

4.8 NOISE

This section describes existing noise levels in the project vicinity and evaluates construction and operational noise impacts. The following analysis is based on the Construction Noise Assessment completed in October 2013 (Illingworth & Rodkin, 2013), included as **Appendix L**.

4.8.1 NOISE AND VIBRATION BACKGROUND

Noise

Noise can be defined as unwanted sound. Noise is commonly measured with an instrument called a sound level meter. The sound level meter “captures” sound with a microphone and converts it into a number called a sound level. Sound levels are expressed in units called decibels (dB). **Table 4.8-1** below illustrates the A-weighted decibel (dBA) levels of common transportation and community sounds generated from different types of noise sources. The table identifies the type of noise source and what the sound level and listener impression would be at a specific distance from the source.

Table 4.8-1 Decibel Levels of Common Sounds

Noise Source (distance between source and listener)	Sound Level (dBA)	Subjective Impression
Civil Defense Siren (100')	130	
Jet Takeoff (200')	120	Threshold of Pain
Rock Music Concert	110	
Bus (15'), Ambulance Siren (100')	100	Very Loud
Boiler Room Printing Press Plant	90	
Garbage Disposal (3'), Freeway (100')	80	
Freight Cars (100')	70	Moderately Loud
Vacuum Cleaner (10') , Department Store Speech (1')	60	
Light Traffic (100') Business Office	50	
Typical Home Interior Typical Home Exterior (Nighttime)	40	Quiet

Noise Source (distance between source and listener)	Sound Level (dBA)	Subjective Impression
Quiet Bedroom Soft Whisper	30	
Mosquito (5')	10	Threshold of Hearing

Source: Sunnyvale General Plan, 2011

To correlate the microphone signal to a level that corresponds to the way humans perceive noise, the “A-weighting” filter is commonly applied. “A-weighting” de-emphasizes both low-frequency and very high-frequency sound in a manner similar to human hearing. The use of A-weighting is required by most local agencies and is used in other federal and state noise regulations. The abbreviation *dBA* is often used when the A-weighted sound level is reported.

Because of the time-varying nature of environmental sound, there are many descriptors that are used to quantify the sound level. Although one individual descriptor alone does not fully describe a particular noise environment, taken together, they can more accurately represent the noise environment. Descriptors commonly used in environmental studies include the following:

- **L_{max}**: The maximum instantaneous noise level, used to identify the loudness of a single event, such as an airplane flyover or car/truck passing.
- **L_{eq}**: Equivalent noise level, a measurement of average noise over some specified period of time.
- **L₉₀**: The noise level exceeded 90 percent of the time, usually considered to represent ambient or background noises.
- **L_{dn}** or CNEL Day/Night Average Sound Level or Community Noise Equivalent Level. **L_{dn}** or CNEL quantifies noise over a 24 hour period, and includes a weighting system of penalties up to 10 dBA for noises occurring during late evening and very early morning hours, which are typically considered the periods of greatest sensitivity to noise.

Except under laboratory conditions, a change in sound level of 1 dBA cannot be measured or perceived by human hearing. Outside of the laboratory, a 3 dBA change in sound level is considered a barely discernible difference. Therefore, for the purposes of environmental review under CEQA, project-related noise increases of less than 3 dBA would be considered a less-than-significant impact. A change in sound level of 5 dBA will typically result in a clearly noticeable difference. A 10 dBA increase would be perceived as a doubling in loudness (or, in the case of a 10 dBA decrease, a halving of loudness).

Vibration

Vibration is the physical manifestation of energy carried through the earth and structures. The effect of vibration on structures and individuals varies depending on the soil type, ground strata, and receptor location. Vibration is generally felt rather than heard, such as the floor and walls vibrating as a result of a passing subway train.

The construction of a project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams, etc.) are used. Vibration amplitude can be measured by its Peak Particle Velocity (PPV). The PPV is the maximum instantaneous positive or negative peak of the vibration wave and is routinely used to assess the potential of vibration to induce structural damage and the degree of annoyance for humans. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.¹

4.8.2 EXISTING CONDITIONS

The primary sources of noise at the project site and surrounding area are local and distant vehicle traffic (including passing trains) and local neighborhood residential and commercial activities. Potential sensitive noise receptors in the project vicinity include surrounding and nearby residential uses.

To quantify existing noise levels, an ambient noise monitoring survey was conducted over two days in October 2013 to document existing noise conditions at or near noise-sensitive receptors. This survey included two long term measurements (LT-1 and LT-2) and six short term measurements (ST-1 to ST-6). **Figure 4.8-1** maps the location of these eight noise monitoring locations within the project vicinity.

Appendix L includes the hourly trend in noise levels at long-term noise measurements for sites LT-1 and LT-2 over a 46 hour period.

Site LT-1 was selected to represent the ambient noise environment at the Heritage Park Apartments both east and west of Fair Oaks Avenue. The day-night average noise level calculated was 66 dBA Ldn with hourly average noise levels typically ranging from 47 dBA to 66 dBA Leq.

¹ Illingworth and Rodkin, January 29, 2014

LT-2 was selected to represent the noise environment of noise-sensitive land uses along Dwight Avenue. The day-night average noise level was 65 dBA Ldn with hourly average noise levels typically ranging from 47 dBA to 63 dBA Leq. These sound level ranges indicate average to below average existing noise level conditions for areas near suburban arterial roadways.

The Sunnyvale General Plan (General Plan) Noise Element indicates residential land uses with exterior noise levels of 60-75 dBA are conditionally acceptable, see **Figure 4.8-2**, and the City has applied this limit through application of conditions of approval that attempt to achieve a 60 dBA. For reference, outdoor nighttime urban activities are typically in the range of 40-45 dBA while heavy traffic at 300 feet from a listener is 60dBA.²

Six additional sites (ST-1 to ST-6) were selected for their immediate proximity to existing residences. Short-term noise measurements were taken between 12:20 and 2:00 p.m. on a weekday.

From these 10 and 20 minute measurements, noise analysts correlated the data with the 46-hour measurement to compute the noise level (L_{dn}) at these locations. Noise is highest at locations ST- 1 and 3, which are closest to Fair Oaks Avenue. As expected, ST- 2, 4, 5 and 6 have the lowest noise levels insofar as they are located farther from Fair Oaks Avenue with more structures intervening between the noise source (i.e. Fair Oaks Avenue).

In both the long and short-term noise measurement surveys, the dominant noise sources were vehicle traffic, both local and more distant. Other noise sources included passing trains and local neighborhood activities. **Table 4.8-2** and **Table 4.8-3** summarize the noise level data collected at each of the monitoring sites. The data illustrate that existing noise conditions are within acceptable exposure ranges to residential uses.

² Technical Noise Supplemental (TeN), Caltrans, November 2009

Table 4.8-2 Long-Term Noise Measurement Data

Noise Measurement Location	L _{dn} dBA	Hourly Average L _{eq} dBA
LT-1:	66	47 – 66
LT-2:	65	47 – 63

L_{dn} calculated based on continuous noise measurements made over a 24-hour period on 5 October 15, 2013.

Note: Data was collected from October 14 – October 16, 2013

Table 4.8-3 Short-Term Noise Measurement Data

Noise Measurement Location	Time Begin	L _{max} dBA	L ₍₁₎ dBA	L ₍₁₀₎ dBA	L ₍₅₀₎ dBA	L ₍₉₀₎ dBA	10-min. L _{eq} dBA
ST-1: Victory Village Park	1220	71	69	63	58	53	60
ST-2: Front of 842 Dwight Avenue	1230	59	55	52	48	45	49
ST-3: Heritage Park Apartments, Units 301-307	1250	66	64	59	53	47	56
ST-4: Heritage Park Apartments, Units 18-19	1310	67	58	52	48	44	50
ST-5: Washington Avenue residences east of Deodar Way	1330	70	53	52	49	45	51
ST-6: Heritage Park Apartments, Units 104-108	1350	61	60	55	50	47	52

Source: Illingworth & Rodkin, Inc; Noise Assessment October 31, 2013

Note: Data was collected on October 16, 2013

4.8.3 REGULATORY SETTING

Caltrans Standard Specifications, Section 14-8.02 (Noise Control) and Vibration Recommendations³.

Section 14-8.02 (Noise Control) of the Caltrans Standard Specifications establishes limits for nighttime construction noise on Caltrans-related projects. Specially, maximum noise at 50 feet from the job site from 9 p.m. to 6 a.m. is not to exceed 86 dBA. Caltrans' specifications also require that internal combustion engines are equipped with a manufacturer-recommended muffler, and night time sound signals be replaced by an alternative warning method unless required by safety laws.

Caltrans also recommends a vibration limit of 0.5 inches/second, peak particle velocity (in/sec, PPV) for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec, PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec, PPV for buildings known or suspected to be structurally weakened.

Sunnyvale Noise Regulations

Sunnyvale General Plan

Goals of the Noise Element of the General Plan include the protection of residents from excessive noise and to preserve and enhance the quality of neighborhoods by maintaining or reducing the levels of noise generated by transportation facilities, while acknowledging that some noise must be tolerated as it is part of any urban environment. Like most cities, Sunnyvale has not adopted any quantitative noise or vibration limits related to short-term construction activities, but instead regulates noise through limits on construction hours as set forth in the Municipal Code as described below.

Sunnyvale Municipal Code

Per Title 16, Chapter 16.08 of the Sunnyvale Municipal Code, construction activity is generally permitted between the hours of 7:00 AM and 6:00 PM daily Mondays through Fridays. Saturday hours of operation are between 8:00 AM and 5:00 PM. No construction activity is allowed on Sundays or national holidays when City offices are closed. Where emergency conditions exist, construction activity may be

³ As Caltrans is the delegated authority for the National Environmental Protection Agency (NEPA) component of the project as it relates to the projects receipt of federal funding, Caltrans noise specifications are included as part of the regulatory setting

permitted at any hour or day of the week. Such emergencies shall be completed as rapidly as possible to prevent any disruption to the residential neighborhoods. No loud environmentally disruptive noises, such as air compressors without mufflers, continuously running motors or generators, loud playing musical instruments, or radios, will be allowed where such noises may be a nuisance to adjacent residential neighborhoods.⁴

Project Consistency

The proposed operation of the rehabilitated, structurally deficient bridge and associated expanded bicycle and pedestrian amenities will not introduce a new land use, substantially alter the roadway travel lanes or travel speeds, nor intensify vehicle usage above existing levels. The potential for significant noise impacts will be limited to period during active construction related activities. Given such, a permanent increase in long-term ambient noise levels as a result of the project is not expected to occur. Mitigation is provided below to help lessen some of the effects of construction period noise.

4.8.4 IMPACTS AND MITIGATION MEASURES

Significance Criteria

Appendix G of the CEQA Guidelines identifies environmental issues to be considered when determining whether a project could have significant effects on the environment. The project would have a significant impact if it would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

⁴ Ord. 2774-05 § 1; Ord. 2756-04 § 1; Ord. 2704-02 § 2.

- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels.

Discussion of No Impacts

Analysis of the details and site characteristics in the context of the six significance criteria stated above shows that no impacts would result for two of the criteria.

Would the project result in a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Would the project result in a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

The project site is not in the vicinity of a public airport or private airstrip and would therefore not be exposed to high noise levels from such sources. The site is not located with an airport land use plan. The closest airport to the project site is Moffett Federal Airfield, located over 2 miles northwest of the project site. There would be no new exposure to noise from public or private airport facilities to people residing or working in the vicinity of the project. As the project does not involve nor introduce any new noise-sensitive uses, there would be no potential to increase noise exposure to this type of receptor.

Discussion of Less-than-Significant Impacts

Analysis of the details and site characteristics in the context of the six significance criteria stated above shows that less than significant impacts result for two of the criteria.

Would the project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Project construction activities such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) presents the potential for temporary exposure to

elevated levels of groundborne vibration. Although the City has not adopted any standard relative to construction-related vibration, “excessive” is defined here as the potential to cause damage to off-site, nearby structures. However, the project does not propose any pile driving or blasting, two activities that typically generate the highest construction related ground-borne vibration. Vibration levels from typical construction activities would be expected to be 0.2 in/sec PPV or less at a distance of 25 feet, below the 0.3 in/sec PPV significance thresholds prescribed by Caltrans. There are no known at-risk buildings (those documented or reasonably likely to be structurally weakened) in the project vicinity. Vibration levels generated during demolition and construction activities may at times be perceptible at neighboring land uses located greater than 25 feet from the bridge, but the levels would not be excessive and would not be expected to cause even cosmetic damage to buildings. As such, vibration impacts as a result of the project would be less-than-significant.

Would the project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The project does not result in any change to the operation or land use of the project, as the project details involve rehabilitation of an existing vehicular bridge. Once completed, the bridge will have the same number of auto travel lanes as in the existing condition. Improvements to pedestrian and cyclist facilities are not expected to have an impact on ambient noise levels in the area. Widening of the bridge deck to allow for expanded pedestrian and bicycle use may have the potential to slightly increase noise levels from individuals walking and/or biking. However, the noise generated from these users is not expected to be substantive. Without substantial changes to the bridge function or capacity, ambient noise levels are not expected to increase, thus any related permanent noise impacts would be less than significant.

Discussion of Significant Impacts

Analysis of details and site characteristics in the context of the six significance criteria stated above shows that less-than-significant impacts would result for two of the criteria.

Would the project result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Impact NOI-1: Construction activities could temporarily expose persons to or generate noise levels in excess of standards established in the general plan and noise ordinance and would temporarily increase ambient noise levels in the project vicinity. (LESS THAN SIGNIFICANT WITH MITIGATION)

Noise generated by project-related construction activities is anticipated to temporarily increase noise levels by 3 dBA or more above existing ambient noise levels. Construction noise would primarily result from the operation of heavy construction equipment, the arrival and departure of heavy-duty trucks, and demolition. The vast majority of this work would occur within the City's allowable construction hours, but given the nature of the proposed improvements, some nighttime work would be necessary and would adhere to pertinent Caltrans regulations.

Potential impacts would be related to noise levels generated by individual pieces of construction equipment, the type and amount of equipment operating at any given time, the timing and duration of construction activities, the proximity of nearby sensitive land uses, and the presence or lack of shielding at these sensitive land uses. Construction noise levels would vary on a day-to-day basis during each phase of construction depending on the specific task being completed. Each construction phase would require a different combination of construction equipment necessary to complete the task and differing usage factors for such equipment.

Demolition and construction activities are estimated to result in hourly average noise levels of 78 to 88 dBA Leq at a distance of 50 feet which would exceed ambient noise levels at receptors in the project vicinity. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor; therefore the noise levels calculated at 100 feet would be about 6 dBA less. At a distance of 200 feet, demolition and construction noise levels would be approximately 12 dBA less than the source noise levels referenced above. Structures that interrupt the line-of-sight between the noise source and receptor would provide a minimum 5 dBA of acoustical shielding.

The total duration of project construction activities is estimated to be approximately 16 months; however, this analysis conservatively assumes that the amount of time where construction noise levels would be expected to substantially exceed ambient noise conditions would be about two-thirds of the overall construction period (less than 12 months) at a constant rate. This assumption is conservative based on the fact that in actual practice construction activities will vary in nature with some activities being less noise generating, would not be stationary at any one point over the entire construction period and would generally move as work progresses over the approximate 0.3 mile project corridor.

In summary, noise from distant construction activities would fall below existing ambient noise levels. At other times, such as when construction occurs in areas adjacent to existing receptors, construction noise levels would exceed ambient noise conditions by 20 to 34 dBA Leq. Table 4 within **Appendix L** summarizes the results of the range of noise calculations made to quantifying hourly average construction noise levels during the six construction stages at the nearest receptors.

Mitigation Measure NOI-1a Require all construction equipment to conform to Section 14-8.02, Noise Control, of the latest Standard Specifications.

Mitigation Measure NOI-1b Project construction operations shall be required to use available noise suppression devices and techniques. Per the Sunnyvale Municipal Code, construction activity is permitted between the hours of 7:00 AM and 6:00 PM daily Mondays through Fridays. Saturday hours of operation are between 8:00 AM and 5:00 PM. Unless expressly permitted in advance, no construction activity is allowed overnight, on Sundays, or on national holidays.

Mitigation Measure NOI-1c Prior to the start of construction, the selected contractor shall prepare for City review and approval a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints construction to reduce noise impacts on neighboring residents and other uses. The construction noise logistics plan shall include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

Noise Notification Measures

- Neighbors located adjacent to the construction site shall be notified of the construction schedule in writing.
- The construction contractor shall designate a noise disturbance coordinator that will be responsible for responding to noise complaints during the construction

phase. The name and phone number of the noise disturbance coordinator will be conspicuously posted at construction areas and on all advanced notifications.

- The construction contractor shall develop a reporting program that documents complaints received, actions taken to resolve problems, and effectiveness of these actions.
- The construction contractor shall hold a preconstruction meeting with the job inspectors and the general contractor/on-site project manager to confirm that noise mitigation and practices (including construction hours, construction schedule, and noise coordinator) are completed.

Noise Control Measures

- All equipment driven by internal combustion engines shall be equipped with mufflers, which are in good condition and appropriate for the equipment.
- Unnecessary idling of internal combustion engines shall be prohibited.
- The construction contractor shall utilize “quiet” models of air compressors and other stationary noise sources where technology exists.
- The construction contractor shall locate stationary noise sources as far from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used. Any enclosure openings or venting shall face away from sensitive receptors.
- The construction contractor shall locate material stockpiles and staging areas as well as maintenance/equipment staging and parking areas as far as feasible from residential receptors.
- The construction contractor shall construct temporary noise barriers to shield significant stationary noise sources (e.g., drill rig while constructing Abutment #1) from nearby receptors. Temporary noise barriers (e.g., solid plywood fences (minimum 8 feet in height) and/or acoustical blankets) could be erected, if necessary, outside the work area or along building facades facing the construction site.

Significance after Mitigation: Less than significant. Adherence to the measures listed in **Mitigation Measures NOI 1a-1c** would reduce temporary construction noise impacts at nearby residential properties to a less-than-significant level by requiring certain construction techniques, shielding, and limiting noise-generating construction activities to an appropriate distance from sensitive receptors and ensure consistency with the City’s Noise Regulations of the Municipal Code, General Plan Noise Element policies, and Caltrans standard specifications.

4.8.5 REFERENCES

City of Sunnyvale Municipal Code. 2013. Available:
<http://qcode.us/codes/sunnyvale/>. Accessed: 1/21/2014.

City of Sunnyvale. Sunnyvale General Plan. 2011. Available:
<http://ecityhall.sunnyvale.ca.gov/cd/GeneralPlan.pdf>.

Fair Oaks Overhead Bridge Rehabilitation Project Construction Noise Assessment,
Illingworth & Rodkin, Inc.10/21, 2013.

Figure 4.8-1 Noise Monitoring Locations Surveyed

Figure 4.8-2 State Noise Guidelines for Land Use Planning

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