- and Medium-Density Residential (R-1 and R-2); Conservation/Open Space (C/OS) | 10:00 p.m. – 7:00 a.m. | 50 |
| | 7:00 a.m. – 10:00 p.m. | 55 |
| Medium- and High-Density Residential (R-3 and R-4) | 10:00 p.m. – 7:00 a.m. | 50 |
| | 7:00 a.m. – 10:00 p.m. | 55 |
| Office and Public Facility (O and PF) | 10:00 p.m. – 7:00 a.m. | 55 |
| | 7:00 a.m. – 10:00 p.m. | 60 |
| Neighborhood, Retail, Community, Downtown and Tourist Commercial (C-N, C-R, C-C, C-D, C T) | 10:00 p.m. – 7:00 a.m. | 60 |
| | 7:00 a.m. – 10:00 p.m. | 65 |
| Service Commercial (C-S) | Anytime | 70 |
| Manufacturing (M) | Anytime | 75 |

Notes: As determined at the property line of the receiver. Noise levels represent an average applied over a 30-minute period. These noise levels are adjusted for shorter exposure periods as follows:

15 minutes/hour = +5 dBA

5 minutes/hour = +10 dBA

1 minute/hour = +15 dBA

Any time = +20 dBA

Source: City of San Luis Obispo 2019a

9.12.070 Interior Noise Limits

A. Maximum Permissible Dwelling Interior Sound Levels.

1. The interior noise standards for multifamily residential dwellings as presented in Table 1 of this section [Table 3.10-12 in this section] shall apply, unless otherwise specifically indicated, within all such dwellings with windows in their normal seasonal configuration.
2. No person shall operate or cause to be operated within a dwelling unit, any source of sound or allow the creation of any noise which causes the noise level when measured inside a neighboring receiving dwelling unit to exceed:
    a. The noise standard as specified in Table 1 [Table 3.10-12 in this section] of this section for a cumulative period of more than five minutes in any hour, or
    b. The noise standard plus 5 db for a cumulative period of more than one minute in any hour; or
    c. The noise standard plus 10 dB or the maximum measured ambient, for any period of time.

**Table 3.10-12 Interior Noise Limits**

| Zoning Designation | Time Period | Maximum Acceptable Noise Level (dBA) |
|---|---|---|
| All Multifamily Residential Land Uses | 10:00 p.m. – 7:00 a.m. | 40 |
| | 7:00 a.m. – 10:00 p.m. | 45 |

Source: City of San Luis Obispo 2019a

# 3.10.2 Environmental Setting

Noise levels are commonly reported in decibels using the A-weighting scale (dbA). The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments of the relative loudness or annoyance of a sound, their judgment correlates well with the A-scale sound levels of those sounds.

Because decibels are logarithmic units, noise levels cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness at the same time, the resulting sound level at a given distance would be 3 dB higher than if only one of the sound sources was producing sound under the same conditions. For example, if one idling truck generates 70 dB, two trucks idling simultaneously would not produce 140 dB; rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level approximately 5 dB louder than one source.

All sound levels discussed in this section are expressed in A-weighted decibels (i.e., dBA). For context, Table 3.10-13 describes typical A-weighted noise levels for various common noise sources.

**Table 3.10-13 Typical A-Weighted Noise Levels**

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

Source: Caltrans 2013a: Table 2-5

## Human Response to Changes in Noise Levels

The doubling of sound energy results in a 3-dB increase in the sound level. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different from what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear can discern 1-dB changes in sound levels when exposed to steady, single-frequency ("pure-tone") signals in the mid-frequency (1,000–8,000 Hz) range. In general, the healthy human ear is most sensitive to sounds between 1,000 and 5,000 Hz and perceives both higher and lower frequency sounds of the same magnitude with less intensity (Caltrans 2013a:2-18). In typical noisy environments, changes in noise of 1–2 dB are generally not perceptible. However, it is widely accepted that people can begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of loudness (Caltrans 2013a:2-10). Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3-dB increase in sound would generally be perceived as barely detectable.

## Vibration

Vibration is the periodic oscillation of a medium or object with respect to a given reference point. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions). Vibration levels can be depicted in terms of amplitude and frequency, relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV and RMS vibration velocity are normally described in inches per second (in/sec) or in millimeters per second. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (FTA 2018; Caltrans 2013a:6).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2018; Caltrans 2013b:7). This is based on a reference value of 1 micro inch per second.

The typical background vibration-velocity level in residential areas is approximately 50 VdB. Ground vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2018; Caltrans 2013b:27).

Typical outdoor sources of perceptible ground vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur to fragile buildings. Construction activities can generate sufficient ground vibrations to pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2018).

Vibrations generated by construction activity can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations are generated by vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment.

Table 3.10-14 summarizes the general human response to different ground vibration-velocity levels.

**Table 3.10-14 Human Response to Different Levels of Ground Noise and Vibration**

| Vibration-Velocity Level | Human Reaction |
|---|---|
| 65 VdB | Approximate threshold of perception for many humans. |
| 75 VdB | Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level annoying. |
| 85 VdB | Vibration tolerable only if there are an infrequent number of events per day. |

Note: VdB = vibration decibels referenced to 1 µ inch/second and based on the root mean square (RMS) velocity amplitude.

Source: FTA 2018

## Sound Propagation

When sound propagates over a distance, it changes in level and frequency content. The manner in which a noise level decreases with distance depends on the following factors.

### Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Roads and highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources, thus propagating at a slower rate in comparison to a point source. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source.

### Ground Absorption

The propagation path of noise from a source to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective-wave canceling provides additional attenuation associated with geometric spreading. Traditionally, this additional attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 feet. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver, such as soft dirt, grass, or scattered bushes and trees), additional ground-attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the attenuate rate associated with cylindrical spreading, the additional ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance. This would hold true for point sources, resulting in an overall drop-off rate of up to 7.5 dB per doubling of distance.

### Atmospheric Effects

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels, as wind can carry sound. Sound levels can be increased over large distances (e.g., more than 500 feet) from the source because of atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also affect sound attenuation.

### Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dB of noise reduction (Caltrans 2013a:2-41; FTA 2018). Barriers higher than the line of sight provide increased noise reduction (FTA 2018). Vegetation between the source and receiver is rarely effective in reducing noise because it does not create a solid barrier unless there are multiple rows of vegetation (FTA 2018).

# EXISTING NOISE ENVIRONMENT

## Existing Noise- and Vibration-Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels, and because of the potential for nighttime noise to result in sleep disruption. Land uses such as schools, transient lodging, historic sites, cemeteries, and places of worship are also generally considered sensitive to increases in noise levels. These land use types are also considered vibration-sensitive, as are commercial and industrial buildings where vibration would interfere with operations within the building, even at levels well below those associated with human annoyance.

The 2035 Master Plan Area is bordered by undeveloped, unincorporated San Luis Obispo County land to the north and the east and by the city of San Luis Obispo to the south and the west. Noise- and vibration-sensitive land uses in the vicinity of the 2035 Master Plan Area include multi-family residential buildings, single-family residences, and educational facilities.

As shown in Figure 3.10-2, the campus is bounded by SR 1 and California Boulevard to the west, Slack Street to the south, Stenner Creek Road to the north, and forested hills to the east. The existing residential areas in the vicinity of the 2035 Master Plan Area include the Alta Vista and Monterey Heights single-family residential neighborhoods, bordering the southern edge of campus, and the Foothill and Ferrini Heights neighborhoods, north of Foothill Boulevard to the west of campus. Noise- and vibration-sensitive land uses are also located within the 2035 Master Plan Area and include student housing and educational facilities.

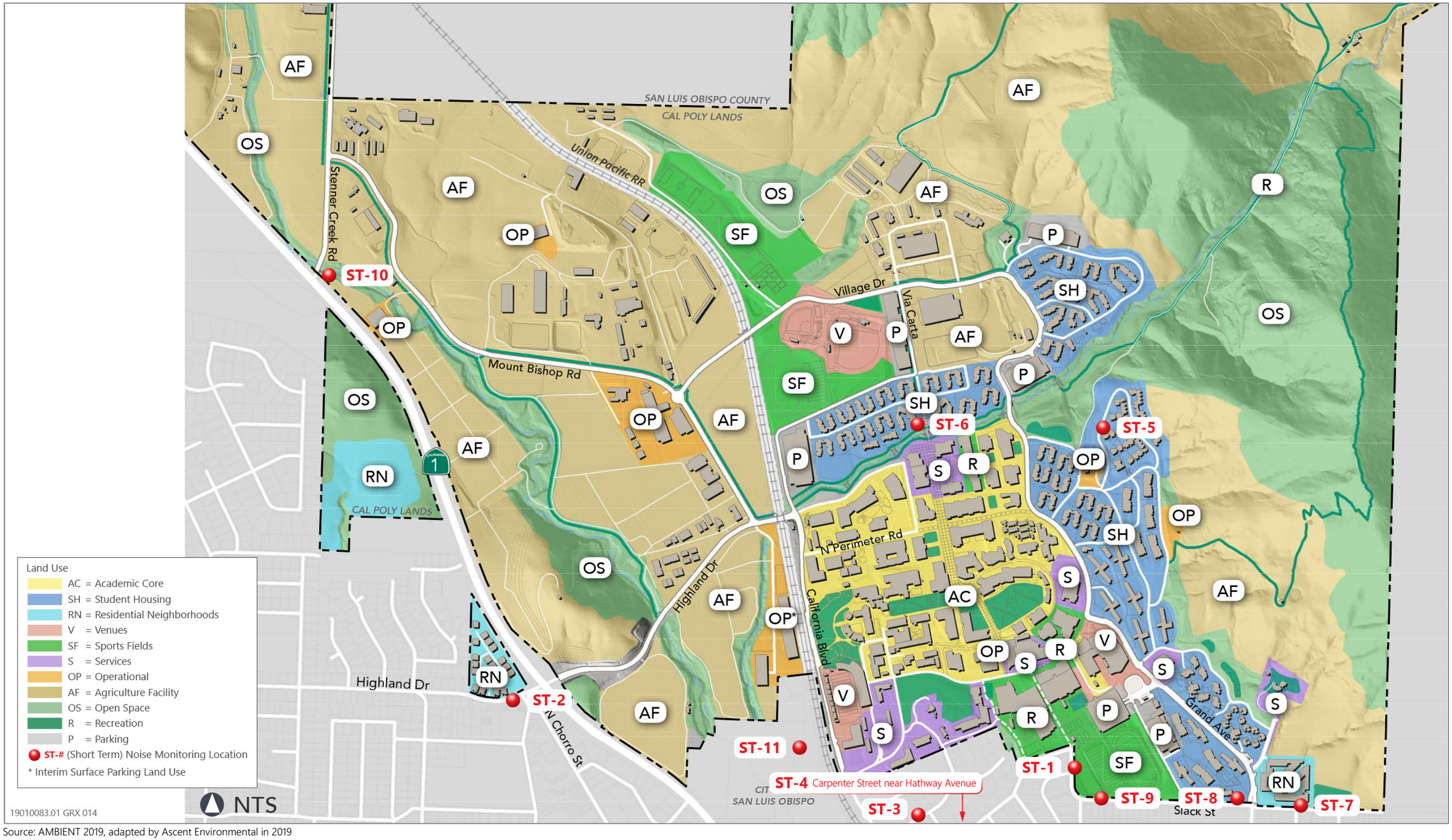
Educational facilities in the vicinity of the 2035 Master Plan Area are located to the southwest of the intersection of Grand Avenue and Slack Street and include Charles E. Teach Elementary School, San Luis Obispo Classical Academy High School, and the Monart Art School. The Foothill and Ferrini Heights residential neighborhoods west of the 2035 Master Plan Area are buffered from the campus by Cal Poly Technology Park and SR 1. Additionally, sports fields used for band practice, events, and games are located along the southern boundary of the 2035 Master Plan Area adjacent to residences in the Alta Vista and Monterey Heights neighborhoods.

Additionally, as shown in Figure 3.10-2, educational facilities located within the 2035 Master Plan Area are generally concentrated in the Academic Core subarea with student housing generally located to the north and east of the Academic Core subarea.

## Existing Noise Sources and Ambient Levels

### Transportation Noise

The existing noise environment in the 2035 Master Plan Area is primarily influenced by noise from vehicular traffic on the surrounding roadway network. Table 3.10-15 summarizes the existing traffic noise levels for major roadways in the 2035 Master Plan Area. To conservatively model traffic noise, noise levels were estimated using the Federal Highway Administration's (FHWA's) Traffic Noise Model Version 2.5 (FHWA 2004). The modeling is based on the reference noise emission levels for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and ground attenuation factors. Existing traffic volumes were obtained from the City of San Luis Obispo (San Luis Obispo, 2019b). Existing plus project traffic volumes were obtained from the project-specific traffic study (Rubins, pers. comm., 2019). The modeling conducted does not account for any natural or human-made shielding (e.g., the presence of walls or buildings) or reflection off building surfaces and is therefore conservative in its input assumptions.




Source: AMBIENT 2019, adapted by Ascent Environmental in 2019

**Figure 3.10-2 Noise Monitoring Locations**

As depicted in Table 3.10-15, existing traffic noise levels at approximately 50 feet from the centerline of the study area roadways generally range from the high 50s CNEL to mid-70s CNEL. Based on modeling, the highest traffic noise levels in the vicinity of the Master Plan Area occur along the segments of Santa Rosa Street north of Highland Drive and south of Foothill Boulevard, which generate predicted noise levels of 75.1 CNEL and 72.9 CNEL, respectively.

**Table 3.10-15 Existing Average-Daily Traffic Noise Levels**

| Roadway Segment | Predicted Noise Level (CNEL) 50 ft from Near Travel Lane Centerline | Predicted Noise Level (CNEL) Distance to Noise Contours (feet) 55 | Predicted Noise Level (CNEL) Distance to Noise Contours (feet) 60 | Predicted Noise Level (CNEL) Distance to Noise Contours (feet) 65 |
|---|---|---|---|---|
| Santa Rosa Street, North of Highland Drive | 75.1 | 5,143 | 1,626 | 514 |
| Santa Rosa Street, South of Foothill Boulevard | 72.9 | 3,083 | 975 | 308 |
| Foothill Boulevard, West of Broad Street | 68.6 | 1,132 | 358 | 113 |
| Chorro Street, South of Foothill Boulevard | 58.4 | 110 | 35 | 11 |
| Grand, South of Slack | 65.2 | 520 | 165 | 52 |

Note: CNEL = Community Noise Equivalent Level.

Sources: Noise levels modeled by Ascent Environmental in 2019. Refer to Appendix F.

## Existing Noise Survey

To document the existing noise environment on and adjacent to the Cal Poly campus, ambient noise surveys were conducted at various locations within and in the vicinity of the 2035 Master Plan Area (see Figure 3.10-2 and Table 3.10-16 for locations). Short-term (10-minute) noise measurements were conducted on September 27–29 between the hours of 1:00 p.m. and 5:30 p.m. using a Larson Davis model 820 sound-level meter placed at a height of approximately 5 feet above the ground surface. Based on observations conducted during the noise measurements, ambient noise levels were predominantly influenced by vehicle traffic on area roadways. To a lesser extent, construction activities, voices, and aircraft overflights also contributed to ambient noise conditions (AMBIENT 2019).

Measured average daytime noise levels in the 2035 Master Plan Area generally range from the upper 40s $L_{eq}$ to the upper 60s $L_{eq}$, primarily dependent on distance from area roadways. Average nighttime noise levels are generally 5 to 10 dBA less than daytime noise levels. Intermittent noise levels in the 2035 Master Plan Area associated with vehicle traffic on area roadways and can reach levels of approximately 80 $L_{max}$ along area roadway corridors. Noise measurement survey results are summarized in Table 3.10-16.

**Table 3.10-16 Ambient Daytime Noise Levels**

| Monitoring Location | | Primary Sources Noted During Measurement | Monitoring Date/Time | Measured Noise Level (dBA) $L_{eq}$ | Measured Noise Level (dBA) $L_{max}$ |
|---|---|---|---|---|---|
| ST-1 | Longview Lane near Hathway Avenue | Vehicle Traffic | 09/27/18 2:40 p.m.-2:50 p.m. | 57.2 | 78.7 |
| ST-2 | Highland Drive near Ferrini Road | Vehicle Traffic | 09/27/18 2:00 p.m.-2:15 p.m. | 62.3 | 78.6 |
| ST-2 | Highland Drive near Ferrini Road | Vehicle Traffic | 09/28/18 5:15 p.m.-5:30 p.m. | 64.5 | 77.1 |
| ST-3 | Foothill Blvd. near Carpenter Street | Vehicle Traffic | 09/27/18 1:20 p.m.-1:30 p.m. | 56.4 | 76.2 |
| ST-4 | Carpenter Street near Hathway Avenue | Vehicle Traffic | 09/27/18 1:00 p.m.-1:10 p.m. | 55.3 | 77.9 |
| ST-5 | Cerro Vista Circle near Cerro Vista Apartments | Vehicle Traffic | 09/27/18 3:20 p.m.-3:30 p.m. | 50.0 | 68.4 |

| Monitoring Location | | Primary Sources Noted During Measurement | Monitoring Date/Time | Measured Noise Level (dBA) $L_{eq}$ | Measured Noise Level (dBA) $L_{max}$ |
|---|---|---|---|---|---|
| ST-6 | Via Carta near E Creek Road | Vehicle Traffic | 09/27/18 3:50 p.m.-4:00 p.m. | 54.5 | 69.1 |
| ST-7 | Slack Street near Graves Avenue | Vehicle Traffic | 09/27/18 4:30 p.m.-4:40 p.m. | 49.1 | 64.8 |
| ST-8 | Slack Street near Grand Avenue | Vehicle Traffic | 09/28/18 4:00 p.m.-4:10 p.m. | 59.7 | 72.6 |
| ST-9 | Slack Street near Longview Lane | Vehicle Traffic | 09/28/18 5:20 p.m.-5:30 p.m. | 56.3 | 69.3 |
| ST-10 | Santa Rosa Street near Stenner Creek Road | Vehicle Traffic | 09/28/18 4:35 p.m.-4:45 p.m. | 68.9 | 74.9 |
| ST-11 | Mustang Drive near Mustang Village Apartments | PA system, crowd noise, music, stopping on bleachers at Spanos Stadium | 09/29/18 4:00 p.m.-4:30 p.m. | 57.3 | 65.4 |

Note: Noise measurements were conducted using a Larson Davis Laboratories Model 820 Type I integrating sound meter positioned at a height of approximately 5 feet above ground surface.

Source: AMBIENT 2019

# 3.10.3 Environmental Impacts and Mitigation Measures

## METHODOLOGY

### Construction Noise and Vibration

To assess potential short-term (construction-related) noise and vibration impacts, sensitive receptors and their relative exposure were identified. Project-generated construction source noise and vibration levels were determined based on methodologies, reference emission levels, and usage factors from FHWA's *Roadway Construction Noise Model User's Guide* (FHWA 2006). Reference levels for noise and vibration emissions for specific equipment or activity types are well documented and the usage thereof common practice in the field of acoustics.

### Operational Noise and Vibration

To assess potential long-term (operation-related) noise impacts due to project-generated increases in traffic, noise levels were estimated using FHWA's roadway noise prediction model (FHWA-RD-77-108) and project-specific traffic data obtained from the traffic analysis prepared for the project (Rubins, pers. comm., 2019). The analysis is based on the reference noise emission levels for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and ground attenuation factors. For detailed modeling inputs and calculations see Appendix F. The project's contribution to traffic noise levels along area roadways was determined by comparing the predicted noise levels with and without project-generated traffic. Note that the modeling conducted does not account for any natural or human-made shielding (e.g., the presence of walls or buildings) or reflection off building surfaces.

With respect to non-transportation noise sources (e.g., stationary) associated with project implementation, the assessment of long-term (operational-related) impacts was based on reference noise emission levels, and measured noise levels for activities and equipment associated with project operation (e.g., heating, ventilation and air conditioning [HVAC] units, parking facilities), and standard attenuation rates and modeling techniques.

Groundborne vibration levels associated with non-transportation (stationary) sources were evaluated qualitatively, based on representative noise and groundborne vibration levels commonly associated with similar uses.

### Cal Poly 2035 Master Plan

The following "Guiding Principles" were developed early on in the process by the 2035 Master Plan professional team with input from campus leadership, including the college deans, and considering continuity with the 2001 Master Plan. Guiding Principles can be thought of both as starting points for the plan process and as overarching directives relevant to all or most Master Plan topics. The following principle is relevant to noise:

- **Guiding Principle (GP 16):** GP 16: Cal Poly should consider potential impacts – including but not limited to traffic, parking, noise and glare – on surrounding areas, especially nearby single-family residential neighborhoods, in its land use planning, building and site design, and operations.

## THRESHOLDS OF SIGNIFICANCE

Cal Poly does not have adopted noise standards or policies, and therefore, this analysis relies on adopted noise standards of the City of San Luis Obispo and other appropriate agencies (e.g., Caltrans), where local standards are not available. It is appropriate to use these available noise standards because they were adopted to protect the community from excessive noise exposure and associated adverse effects. Impacts related to noise would normally be significant if implementation of the 2035 Master Plan would result in:

- generation of a substantial temporary construction increase in ambient noise levels in the vicinity of the project that exceeds 75 $L_{max}$ during the daytime hours (7:00 a.m. to 7:00 p.m.) and 60 $L_{max}$ during the nighttime hours(7:00 p.m. to 7:00 a.m.) applicable to mobile construction equipment at noise-sensitive land uses;
- generation of a substantial permanent traffic noise increase in ambient levels in the vicinity of the project in excess of 60 dBA Ldn (exterior), or where existing traffic noise levels exceed this level, result in a substantial (i.e., 3 dB) increase in noise;
- generation of a substantial permanent stationary noise increase in ambient noise levels in the vicinity of the project in excess of exterior noise standards for stationary noise sources of 50 $L_{eq}$/70 $L_{max}$ during the daytime hours (7:00 a.m. to 10:00 p.m.) and 45 $L_{eq}$/65 $L_{max}$ during the nighttime hours (10:00 p.m. to 7:00 a.m.) at noise-sensitive land uses; or
- generation of excessive groundborne vibration or groundborne noise levels that exceed Caltrans's recommended standards of 0.25 ppv/sec, aimed at preventing architectural damage to structures or FTA's recommended maximum exposure level of 80 VdB for assessing groundborne noise impacts to residences where people normally sleep.

## ISSUES NOT DISCUSSED FURTHER

### Airport/Airstrip-Related Noise Exposure

The project is not located within an airport land use plan, or within 2 miles of a public airport or public use airport/airstrip. San Luis Obispo County Regional Airport is the closest airport and is located approximately 3.5 miles south of the project site. Additionally, the project is not located within 2 miles of a private airstrip. Therefore, implementation of the project would not affect airport operations or result in the development or relocation of any noise-sensitive land uses in proximity to any airport or airstrip; and thus, the project would not result in noise impacts related to the exposure of people residing or working in the project area to excessive aircraft-related noise levels. This issue is not discussed further.

### Long-Term Operational Vibration

The implementation of the 2035 Master Plan would not introduce any major sources of long-term or permanent ground vibration (in contrast to construction vibration, which is evaluated in impact analysis, below). Additionally, no major stationary sources of groundborne vibration were identified in the project area that would result in the long-term exposure of proposed on-site land uses to unacceptable levels of ground vibration. Thus, long-term or permanent ground vibration levels in exceedance of the significance thresholds are not anticipated as a result of 2035 Master Plan implementation. This issue is not discussed further in this EIR.

# ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

## Impact 3.10-1: Generate Substantial Temporary (Construction) Noise

Implementation of the 2035 Master Plan would result in construction activities associated with the development of facilities to accommodate projected student enrollment and furtherance of the University's academic mission. Although construction activities would be intermittent and temporary, construction noise could reach high levels at nearby noise-sensitive land uses and could result in human disturbance. As a result, this impact would be **significant**.

The development of campus facilities contemplated in the 2035 Master Plan would result in increases in noise-generating construction activities. Noise generated during construction of buildings and associated structures is typically associated with operation of on- and off-road vehicles and equipment, including heavy trucks, excavators, earth movers, and building equipment. Noise levels associated with construction activities occurring during the more noise-sensitive evening and nighttime hours are of greater concern. Because exterior ambient noise levels typically decrease during the evening and nighttime hours (i.e., 7:00 p.m. to 7:00 a.m.) as community activities (e.g., commercial activities, vehicle traffic) decrease, construction activities performed during these more noise-sensitive periods can result in increased annoyance and potential sleep disruption for occupants of nearby residential dwellings.

Construction equipment in use at a given time would vary depending on the phase of construction and specific activities underway. Typical construction activities include grubbing/clearing of project sites, excavation and relocation of soil and rock, backfilling and compaction of soils, construction of utilities (i.e., potable and non-potable water conveyance, wastewater conveyance, storm water drainage facilities, and electrical and natural gas infrastructure), and construction of proposed buildings. Typical noise levels generated by various types of construction equipment likely to be used are identified in Table 3.10-17.

Short-term construction noise levels near the project site would fluctuate depending on the type, number, and duration of usage for the varying equipment. The effects of construction noise largely depend on the type of construction activities being performed, noise levels generated by those activities, distances to noise-sensitive receptors, the relative locations of noise-attenuating features such as vegetation and existing structures, and existing ambient noise levels.

Typically, the site preparation/grading phase of construction generates the most noise because the heaviest, loudest equipment (e.g., graders, excavators, dozers) is used for these activities. Specific construction-related details (e.g., location, schedule, equipment) for individual projects are unknown at this time. Therefore, to evaluate potential construction impacts, construction noise levels were modeled conservatively assuming that up to six pieces of equipment would be operating simultaneously along the boundary of the construction site nearest to the surrounding noise-sensitive receptors. Based on modeling conducted, construction-related noise levels could be approximately 88 $L_{eq}$ and 92 $L_{max}$ at 50 feet from a construction site. For detailed modeling and inputs see Appendix F.

Implementation of projects proposed under the 2035 Master Plan would necessitate construction activities near existing development, both on- and off-campus. Construction activities generally occur in phases and would be dispersed throughout the campus. However, construction activities could occur adjacent to existing residential development and depending on the construction activities conducted, equipment used, and distance to nearby noise-sensitive land uses, construction activities occurring could exceed acceptable daytime construction-noise levels (see Table 3.10-5) at existing on-campus and off-campus sensitive land uses.

**Table 3.10-17 Typical Construction Equipment Noise Levels**

| Equipment | Noise Level (dBA at 50 feet) $L_{max}$ | Noise Level (dBA at 50 feet) $L_{eq}$ |
|---|---|---|
| Backhoes | 78 | 74 |
| Bulldozers | 82 | 78 |
| Compressors | 78 | 74 |
| Cranes | 81 | 73 |
| Concrete Pump Truck | 81 | 74 |

| Equipment | Noise Level (dBA at 50 feet) $L_{max}$ | Noise Level (dBA at 50 feet) $L_{eq}$ |
|---|---|---|
| Drill Rigs | 79 | 72 |
| Dump Trucks | 77 | 73 |
| Excavator | 81 | 77 |
| Generator | 81 | 78 |
| Grader | 85 | 81 |
| Front End Loaders | 79 | 75 |
| Pneumatic Tools | 85 | 82 |
| Pumps | 81 | 78 |
| Rollers | 80 | 73 |
| Scrapers | 84 | 80 |
| Tractor | 84 | 80 |

Notes: Based on measured instantaneous noise levels ($L_{max}$), average equipment usage rates, and calculated average-hourly ($L_{eq}$) noise levels derived from the FHWA Road Construction Noise Model.

Source: FHWA 2006

While the majority of construction activities would occur during the time when construction noise standards are higher (i.e., 7:00 a.m. to 7:00 p.m. with City noise standards ranging from 60-85 dBA depending on affected land use and duration of noise generating activity, see tables 3.10-9 and 3.10-10), some activity may be required outside of these hours depending on the circumstance and location. Outdoor construction would be permitted to occur only during the nighttime hours if there are no other reasonable options. For example, some foundation designs require that once the pouring of concrete begins, the pour must continue without pause until complete. In some instances, such a concrete pour may take 20 or more hours, requiring work to occur during some nighttime hours. It is unknown at this time if the 2035 Master Plan would include construction that would have any elements that require outdoor nighttime construction. Therefore, to ensure a comprehensive evaluation of potential environmental effects, this EIR assumes the potential for outdoor nighttime construction activity. Depending on the type of construction activities required during the nighttime, this could also result in an exceedance of the City's most conservative threshold for nighttime construction noise of 50 dBA $L_{max}$ (see Tables 3.10-9 and 3-10-10).

Therefore, both daytime and nighttime construction activities associated with implementation of the 2035 Master Plan could result in exceedances of the most conservative daytime and nighttime construction-noise levels standards (i.e., 75 dBA $L_{max}$ and 60 dBA $L_{max}$, respectively) as established in the City of San Luis Obispo Municipal Code. Thus, this impact would be **significant**.

## Mitigation Measures

### Mitigation Measure 3.10-1: Implement Construction-Noise Reduction Measures

For all construction activities related to new/renovated structures, Cal Poly shall implement or incorporate the following noise reduction measures into construction specifications for contractor(s) implementation during project construction:

- All construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturer recommendations. Equipment engine shrouds shall be closed during equipment operation.
- All construction equipment and equipment staging areas shall be located as far as possible from nearby noise-sensitive land uses, and/or located to the extent feasible such that existing or constructed noise attenuating features (e.g., temporary noise wall or blankets) block line-of-site between affected noise-sensitive land uses and construction staging areas.

- Individual operations and techniques shall be replaced with quieter procedures (e.g., using welding instead of riveting, mixing concrete off-site instead of on-site, using electric powered equipment instead of pneumatic or internal combustion powered equipment) where feasible and consistent with building codes and other applicable laws and regulations.
- Stationary noise sources such as generators or pumps shall be located as far away from noise-sensitive uses as feasible.
- No less than 1 week prior to the start of construction activities at a particular location, notification shall be provided to nearby off-campus, noise-sensitive land uses (e.g., residential uses) that are located within 350 feet of the construction site (i.e., based on the construction noise modeling, distance at which noise-sensitive receptors would experience noise levels exceeding acceptable daytime construction-noise levels).
- When construction would occur within 350 feet of on-campus housing or other on-campus or off-campus noise-sensitive uses and may result in temporary noise levels in excess of 75 $L_{max}$ at the exterior of the adjacent noise-sensitive structure, temporary noise barriers (e.g., noise-insulating blankets or temporary plywood structures) shall be erected, if deemed to be feasible and effective, between the noise source and sensitive receptor such that construction-related noise levels are reduced to 75 $L_{max}$ or less at the receptor.]
- Loud construction activity (e.g., jackhammering, concrete sawing, asphalt removal, and large-scale grading operations) within 350 feet of adjacent primary school facilities, shall not occur during state standardized testing time periods for the surrounding school districts.
- When construction requires material hauling, a haul route plan shall be prepared for construction of each facility and/or improvement for review and approval by the Cal Poly that designates haul routes as far as feasible from sensitive receptors.
- The contractor shall designate a disturbance coordinator and post that person's telephone number conspicuously around the construction site and provide to nearby residences. The disturbance coordinator shall receive all public complaints and be responsible for determining the cause of the complaint and implementing any feasible measures to alleviate the problem.
- Construction activities (excluding activities that would result in a safety concern to the public or construction workers) shall be limited to between the hours of 7:00 a.m. and 7:00 p.m., Monday through Saturday, where feasible. For any construction activity that must extend beyond the daytime hours of 7:00 a.m. and 7:00 p.m. Monday through Saturday, occur on Sunday, or legal holidays and occurs within 2,000 feet of a residential building, Cal Poly shall ensure that the City of San Luis Obispo exterior noise level standard of 60 dBA $L_{max}$ for temporary construction noise is not exceeded at any residence. Typical residential structures with windows closed achieve a 25-30 dBA exterior-to-interior noise reduction (Caltrans 2002). Thus, using the lower end of this range, an exterior noise level of 60 dBA $L_{max}$ would result in interior noise levels of about 35 dBA $L_{max}$, which would not result in a substantially increased risk for sleep disturbance. If exterior noise levels of 60 dBA Lmax are infeasible due to type of construction activity and proximity to residential structure, ensuring interior noise levels do not exceed 45 dBA $L_{eq}$, consistent with City standards, would ensure residents are not disturbed. To achieve this performance standard, one or more of the following or equivalent measures shall be considered and implemented where appropriate:
    - Use of noise-reducing enclosures and techniques around stationary noise-generating equipment (e.g., concrete mixers, generators, compressors).
    - Installation of temporary noise curtains installed as close as possible to the boundary of the construction site within the direct line of sight path of the nearby sensitive receptor(s) and consist of durable, flexible composite material featuring a noise barrier layer bounded to sound-absorptive material on one side.
    - Retain a qualified noise specialist to develop a noise monitoring plan and conduct noise monitoring to ensure that noise reduction measures are achieved the necessary reductions such that levels at the receiving land uses do not exceed exterior noise levels of 60 dBA $L_{max}$ for construction activity occurring during these noise-sensitive hours.

Significance after Mitigation

Mitigation Measure 3.10-1 would limit the periods during which construction activities would occur in the vicinity of nearby noise-sensitive land uses. Additional measures would be required to further reduce the potential for noise exposure, including use of alternatively powered equipment, exhaust mufflers, engine shrouds, equipment enclosures, and barriers for activities in the vicinity of noise-sensitive uses. Implementation of these noise-reduction features can reduce construction noise levels by approximately 10 dBA, or more. With mitigation, construction-generated noise levels would be substantially reduced. However, construction noise levels at some nearby land uses may need to be reduced by up to 17 dBA during daytime hours to achieve applicable noise standards; thus, even with implementation of all feasible mitigation, construction noise could still exceed applicable noise standards. Therefore, this impact would be **significant and unavoidable**.

## Impact 3.10-2: Generate Substantial Increase in Long-Term (Traffic) Noise Levels

Population growth and development associated with implementation of the 2035 Master Plan would increase traffic within and outside the 2035 Master Plan Area. However, project-generated traffic volumes would not be at levels high enough to cause substantial increases in noise (i.e., 3 dB or more). This impact would be **less than significant**.

Development associated with the 2035 Master Plan would result in some increases in traffic volumes along affected roadway segments and potentially generate an increase in traffic source noise levels.

Generally, a doubling of a noise source (such as twice as much traffic) is required to result in an increase of 3 dB, which is perceived as noticeable by people. Therefore, regarding traffic noise specifically, an increase in 3 dB or more in traffic noise would be considered substantial. To assess this impact, traffic noise levels associated with the proposed development under existing and existing-plus-project conditions were modeled for affected roadway segments. For further details on traffic counts and conditions, see Section 3.13, "Transportation." Table 3.10-18 summarizes the increases in noise on project-affected roadway segments. As shown in Table 3.10-18, development of the 2035 Master Plan would result in predicted increases in traffic noise levels of approximately 0.9 dBA, or less along affected area roadway segments.

**Table 3.10-18 Predicted Increases in Traffic Noise Levels**

| Roadway | Predicted dBA CNEL, 50 Feet from Near-Travel Lane Centerline Existing | Predicted dBA CNEL, 50 Feet from Near-Travel Lane Centerline Existing Plus Project | Predicted Change (dBA) | Significant Increase? |
|---|---|---|---|---|
| Santa Rosa Street, North of Highland Drive | 75.1 | 75.2 | 0.1 | No |
| Santa Rosa Street, South of Foothill Boulevard | 72.9 | 73.1 | 0.2 | No |
| Foothill Boulevard, West of Broad Street | 68.6 | 68.6 | 0.0 | No |
| Chorro Street, South of Foothill Boulevard | 58.4 | 59.0 | 0.6 | No |
| Grand Avenue, South of Slack Street | 65.2 | 66.1 | 0.9 | No |

Notes: Traffic noise levels were calculated using methods consistent with the FHWA roadway noise prediction model, based on data obtained from the traffic analysis prepared for this project; dBA=A-weighted decibel.

Source: Modeled by Ascent Environmental, Inc, in 2019

Increases in project-generated traffic could result in some increase in traffic noise levels along roadways internal to the campus. As discussed in Section 3.3 "Air Quality," the project would result in an increase of 7,495 vehicle trips per day that would be spread out over several local roadways (evaluated in Table 3.10-18) and would enter/leave campus through multiple entry points, dispersing any new trips throughout the internal roadway network. Further, students and faculty/staff driving to and from campus would be driving toward parking structures and parking lots that are generally not located near on-campus residential uses. In addition, peak travel times would generally occur in the morning hours, times when people are awake and less prone to be disturbed from traffic noise. For these reasons, traffic noise increases on internal roadways would be minimal and would generally not affect any existing or future sensitive receptors. Therefore, implementation of the project would not result in a substantial increase (i.e., 3 dB) in

traffic noise and, for roadways currently below 60 dBA $L_{dn}$,, would not exceed 60 dBA $L_{dn}$ as a result of project-generated traffic increases. This impact would be **less than significant**.

### Mitigation Measures

No mitigation is required.

## Impact 3.10-3: Generate Substantial Long-Term Increase in Stationary Noise

The new buildings and facilities constructed as part of the 2035 Master Plan may include new stationary noise sources and equipment (e.g., mechanical equipment), and increased noise levels associated with athletic and special events. Depending on location and design, equipment location, intervening shielding, and noise-reduction features incorporated, noise levels associated with new stationary noise sources (Spanos Stadium, parking facilities, HVAC systems) could result in exceedances of exterior noise limits at existing sensitive land uses. This impact would be **significant**.

Noise sources commonly associated with the facilities proposed in the 2035 Master Plan would include sporting and special events; parking lot activities (e.g., opening and closing of vehicle doors, people talking); and the use of onsite building equipment such as HVAC systems, boilers, and emergency/back-up generators. Emergency/back-up generators would only be used for continued periods of time during power outages or building equipment malfunctions and, therefore, do not substantially contribute to increases in average ambient noise levels. Further, back-up equipment would be tested periodically for short periods of time during the daytime hours, consistent with typical work shifts of maintenance personnel, and City standards for stationary sources (i.e., 7:00 a.m. to 10:00 p.m.). Thus, due to the infrequent, intermittent, and temporary use characteristics of these noise sources, in combination with that fact that typical maintenance activity would occur during the less sensitive times of the day, noise generated from new emergency/back-up generators would not be considered a substantial permanent increase in noise that could disturb nearby receptors. For these reasons, stationary noise sources evaluated in this impact include Spanos Stadium, parking facilities, and HVAC systems. Noise levels associated with these noise sources are discussed separately, below.

#### Sporting and Special Events

The 2035 Master Plan provides for enhancement of existing sport and event facilities on campus, including the expansion of Spanos Stadium. The Spanos Stadium expansion would add approximately 4,000 seats to better accommodate home sporting events and graduation ceremonies. This additional seating would result in additional spectator noise from the stadium during sporting and special events. The nearest off-campus noise-sensitive land uses are the Mustang Village Apartments, located approximately 350 feet southwest of the stadium across California Boulevard and the Union Pacific Railroad tracks. Detailed information regarding stadium improvements are not yet available. Events at Spanos Stadium are typically limited to the less sensitive times of day (i.e., 7:00 a.m. to 10:00 p.m), as defined by the municipal code standards that apply to stationary equipment. Because specific stadium improvements, event types, and timing of events are unknown at this time, this EIR conservatively assumes that operational noise levels associated with the stadium expansion could exceed applicable noise standards at nearby noise-sensitive land uses, including the Mustang Village Apartments. This impact would be significant.

#### Parking Facilities

Various parking structures and surface parking lots are proposed to be constructed as part of the 2035 Master Plan. Near-term development (within the first 10 years of 2035 Master Plan implementation) would include construction of a new parking structure located along Via Carta south of Village Drive in the North Campus subarea and construction of a second structure near the Union Pacific Railroad right-of-way, immediately north of Brizzolara Creek and also in the North Campus subarea. Various other parking facilities may also be constructed to replace surface parking lots that may be displaced by future planned development, such as the interim parking lot in the West Campus. Noise levels commonly associated with large parking structures can reach levels of approximately 60-65 dBA $L_{eq}$ at 50 feet during periods of peak use (Ambient 2019). Given that the proposed parking facilities would be located within the North Campus subarea of the main campus or in a relatively isolated area in the West Campus, operational noise levels associated with these facilities would not be audible at off-campus residential neighborhoods (Ambient 2019).

However, the proposed parking facilities could be located adjacent to where new student housing areas are proposed. Based on the conservative reference noise level of 65 dBA $L_{eq}$ at 50 feet, and applying typical attenuation rates, noise from the proposed parking structures could exceed daytime exterior noise thresholds for stationary equipment (i.e., 50 $L_{eq}$/70 $L_{max}$ between 7:00 a.m. and 10:00 p.m.) if a sensitive receptor is located within 280 feet of the source, and the nighttime exterior noise thresholds (i.e., 45 $L_{eq}$/65 $L_{max}$ between 10:00 p.m. to 7:00 a.m.) if a sensitive receptor is located within 498 feet of the source. Based on the 2035 Master Plan, it is likely that student housing would be located closer than 280 feet from the proposed parking structures. Therefore, it is possible that proposed parking structures could cause both daytime and nighttime exterior noise thresholds to be exceeded at noise-sensitive receptors. This impact would be significant.

Building Mechanical Equipment

Implementation of the 2035 Master Plan would result in increased stationary source noise levels, primarily associated with building mechanical equipment (e.g., HVAC systems). As discussed above, this discussion focusses on HVAC equipment. Detailed information regarding the stationary equipment to be installed for facilities constructed under the 2035 Master Plan is not available at this time. However, noise levels commonly associated with larger commercial-use air conditioning systems can reach levels of up to 78 dBA at 3 feet (Lennox 2019). Commonly installed building equipment, such as HVAC systems, can be located in the interior of the structure, on rooftops, or in direct line-of-sight to adjacent land uses. Based on the reference noise level, and applying typical attenuation rates, noise from HVAC units could exceed daytime (i.e., 7:00 a.m. to 10:00 p.m.) exterior noise thresholds for stationary equipment of 50 dBA $L_{eq}$ within 75 feet and the 70 dBA $L_{max}$ standard within 8 feet of the source. Nighttime (i.e., 10:00 p.m. to 7:00 a.m.) exterior noise standards of 45 dBA $L_{eq}$ could be exceeded within 134 feet and 65 dBA Lmax within 14 feet of an HVAC unit. Thus, depending on the proximity of HVAC systems to surrounding noise-sensitive receptors, the increase in ambient noise levels associated with HVAC systems at nearby noise-sensitive land uses could exceed applicable noise standards. This impact would be significant.

Summary

Dependent on the specific improvements proposed to the stadium and the associated design and location of those improvements, operational noise levels associated with the stadium expansion could exceed applicable daytime noise standards at nearby noise-sensitive land uses. Additionally, parking structures proposed in the 2035 Master Plan could cause both daytime and nighttime exterior noise thresholds to be exceeded at on-site noise-sensitive receptors (on-campus residences). Lastly, depending on building design, and the type, size, and location of the mechanical equipment installed, operational noise levels associated with stationary noise sources could result in exceedances of exterior noise limits at existing sensitive land uses. This impact would be **significant**.

## Mitigation Measures

### Mitigation Measure 3.10-3a: Implement Noise Reduction Measures to Reduce Long-Term Noise Impacts of Spanos Stadium

To minimize noise levels generated by the Spanos Stadium expansion, the following measures shall be implemented:

- Prior to final design, a noise assessment shall be conducted by a qualified acoustical engineer or noise specialist to evaluate potential increases in noise levels associated with the proposed expansion of Spanos Stadium. Noise-reduction measures shall be incorporated to reduce significant increases in existing operational noise levels (i.e., 3 dBA, or greater) at nearby noise-sensitive land uses, including Mustang Village Apartments, to the extent feasible. Such measures may include, but are not limited to, the incorporation of structural shielding, enclosed bleachers, and revised placement for amplified sound system speakers.

### Mitigation Measure 3.10-3b: Implement Noise Reduction Measures to Reduce Long-Term Noise Impacts of the Proposed Parking Structures

To minimize noise levels generated by the proposed parking structures, the following measures shall be implemented:

- Prior to final design, a noise assessment shall be conducted by a qualified acoustical engineer or noise specialist to evaluate potential increases in noise levels associated with the proposed expansion of any proposed parking structure. Noise-reduction measures shall be incorporated to reduce to the extent feasible significant increases in

existing operational noise levels (i.e., 3 dBA, or greater) at nearby noise-sensitive land uses, including campus student housing. Such measures may include, but are not limited to, locating parking structures as far away as possible from noise-sensitive land uses, constructing noise barriers between parking structures and noise-sensitive land uses, or using buildings and topographic features to provide acoustic shielding for noise-sensitive land uses.

### Mitigation Measure 3.10-3c: Implement Noise Reduction Measures to Reduce Long-Term Noise Impacts of Building Mechanical Equipment

To minimize noise levels generated by building mechanical equipment, the following measures shall be implemented:

- Building air conditioning units for proposed structures shall be located on building rooftops or shielded from direct line-of-sight of adjacent noise-sensitive land uses. Building parapets shall be constructed, when necessary, to shield nearby land uses from direct line-of-site of air conditioning units.
- During project design of individual projects proposed as part of the 2035 Master Plan, Cal Poly shall review and ensure that external building mechanical equipment (e.g., HVAC systems) incorporate noise-reduction features sufficient to reduce average-hourly exterior operational noise levels at nearby noise-sensitive land uses to 50 $L_{eq}$ and 70 dba $L_{max}$, or less during the daytime (i.e., 7:00 a.m. to 10:00 p.m.) and 45 $L_{eq}$ and 60 dBA $L_{max}$, or less during the nighttime (i.e., 10:00 p.m. to 7:00 a.m.), within outdoor activity areas. Noise-reduction measures to be incorporated may include, but are not limited to, the selection of alternative or lower noise-generating equipment, relocation of equipment, and use of equipment enclosures.

Significance after Mitigation

Implementation of Mitigation Measure 3.10-3a would require the preparation of an acoustical analysis for the planned expansion of Spanos Stadium, prior to final site design. The acoustical analysis would be required to evaluate changes in operational noise levels associated with the proposed stadium expansion and, where practical, incorporate noise reduction measures (e.g., structural shielding, enclosed bleachers, and changes in speaker placement for amplified sound systems).

Implementation of Mitigation Measure 3.10-3b would require the preparation of an acoustical analysis for the planned parking structures prior to final site design. The acoustical analysis would be required to evaluate changes in operational noise levels associated with the proposed parking structures and, where practical, incorporate noise reduction measures (e.g., building location and design, construction of noise barriers).

Similarly, implementation of Mitigation Measure 3.10-3c would require that all external building mechanical equipment noise sources are oriented, located, and designed in such a way that reduces noise exposure and would ensure that exterior and interior noise levels at nearby noise-sensitive land uses would not exceed the exterior noise standards for stationary sources. Thus, incorporated mitigation would ensure that stationary equipment do not exceed applicable standards and this impact would be reduced to less than significant.

However, depending on the final site design for the proposed parking structures, proposed housing facilities, and the Spanos Stadium expansion, the implementation of mitigation measures may not be sufficient to fully mitigate associated increases in operational noise levels at all nearby noise-sensitive land uses to levels at or below the identified noise standard. As a result, this impact would be **significant and unavoidable**.

## Impact 3.10-4: Generate Substantial Temporary (Construction) Vibration Levels

If pile driving is required during project construction, it could expose existing nearby sensitive receptors and structures to levels of ground vibration that could result in structural damage and/or human disturbance. This impact would be **significant**.

As shown in Table 3.10-19, construction activities generate varying degrees of temporary ground vibration, depending on the specific construction equipment used and activities involved. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increased distance. Construction-related ground vibration is normally associated with impact equipment, such as pile drivers and jackhammers, and the

operation of some heavy-duty construction equipment, such as dozers and trucks. Blasting activities also generate relatively high levels of ground vibration and vibration noise. The effects of ground vibration may be imperceptible at the lowest levels, result in low rumbling sounds and detectable vibrations at moderate levels, and at high levels can cause sleep disturbance in places where people normally sleep or annoyance in buildings that are primarily used for daytime functions.

As shown in Table 3.10-19, pile driving and blasting are the typical construction activities that generate the greatest ground vibration. Construction associated with the 2035 Master Plan could include the use of impact or sonic pile driving. No blasting would occur.

**Table 3.10-19 Representative Ground Vibration and Noise Levels for Construction Equipment**

| Equipment | PPV (in/sec)[1] at 25 feet | Approximate $L_v$ (VdB) at 25 feet[2] |
|---|---|---|
| Impact Pile Driver | 1.518 | 112 |
| Blasting | 1.13 | 109 |
| Sonic Pile Driver | 0.734 | 105 |

Notes: PPV = peak particle velocity; LV = the root mean square velocity expressed in vibration decibels (VdB), assuming a crest factor of 4.
Source: FTA 2018

Construction activities would occur in close proximity to existing on- and off-site sensitive receptors. The location and method for sinking piles, if needed, and the distance to the nearest sensitive receptors cannot be known at this time.

It is not known if any of the structures in the project vicinity would be considered historic; therefore, vibration levels from impact and sonic pile driving were modeled to determine the distance at which the Caltrans's 0.25 in/sec PPV vibration standard for prevention of structural damage for historic and some old buildings and the FTA's maximum acceptable level for human response of 80 VdB would be exceeded. Modeling was based on FTA's recommended procedure for applying a propagation adjustment to these reference levels. Modeling results are shown in Table 3.10-20.

**Table 3.10-20 Representative Ground Vibration and Noise Levels for Construction Equipment**

| Equipment | Distance (feet) at Which PPV (in/sec)[1] of 0.25 Would Be Exceeded | Distance (feet) at Which $L_v$ (VdB) of 80.0 Would Be Exceeded |
|---|---|---|
| Impact Pile Driver | 83 | 292 |
| Sonic Pile Driver | 51 | 170 |

Notes: PPV = peak particle velocity; $L_V$ = the root mean square velocity expressed in vibration decibels (VdB), assuming a crest factor of 4.
Source: FTA 2018

As shown in Table 3.10-20, impact pile driving and sonic pile driving could exceed Caltrans's 0.25 in/sec PPV vibration standard for prevention of structural damage for historic and some old buildings and the FTA's maximum acceptable level for human response of 80 VdB, depending on the distance to the nearest sensitive receptor. Therefore, implementation of the project could expose existing on-site and off-site sensitive receptors and structures to levels of ground vibration that could result in and/or structural damage and/or human disturbance. This impact would be **significant**.

## Mitigation Measures

### Mitigation Measure 3.10-4a: Implement Measures to Reduce Ground Vibration

For any future construction activity that would involve pile driving and be located within 300 feet of an existing sensitive land use or occupied building, the following measures shall be implemented:

- To the extent feasible, earthmoving and ground-impacting operations shall be phased so as not to occur simultaneously in areas close to sensitive receptors (i.e., within 300 feet). The total vibration level produced could be significantly less when each vibration source is operated at separate times.

- Where there is flexibility in the location of use of heavy-duty construction equipment, or impact equipment, the equipment shall be operated as far away from vibration-sensitive sites as reasonably feasible.

### Mitigation Measure 3.10-4b: Develop and Implement a Vibration Control Plan

To assess and, when needed, reduce vibration and noise impacts from construction activities, the following measures shall be implemented:

- A vibration control plan shall be developed prior to initiating any pile-driving activities. Applicable elements of the plan shall be implemented before, during, and after pile-driving activity. The plan will include measures sufficient to reduce vibration at sensitive receptors to levels below applicable thresholds. Items that will be addressed in the plan include, but are not limited to, the following:
  - Identification of the maximum allowable vibration levels at nearby buildings may consider Caltrans's recommended standards with respect to the prevention of architectural building damage of 0.25 in/sec PPV for historic and some old buildings and for buildings that are occupied at the time of pile driving, FTA's maximum-acceptable-vibration standard with respect to human response, 80 VdB. However, based on site-specific parameters (e.g., building age, structural integrity), and construction specifics (e.g., time of day when vibration activities occur, pile frequency), these standards may be adjusted, as long as sensitive receptors and structures are protected.
  - Pre-construction surveys shall be conducted to identify any pre-existing structural damage to buildings that may be affected by project-generated vibration.
  - Identification of minimum setback requirements for different types of ground-vibration-producing activities (e.g., pile driving) for the purpose of preventing damage to nearby structures and preventing adverse effects on people. Factors to be considered include the nature of the vibration-producing activity, local soil conditions, and the fragility/resiliency of the nearby structures. Initial setback requirements can be reduced if a project- and site-specific analysis is conducted by a qualified geotechnical engineer or ground vibration specialist that indicates that no structural damage to buildings or structures would occur.
  - Vibration levels from pile driving shall be monitored and documented at the nearest sensitive land use to document that applicable thresholds are not exceeded. Recorded data shall be submitted on a twice-weekly basis to Cal Poly. If it is found at any time that thresholds are exceeded, pile driving shall cease in that location, and methods shall be implemented to reduce vibration to below applicable thresholds, or an alternative pile installation method shall be used at that location.

**Significance after Mitigation**

Implementation of Mitigation Measures 3.10-4a and 3.10-4b would require the contractor to minimize vibration exposure to nearby receptors by locating equipment far from receptors and phasing operations. Further, if pile driving would be required, a vibration control plan would be prepared and implemented to refine appropriate setback distances and identify other measures to reduce vibration, if necessary, and identify and implement alternative methods to pile driving if required. These measures would ensure compliance with recommended levels to prevent structural damage and human annoyance. Thus, this impact would be reduced to a **less-than-significant** level.