Section 3.11
Noise

This section addresses potential noise impacts that may result from implementation of the proposed San Rafael Transit Center Replacement Project (proposed project). This section describes the regulatory and environmental setting for noise in the project area, analyzes effects related to noise that would result from implementation of the proposed project and other build alternatives, and provides mitigation measures to reduce the effects of any potentially significant impacts. The noise study area includes areas within a half-mile radius of the project area. Impacts related to the No-Project Alternative are discussed in Chapter 5, Alternatives to the Project.

3.11.1 Fundamentals of Noise and Vibration

3.11.1.1 Noise

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise can be defined as unwanted sound. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient sound. The decibel (dB) scale is used to quantify sound intensity. Because sound pressure can vary enormously within the range of human hearing, the logarithmic decibel scale is used to keep sound intensity numbers at a convenient and manageable level.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1-dB changes in sound levels, when exposed to steady, single-frequency (pure-tone) signals in the mid-frequency (1,000 Hertz to 8,000 Hertz) range. It is widely accepted, however, that people are able to begin to detect sound level changes of 3 dB for typical noisy environments. Furthermore, a 10-dB increase is generally perceived as a doubling of loudness. Therefore, doubling sound energy (e.g., doubling the volume of traffic on a highway), which would result in a 3-dB increase in noise, is generally perceived as a detectable, but not substantial, increase in sound level.

The human ear is not equally sensitive to all frequencies in the entire spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called “A-weighting.” Because humans are less sensitive to low-frequency sound than to high-frequency sound, A-weighted decibel (dBA) levels deemphasize low-frequency sound energy to better represent how humans hear. Table 3.11-1 summarizes typical A-weighted sound levels.

Table 3.11-1. Typical A-Weighted Sound Levels

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

Source: Caltrans 2013
mph = miles per hour

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (L_{eq}), the minimum and maximum sound levels (L_{min} and L_{max}), percentile-exceeded sound levels (L_{xx}), the day-night sound level (L_{dn}), and the community noise equivalent level (CNEL). Below are brief definitions of these measurements and other terminology used in this section.

- **Sound:** A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise:** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Ambient noise:** The composite of noise from all sources near and far in a given environment exclusive of particular noise sources to be measured.
- **Decibel (dB):** A unitless measure of sound. A sound level measurement in dB describes the logarithmic ratio of a measured sound pressure level to a reference sound pressure level of 20 micropascals.

- **A-Weighted Decibel (dBA):** An overall frequency-weighted sound level that approximates the frequency response of the human ear.
- **Maximum and Minimum Sound Levels (L_{max} and L_{min}):** The maximum or minimum sound level measured during a specified interval.
- **Equivalent 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 that actually occurs during the same period. The duration of the measurement is commonly indicated in the subscript; for example, a 1-hour L_{eq} sound level would be indicated as dBA L_{eq}(1h).
- **Exceedance sound level (L_{xx}):** The sound level exceeded "XX" percent of the time during a sound level measurement period. For example, L_{90} is the sound level exceeded 90 percent of the time, and L_{10} is the sound level exceeded 10 percent of the time. L_{90} is typically considered to represent the ambient noise level.
- **Day-night level (L_{dn}):** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community noise equivalent level (CNEL):** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

L_{dn} and CNEL values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving sound level.

For a point source, such as a stationary compressor, sound attenuates based on geometry at rate of 6 dB per doubling of distance. For a line source, such as free-flowing traffic on a freeway, sound attenuates at a rate of 3 dB per doubling of distance. Atmospheric conditions including wind, temperature gradients, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically in the range of 1 to 2 dB per doubling of distance. Barriers, such as buildings and topography that block the line of site between a source and receiver, also increase the attenuation of sound over distance.

Auditory and non-auditory effects can result from excessive or chronic exposure to elevated noise levels. Auditory effects of noise on people can include temporary or permanent hearing loss. Non-auditory effects of exposure to elevated noise levels include sleep disturbance, speech interference, and psychological effects such as annoyance. Land use compatibility standards for noise typically are based on research related to these non-auditory effects.

3.11.1.2 Vibration

In contrast to airborne sound, groundborne vibration is not a phenomenon that most people experience every day. Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. The background vibration velocity level in residential areas is usually much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within buildings, such as mechanical equipment while in operation, people moving, or doors slamming. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. Dynamic construction equipment, such as pile drivers, can create vibrations that radiate along the surface and downward into the earth. These surface waves can be felt as groundborne vibration. Vibration can result in effects that range from annoyance to structural damage. Variations in geology and distance result in different vibration levels with different frequencies and displacements.

Groundborne vibration can be expressed in terms of root-mean-square (RMS) vibration velocity to evaluate human response to vibration levels. RMS is defined as the average of the squared amplitude of the vibration signal. The vibration amplitude is expressed in terms of vibration decibels (VdB), which use a reference level of 1 micro-inch per second. Vibration can also be measured by peak particle velocity (PPV), defined as the maximum instantaneous peak of the vibration signal in inches per second.

Table 3.11-2 summarizes typical vibration levels generated by construction equipment at a reference distance of 25 feet and other distances.

Updated Table 3.11-2. Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 Feet	PPV at 50 Feet	PPV at 75 Feet	PPV at 100 Feet
Impact pile driver	1.518	0.054	0.2920	0.190
~~Auger drill~~	~~0.089~~	~~0.032~~	~~0.017~~	~~0.011~~
Hoe ram	0.089	0.032	0.017	0.011
Large bulldozer	0.089	0.032	0.017	0.011
Loaded trucks	0.076	0.027	0.015	0.010
Jackhammer	0.035	0.012	0.007	0.004
Small bulldozer	0.003	0.001	0.001	< 0.001

Source: FTA 2018

3.11.2 Existing Conditions

3.11.2.1 Regulatory Setting

Federal

Noise Control Act of 1972

The Noise Control Act of 1972 (Public Law 92 574) established a requirement for all federal agencies to administer their programs in a manner that promotes an environment that is free of

noise that jeopardizes public health or welfare. The U.S. Environmental Protection Agency (EPA) was given the following responsibilities.

- Providing information to the public regarding the identifiable effects of noise on public health and welfare
- Publishing information on the levels of environmental noise to protect the public health and welfare with an adequate margin of safety
- Coordinating federal research and activities related to noise control
- Establishing federal noise emission standards for selected products distributed in interstate commerce

U.S. Environmental Protection Agency Standards for Environmental Noise

In 1974, EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, a comprehensive document that identifies noise levels consistent with the protection of public health and welfare against hearing loss, annoyance, and activity interference.

In response to the requirements of the Noise Control Act, EPA identified indoor and outdoor noise limits to protect public health and welfare. Outdoor L_{dn} limits of 55 dB and indoor L_{dn} limits of 45 dB were identified as desirable for protecting against speech interference and sleep disturbance in residential areas and at educational and health care facilities. The sound-level criterion for protecting against hearing damage in commercial and industrial areas is identified as the 24-hour L_{eq} value of 70 dB (both outdoors and indoors). Based on attitudinal surveys, EPA determined that a 5-dB increase in L_{dn} or L_{eq} is the minimum required for a change in community reaction (EPA 1974).

The Noise Control Act also directed federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. Although EPA was given a major role in disseminating information to the public and coordinating with federal agencies, each federal agency retained authority to adopt noise regulations pertaining to agency programs. EPA can, however, require federal agencies to justify their noise regulations in terms of Noise Control Act policy requirements.

Key federal agencies that have adopted noise regulations and standards are listed below.

- Housing and Urban Development: Noise standards for federally funded housing projects
- Federal Aviation Administration: Noise standards for aircraft
- Federal Highway Administration: Noise standards for federally funded highway projects
- Federal Transit Administration (FTA): Noise standards for federally funded transit projects
- Federal Railroad Administration: Noise standards for federally funded rail projects

Federal Transit Administration Standards for Construction Noise

FTA has developed methods for evaluating construction noise levels, which are discussed in the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). The manual does not contain standardized criteria for assessing construction noise impacts but provides guidelines for suggested noise limits for residential uses exposed to construction noise to describe levels that may result in a negative community reaction. These guidelines are summarized in Table 3.11-3.

Table 3.11-3. Federal Transit Administration Construction Noise Impact Guidelines

Land Use	1-hour L_{eq} (dBA), Day	1-hour L_{eq} (dBA), Night
Residential	90	80
Commercial	100	100
Industrial	100	100

Source: FTA 2018

Thresholds for construction noise may also be set at the local level according to expected hours of equipment operation and the noise limits specified in the noise ordinances of the applicable jurisdictions.

Federal Transit Administration Standards for Transit Noise

The U.S. Department of Transportation has implemented and published impact assessment procedures and criteria pertaining to noise based on the above standards. Noise impact criteria have been adopted by FTA to assess noise contributions and potential impacts from rapid transit sources on the existing environment. Noise impact criteria defined in the FTA manual are based on the objective of maintaining a noise environment considered acceptable for land uses that are noise sensitive. For noise from transit operations, FTA's three land use categories are as follows:

- **Category 1**: Tracts of land where quiet is an essential element in their intended purpose, such as outdoor amphitheaters, concert pavilions, and national historic landmarks with significant outdoor use
- **Category 2**: Residences and buildings where people normally sleep, including homes, hospitals, and hotels
- **Category 3**: Institutional land uses (schools, places of worship, libraries) with use typically during the daytime and evening. Other uses in this category can include medical offices, conference rooms, recording studios, concert halls, cemeteries, monuments, museums, historical sites, parks, and recreational facilities.

Noise exposure values are reported as the L_{dn} for residential land uses (Category 2) or hourly equivalent sound level (L_{eq}[h]) for other land uses (Categories 1 and 3). Commercial and industrial uses are not included in the vast majority of cases because they are generally considered compatible with higher noise levels. Exceptions would include commercial uses with a feature that receives substantial outdoor use, such as a playground, or uses that require quiet as an important part of their function, such as recording studios.

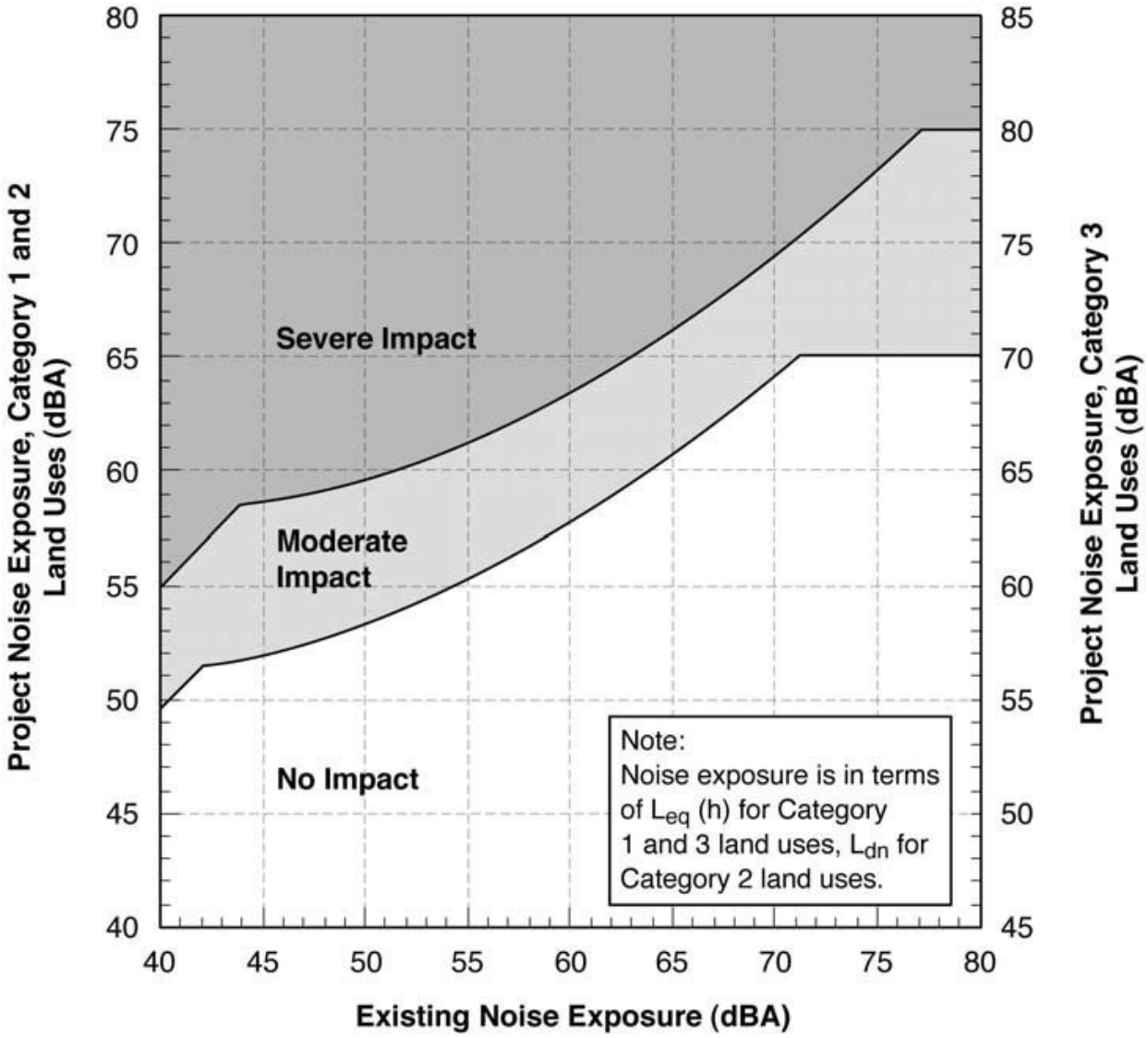
In the FTA manual, the noise impact criteria for construction and operation of rapid transit facilities consider a project's contribution to existing noise levels using a sliding scale based on land uses affected. The criteria correspond to heightened community annoyance due to the introduction of a new transit facility relative to existing ambient noise conditions.

Noise impacts are assessed by comparing existing outdoor exposures with future project-related outdoor noise levels, as illustrated on Figure 3.11-1. The criterion for each degree of impact is based on a sliding scale that is dependent on the existing noise exposure and the increase in noise exposure due to a project. The noise impact categories are as follows:

- **No Impact:** A project, on average, will result in an insignificant increase in the number of instances where people are "highly annoyed" by new noise.

- **Moderate Impact:** The change in noise is noticeable to most people but may not be enough to cause strong, adverse community reactions.
- **Severe Impact:** A significant percentage of people would be highly annoyed by the noise, perhaps resulting in vigorous community reaction.

Note that the proposed project's contribution relative to existing noise levels follows a sliding scale according to the level of existing noise exposure. The justification for this sliding scale is that people who are already exposed to high levels of noise in the ambient environment should be expected to tolerate smaller increases in noise in their community compared to locations where existing noise exposure is relatively low. For example, according to Figure 3.11-1, a project contribution of 59 dBA L_{dn} would be considered a Severe Impact at a Category 2 receiver with an existing noise exposure of up to 50 dBA L_{dn}, whereas a project contribution of 69 dBA L_{dn} would result in a Severe Impact at a Category 2 receiver with an existing noise exposure of up to 70 dBA L_{dn}.



Source: Federal Transit Administration, 2018.

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Figure 3.11-1
Federal Transit Administration Noise Imapact Criteria

State

California Noise Control Act

The California Noise Control Act was enacted in 1973. In preparing its general plan noise element, a city or county must identify local noise sources and analyze and quantify to the extent practicable current and projected noise levels from various sources, including highways and freeways; passenger and freight railroad operations; ground rapid transit systems; commercial, general, and military aviation and airport operations; and other stationary ground noise sources.

The *State of California General Plan Guidelines* (Governor's Office of Planning and Research 2017) provides noise compatibility guidelines for land use planning according to the existing community noise levels; however, these guidelines offer no information regarding construction noise. The state has also published its *Model Community Noise Ordinance* (California Office of Noise Control 1977), which provides guidance to cities and counties on how to develop a community noise ordinance.

California Department of Transportation Vibration Standards

The California Department of Transportation (Caltrans) provides guidelines regarding vibration associated with construction and operation of transportation infrastructure. Table 3.11-4 provides the Caltrans vibration guidelines for potential damage to different types of structures.

Groundborne vibration and noise can also disturb people. Numerous studies have been conducted to characterize the human response to vibration. In general, people are more sensitive to vibration during nighttime hours when sleeping than during daytime waking hours. Table 3.11-5 provides the Caltrans guidelines regarding vibration annoyance potential (expressed here as peak particle velocity [PPV]).

Table 3.11-4. Caltrans Vibration Guidelines for Potential Damage to Structures

	Maximum Peak Particle Velocity (PPV, in/sec)	
Structure Type and Condition	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Caltrans 2020:Table 19
Note: Transient sources create a single, isolated vibration event (e.g., blasting or the use of drop balls). Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.
in/sec = inch per second

Table 3.11-5. Caltrans Guidelines for Vibration Annoyance Potential

	Maximum PPV (in/sec)	
Human Response	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: Caltrans 2020:Table 20
Note: Transient sources create a single, isolated vibration event (e.g., 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.
in/sec = inch per second

Local

San Rafael General Plan 2040

California requires that a noise element be included in the general plan of each county and city in the state. The City of San Rafael (City) adopted *San Rafael General Plan 2040* in August 2021. The noise element establishes the local government's goals, objectives, and policies related to noise control. The Noise Element of ~~The City of~~ *San Rafael General Plan ~~2020~~ 2040* (City of San Rafael 2021a~~2016~~) establishes goals and policies for ensuring that existing and proposed land uses are compatible with their noise environments. Therefore, the City ~~of San Rafael (City)~~ has adopted quantitative ~~exterior~~ noise compatibility criteria for various land uses. The purpose of these criteria is to reduce the potential adverse noise effects of new developments on people, including sleep disturbance, interference with speech communication, and the general sense of dissatisfaction that is often associated with high noise exposure.

Land use compatibility noise standards are included in the City's Noise Element (see Table 3.11-6 below). According to the Noise Element as outlined under ~~Goal 31~~Policy N-1.2, Maintaining Acceptable Noise Levels, noise levels up to 60 dBA L_{dn} are considered acceptable for all new residential projects. In common outdoor areas in Downtown, mixed-use residential, and high-density residential districts, up to 65 dBA L_{dn} is allowed if determined acceptable through development review. New ~~nonresidential projects~~ development ~~are~~ is not permitted to increase noise levels in a residential area by more than 3 dB L_{dn}, or in a non-residential ~~or mixed-use district~~area by more than 5 dB L_{dn}, or create noise impacts that would increase noise levels to more than ~~65~~ 70 dBA L_{dn} for office ~~and~~ , retail, ~~uses~~ or ~~70 dBA L_{dn} for~~ industrial uses.

Noise measurements were taken in May 2019 to provide a baseline for updated noise policies. Noise levels varied from 47 to 74 dBA L_{dn} through the City. Residential areas had a noise level of 60 dBA L_{dn} or below; Downtown San Rafael had just over 70 dBA L_{dn}. The City's noise compatibility guidelines have been adapted from state guidelines and specify acceptable noise levels based on land uses. Future residential uses, schools, and library uses around the Downtown Sonoma-Marin Area Rail Transit (SMART) station and proposed project would likely be required to incorporate extensive sound proofing to achieve required interior noise levels of 45 dBA.

Updated Table 3.11-6. Land Use Compatibility Standards for New Development

~~Land Use~~	~~Exterior Noise Exposure to the Site L_{dn} (dB)~~						
	~~50~~	~~55~~	~~60~~	~~65~~	~~70~~	~~75~~	~~80~~
~~Residential, Hotels, Motels~~							
~~Schools, Libraries, Churches, Hospitals, Nursing Homes~~							
~~Auditoriums, Concert Halls, Amphitheaters~~							
~~Sports Arena, Outdoor Spectator Sports~~							
~~Playgrounds, Neighborhood Parks~~							
~~Other Outdoor Recreation and Cemeteries~~							
~~Office and Other Commercial Uses~~							
~~Industrial, Manufacturing, Utilities, Agriculture~~							

Land Use	Interior L_{dn}	Exterior Noise Exposure, L_{dn} (dBA)						
		50	55	60	65	70	75	80
Residential, Single-family, Duplex, Mobile Homes	45[1]							
Residential, Multiple family	45[1]							
Transient Lodging, Motels, Hotels	45[1]							
Schools, Libraries, Churches, Hospitals, Nursing Homes	45[1]							
Auditoriums, Concert Halls, Amphitheaters	--							
Sports Arena, Outdoor Spectator Sports	--							
Playgrounds, Neighborhood Parks	--							
Other Outdoor Recreation and Cemeteries	--							
Office and Other Commercial Uses	50							
Industrial, Manufacturing, Utilities, Agriculture	--							

~~Source: City of San Rafael 2016.~~

Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and the needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice. ~~Specific land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.~~

Normally Unacceptable: New construction or development should generally be discouraged. If new construction does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable: New construction of development ~~clearly~~ generally should not be undertaken.

Source: City of San Rafael 2021a.

[1] Noise level requirement with closed windows, mechanical ventilation, or other means of ventilation shall be provided per Chapter 12 Section 1205 of the Building Code.

~~The following goals and policies from *The City of San Rafael General Plan 2020*[1] Noise Element pertain to noise and relate to the proposed project (City of San Rafael 2016).~~

~~**Goal 31: Acceptable Noise Levels.** It is the goal of San Rafael to have acceptable noise levels. Excessive noise is a concern for many residents of San Rafael. These concerns can be managed with~~

~~[1] The City is in the process of updating its general plan, which was adopted in 2004 to provide guidance until 2020. At the time of this document's preparation, the City had prepared reports containing background information on specific topics that will be included in the revised *San Rafael General Plan 2040*, which will extend planning guidance until 2040.~~

~~proper mitigation or through the implementation of the noise ordinance. The City of San Rafael recognizes the issue of noise and has standards to protect people from excessive, unnecessary and unreasonable noises from any and all sources in the community.~~

~~**N-1. Noise Impacts on New Development.** Protect people in new development from excessive noise by applying noise standards in land use decisions. Apply the Land Use Compatibility Standards (see Exhibit 31) to the siting of new uses in existing noise environments. These standards identify the acceptability of a project based on noise exposure. If a project exceeds the standards in Exhibit 31, an acoustical analysis shall be required to identify noise impacts and potential noise mitigations. Mitigation should include the research and use of state-of-the-art abating materials and technology.~~

~~**N-2. Exterior Noise Standards for Residential Use Areas.** The exterior noise standard for backyards and/or common usable outdoor areas in new residential development is up to L_{dn} of 60 dB. In common usable outdoor areas in Downtown, mixed-use residential, and high-density residential districts, up to L_{dn} of 65 dB may be allowed if determined acceptable through development review.~~

~~**N-3. Planning and Design of New Development.** Encourage new development to be planned and designed to minimize noise impacts from outside noise sources.~~

~~**N-4. Noise from New Nonresidential Development.** Design nonresidential development to minimize noise impacts on neighboring uses.~~

~~**N-5. Traffic Noise from New Development.** Minimize noise impacts of increased off-site traffic caused by new development. Where the exterior L_{dn} is 65 dB or greater at a residential building or outdoor use area and a plan, program, or project increases traffic noise levels by more than 3 dB, reasonable noise mitigation measures shall be included in the plan, program or project.~~

~~**N-6. Traffic Noise.** Attempt to minimize traffic noise through land use policies, law enforcement, and street improvements.~~

~~**N-8. Sonoma Marin Area Rail Transit.** If a commuter rail service or other use is developed along the Sonoma Marin Area Rail Transit right-of-way, minimize noise impacts on existing development.~~

~~**N-9. Nuisance Noise.** Minimize impacts from noise levels that exceed community sound levels.~~

~~Draft City of San Rafael General Plan 2040~~

~~The City is in the process of updating *The City of San Rafael General Plan 2020* with the *San Rafael General Plan 2040* in progress.~~ Policies ~~currently under review for the~~in the Noise Element include the following (City of San Rafael ~~2020~~2021a):

Goal ~~31~~N-1: Acceptable Noise Levels. Protect the public from excessive unnecessary, and unreasonable noise. Excessive noise is a concern for many residents of San Rafael. This concern can be addressed through the implementation of standards to protect public health and reduce noise conflicts in the community, including the Noise Ordinance.

- **Policy N-1.1: Land Use Compatibility Standards for Noise.** Protect people from excessive noise by applying noise standards in land use decisions. The Land Use Compatibility standards in [Table ~~9-2~~3.11-6] are adopted by reference as part of this General Plan and shall be applied in the determination of appropriate land uses in different ambient noise environments.
- **Policy N-1.2: Maintaining Acceptable Noise Levels.** Use the following performance standards to maintain an acceptable noise environment in San Rafael: (a) New development shall not increase noise levels by more than 3 dB Ldn in a residential area, or by more than 5 dB Ldn in a non-residential area. (b) New development shall not cause noise levels to increase above the "normally acceptable" levels shown in [Table ~~9-2~~3.11-6]. (c) For larger projects, the noise levels in (a) and (b) should include any noise that would be generated by additional traffic associated with the new development. (d) Projects that exceed the thresholds above may be permitted if an

acoustical study determines that there are mitigating circumstances (such as higher existing noise levels) and nearby uses will not be adversely affected.

- **Policy N-1.3: Reducing Noise ~~.~~ Through Planning and Design.** Use a range of design, construction, site planning, and operational measures to reduce potential noise impacts.
- **Policy N-1.4: Sound Walls.** Discourage the use of sound walls when other effective noise reduction measures are available. Vegetation, berms, and the mitigation measures in Policy N-3 are the preferred methods of absorbing sound along roads, rail, and other transportation features. Where there are no other feasible options (for example, along many sections of US Highway 101), the City will review and comment on sound wall design. Sound walls should be aesthetically pleasing, regularly maintained, and designed to minimize the potential displacement of sound.
- **Policy N-1.5: Mixed Use.** Mitigate the potential for noise-related conflicts in mixed use development combining residential and nonresidential uses.
- **Policy N-1.6: Traffic Noise.** Minimize traffic noise through land use policies, law enforcement, street design and improvements, and site planning and landscaping.
- **Policy N-1.7: Aviation-Related Noise.** To the extent allowed by federal and state law, ensure that the noise impacts of any changes in facilities or operations are considered when granting or modifying use permits at the San Rafael Airport in North San Rafael and the heliport in East San Rafael ~~(see Noise Contours for San Rafael Airport and Heliport in Appendix I). (See also Program M-1.4B on drones).~~
- **Policy N-1.8: Train Noise.** Work with Sonoma Marin Area Rail Transit (SMART) to minimize noise and vibration associated with train service and to reduce the potential for impacts on nearby residences.
- **Policy N-1.9: Maintaining Peace and Quiet**. Minimize noise conflicts resulting from everyday activities such as construction, sirens, yard equipment, business operations, night-time sporting events, and domestic activities.
- **Policy N-1.10: City-County Coordination.** Coordinate with the County of Marin to consider and mitigate noise impacts when activities in one jurisdiction may affect the other.
- **Policy N-1.11: Vibration.** Ensure that the potential for vibration is addressed when transportation, construction, and nonresidential projects are proposed, and that measures are taken to mitigate potential impacts.

San Rafael Municipal Code

The City's Municipal Code also contains noise regulations. Chapter 8.13, Noise, of the City's Municipal Code contains noise limitations and exclusions for land uses within the City in order to maintain noise levels that are not detrimental to the health and welfare of people. The noise ordinance addresses noise limits that would constitute a noise disturbance, primarily as measured at residential land uses. The City's Municipal Code regulations below would be applicable to the proposed project. General noise limits are outlined in Table 3.11-7.

8.13.040 – General noise limits.

A summary of general noise limits is included in Table 3.11-7. In the case where two or more noise limits apply, the more restrictive noise limit will take precedence.

Table 3.11-7. General Noise Limits

Property type or zone	Daytime limits	Nighttime Limits
Residential	60 dBA Intermittent 50 dBA Constant	50 dBA Intermittent 40 dBA Constant
Mixed-use	65 dBA Intermittent 55 dBA Constant	55 dBA Intermittent 44 dBA Constant
Multifamily residential (interior sound source)	40 dBA Intermittent 35 dBA Constant	35 dBA Intermittent 30 dBA Constant
Commercial	65 dBA Intermittent 55 dBA Constant	65 dBA Intermittent 55 dBA Constant
Industrial	70 dBA Intermittent 60 dBA Constant	70 dBA Intermittent 60 dBA Constant
Public Property	Most restrictive noise limit applicable to adjoining private property	Most restrictive noise limit applicable to adjoining private property

Source: San Rafael Municipal Code Title 8.13 (Ord. 1789 § 3 (part), 2002)

8.13.050 Standard exceptions to general noise limits

A summary of standard exceptions is included in Table 3.11-8 below.

Table 3.11-8. Standard Exceptions to General Noise Limits

Type of Activity	Maximum Noise Level	Days/Hours Permitted
Construction	90 dBA	Mon–Fri 7:00 a.m.–6:00 p.m. Sat 9:00 a.m.–6:00 p.m. Sun, Holiday—prohibited or as otherwise set by City approval
Residential Power Equipment and Construction Activities Undertaken by Residential Property Owners	90 dBA	Mon–Fri 8:00 a.m.–8:00 p.m. Sat, Sun, Holiday 9:00 a.m.–6:00 p.m.
Sound performances	80 dBA measured 50 feet or more from property plane, or as excepted by permit approval	Every day 10:00 a.m.–10:00 p.m., or as excepted by permit approval
Refuse Collection	95 dBA	Residential or mixed-use property: Mon–Sat 6:00 a.m.–9:00 p.m. Industrial or commercial property: Daily 4:00 a.m.–9:00 p.m.

Source: San Rafael Municipal Code Title 8.13 (Ord. 1789 § 3 (part), 2002)

8.13.060 – Exceptions allowed with permit

A. In addition to the standard exceptions permitted pursuant to Section 8.13.050 of this chapter, the director of community development or his designee may grant a permit allowing an exception from any or all provisions of this chapter where the applicant can show that a diligent investigation of available noise abatement techniques indicates that immediate compliance with the requirements of this chapter would be impractical or unreasonable, or that no public detriment will result from the proposed exception. Any such permit shall be issued with

appropriate conditions to minimize the public detriment caused by the permitted exceptions. Any such permit shall be of such duration, as approved by the director of community development or his designee, up to a maximum period of six (6) months, but shall be renewable upon a showing of good cause, and shall be conditioned by a schedule for compliance and details of methods therefor in appropriate cases. At the discretion of the director of community development or his designee, an exception permit may be issued and reissued for successive short periods of time in order to allow monitoring of the adverse noise impacts of the excepted activity, and additional conditions may be imposed upon reissuance of the permit, if the director of community development or his designee determines that such additional conditions are necessary to mitigate noise impacts from the excepted activity to a level he deems acceptable under all the circumstances.

B. Any application for an exception permit under this section shall be accompanied by a fee to be set by resolution of the city council.

C. Prior to granting any permit under this section, the director of community development or his designee shall provide at least ten (10) calendar days' written notice to all property owners within three hundred feet (300') of the property for which the application is made, and shall consider any objections to the granting of such permit received before issuance of the permit.

D. Any person aggrieved with the decision of the director of community development or his designee may appeal to the city council, by writing filed with the city clerk within five (5) business days after the date of such decision; however, such decision shall not stay the effective date of the permit.

8.13.070 – Exemptions

1. Aerial warning devices which are required by law to protect the health, safety and welfare of the community;
2. Emergency vehicle responses and all necessary equipment utilized for the purpose of responding to an emergency, or necessary to restore, preserve, protect or save lives or property from imminent danger of loss or harm;
3. Aviation, railroad, and public transit operations;
4. The operation of any municipal or public utility vehicles;
5. Public safety training exercises conducted between the hours of eight a.m. (8:00 a.m.) and eight p.m. (8:00 p.m.);
6. Uses established through any applicable discretionary review process containing specific noise conditions of approval and/or mitigation measures;
7. Work on capital improvements, or repairs on public property by employees or contractors of the city;
8. Vehicle noise subject to regulation under the California Vehicle Code;
9. Emergency repair work performed by, or at the request of, a property owner on his or her private property, where the delay required to obtain an exception permit under this chapter would result in substantial damage, personal injuries, or property loss to the owner, provided that such emergency work shall be subject to such reasonable conditions as may be imposed by authorized city employees to mitigate the noise level of the activity.
10. Portable generator used during emergencies or utility power outages per manufacturer's recommendations.
11. Stationary generator installed and used during emergencies, utility power outages or routine testing per manufacturer's recommendations. Routine testing for stationary generators shall be conducted between the hours of ten a.m. (10:00 a.m.) and four p.m. (4:00 p.m.).

3.11.2.2 Environmental Setting

Noise Sources in the Project Area

The proposed project is along the eastern limit of Marin County in the heart of Downtown San Rafael. Existing noise sources in the project area include traffic (primarily from U.S. Highway 101 [US-101] and Downtown commuting traffic), locomotive horns and rail car movements from the SMART Train passing through San Rafael Train Station, bus traffic to and from the existing transit center, and aircraft overflights. The nearest airport to the proposed project area is the San Rafael Airport (also called Marin Ranch Airport), a small, privately owned airport approximately 3 miles north of the project area. The areas immediately surrounding the project area include a mix of the following uses: residential/office, commercial/office, mixed use, and street retail characteristic of a Downtown urban area.

Noise Measurements

Noise-sensitive land uses in the project area consist primarily of single- and multifamily residences, mixed-use buildings with residential uses, schools, churches, and outdoor recreational areas. Other land uses in the project area include retail, office, and commercial uses, which are typically considered to be less sensitive to noise. The existing ambient noise environment in the project area is characteristic of an urban environment (e.g., highway and local vehicular traffic, train operations, people walking, aircraft overflights, commercial noise). Noise from vehicular traffic traveling on the nearby US-101, major roadways (e.g., Hetherton Street), and the existing transit center are the dominant noise sources in the project area.

To quantify existing ambient noise levels in the project area, long-term (24-hour) ambient noise measurements were conducted between Monday, November 30 and Wednesday, December 2, 2020. Measurements were conducted at locations adjacent to the project area. Four long-term (LT) measurement locations were selected to capture noise levels in areas that are sensitive to noise or representative of ambient levels at the property line of the project area (see Figure 3.11-2). Piccolo II meters were installed at LT sites LT-1, LT-2, and LT-4 and one Piccolo I meter was installed at LT-3. Conditions were clear at time of installation with little to no wind and temperatures ranging from 45 to 57 degrees Fahrenheit. During installation of LT-2 and LT-3, there was audible utility construction taking place on 5th Avenue between Grand Avenue and Irwin Street.

Additional LT measurements were taken adjacent to the existing transit center to characterize ambient noise levels that included activity and bus movements through the existing facility. These measurements were taken from Tuesday, February 9 to Thursday, February 11, 2021. Site LT-5 was near the northwest corner of the existing transit center, and site LT-6 was near the southwest corner. Buses were observed to generate distinctive engine and rumbling sounds while operating in and around the station, but generally noise from buses was not observed to be noticeably higher than ambient traffic noise from surrounding streets.

The locations of the noise measurement sites are shown on Figure 3.11-2. Table 3.11-9 summarizes the results of the noise measurement survey. For the complete dataset of measured noise levels, see Appendix ~~J~~L of the Final EIR.

Table 3.11-9. Long-Term Noise Measurements Near the Project Area and the Existing Transit Center

Site	Site Description	Date and Time	Daytime Average L_{eq} (dBA)	Nighttime Average L_{eq} (dBA)	Loudest Daytime Hour L_{eq} (dBA)	Quietest Daytime Hour L_{eq} (dBA)	L_{dn} (dBA)
LT-1	Located between the intersections of Lincoln Avenue/Tamalpais Avenue and 5th Avenue/Lincoln Avenue northwest of the project area, in front of the shared office and teen rehabilitation center building at 1104 Lincoln Avenue.	Start: Monday, November 30, 2020, at 12:47 p.m. End: Wednesday, December 2, 2020, at 9:01 a.m.	66.6	60.7	71.1 8:00 a.m.	61.0 9:00 p.m.	68.8
LT-2	Located between the intersections of Tamalpais Avenue/5th Avenue and 5th Avenue/Hetherton Street north of the project area in front of the San Rafael Auction Gallery on 634 5th Avenue.	Start: Monday, November 30, 2020, at 12:32 p.m. End: Wednesday, December 2, 2020, at 9:05 a.m.	75.2	70.3	77.8 3:00 p.m.	70.3 9:00 p.m.	78.1
LT-3	Located near the southwest corner of 4th Street and Lincoln Avenue, north and west of the project area.	Start: Monday, November 30, 2020, at 1:04 p.m. End: Wednesday, December 2, 2020, at 9:25 a.m.	72.9	67.4	78.1 4:00 p.m.	65.9 9:00 p.m.	75.1
LT-4	Located east of US-101 between the intersections of Mission Avenue and Irwin Street and Irwin Street/5th Avenue along Irwin Street in front of law offices.	Start: Monday, November 30, 2020, at 12:20 p.m. End: Wednesday, December 2, 2020, at 9:15 a.m.	78.8	70.3	88.0 5:00 p.m.	74.2 3:00 p.m.	79.5
LT-5	Located near the intersection of Tamalpais Avenue and 3rd Street, near the northwest corner of the existing transit center.	Start: Tuesday, February 9, 2021, at 12:00 p.m. End: Thursday, February 11, 2021, at 12:00 p.m.	70.8	65.9	76.3 6:00 p.m.	64.8 9:00 p.m.	73.6
LT-6	Located near the intersection of Tamalpais Avenue and 2nd Street, near the southwest corner of the existing transit center.	Start: Tuesday, February 9, 2021, at 12:00 p.m. End: Thursday, February 11, 2021, at 12:00 p.m.	72.2	67.0	74.6 7:00 a.m.	67.1 9:00 p.m.	74.7

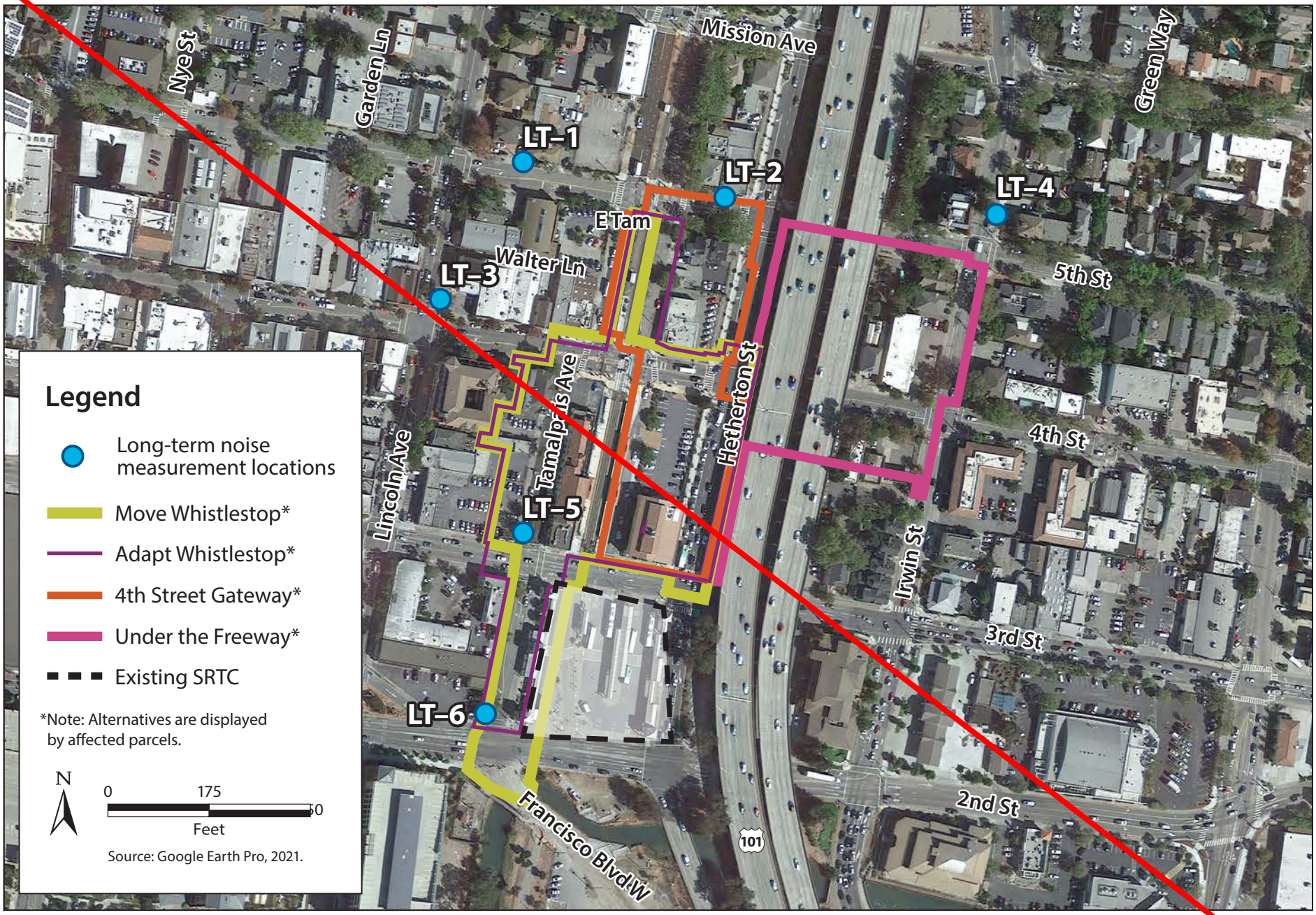
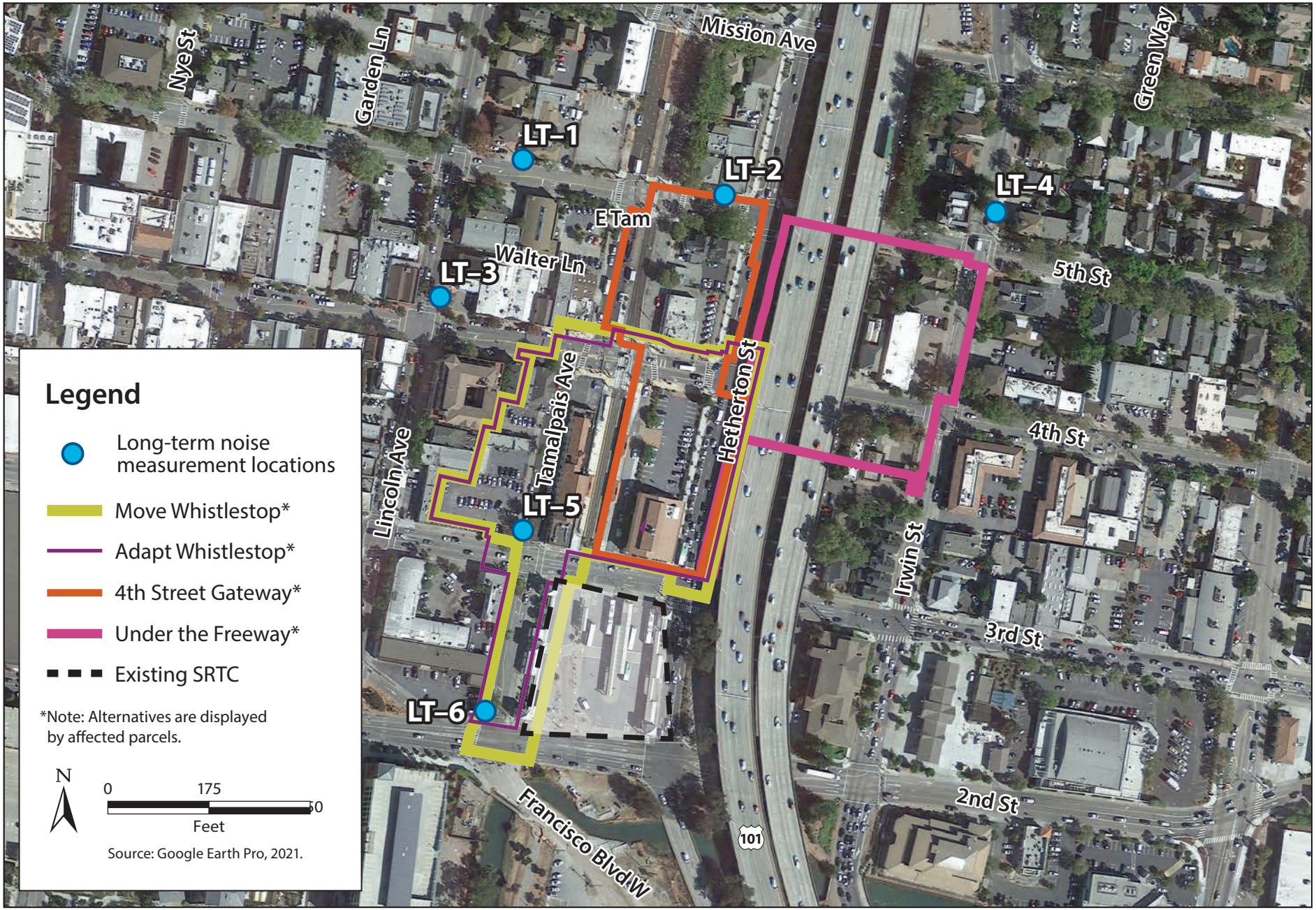


Figure 3.11-2
Noise Measurement Locations



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Updated Figure 3.11-2
Noise Measurement Locations

Alternatives for the Noise Analysis

The four build alternatives presented in the project description (Move Whistlestop Alternative, Adapt Whistlestop Alternative, 4th Street Gateway Alternative, and Under the Freeway Alternative) would have similar construction requirements. Construction is expected to ~~occur in 2023 or 2024~~begin in 2025 and would last up to 18 months. As displayed in Table 3.11-10, all four build alternatives are adjacent to a mix of residential and commercial land uses.

Updated Table 3.11-10. Alternatives Land Uses

Alternative	Land Uses within 500 feet
Move Whistlestop	North: Hetherton office and multifamily residential districts/office East: commercial/office South: public/quasi-public zoning district West: multifamily residential districts/office, retail, mixed-use The nearest residence is directly adjacent to the west of this alternative
Adapt Whistlestop	North: Hetherton office and multifamily residential districts/office East: commercial/office South: public/quasi-public zoning district West: multifamily residential districts/office, retail, mixed-use The nearest residence is directly adjacent to the west of this alternative
4th Street Gateway	North: Hetherton office East: residential/office, and commercial/office South: The existing San Rafael Transit Center West: multifamily residential districts/office, Hetherton office The nearest residence is approximately 50 feet north of this alternative.
Under the Freeway	North: residential/office and multifamily residential uses East: residential/office, commercial/office, and single-family residential South: commercial/office West: Hetherton office (including the Downtown San Rafael SMART station and the existing San Rafael Transit Center) The nearest residence is approximately 50 feet east of this alternative.

Sources: Google Maps 2021; City of San Rafael 2021b

Surrounding Noise-Sensitive Land Uses

Some land uses are more sensitive to noise impacts than others. Consistent with the Governor's Office of Planning and Research's *State of California General Plan Guidelines*, noise-sensitive receptors are defined in this document as residential land uses, schools, open spaces, nursing homes, hospitals, convalescent homes, and churches (Governor's Office of Planning and Research 2017). Potential noise-related impacts on biological resources are disclosed in Section 3.3, Biological Resources. In addition, the Golden Gate Bridge, Highway and Transportation District considers hotels, motels, libraries, and cemeteries to be noise-sensitive receptors. As noted, sensitivity to noise may vary with the source of the noise and the land use context. An important way of predicting a human reaction to a new noise environment is to compare it with the existing ambient noise level. In general, the more a new noise source exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. The noise analysis in this section accounts for the Downtown urban environment and close proximity of the project area to US-101,

the existing transit center, and the SMART train station. Therefore, the existing ambient noise level is louder than non-urban uses.

Existing noise-sensitive land uses in the vicinity of the project area include residences, hotels, motels, schools, libraries, churches, hospitals, nursing homes, playgrounds, neighborhood parks, cemeteries, and other outdoor recreation (see Table 3.11-11 for a full list of surrounding sensitive receptors). These sensitive land uses are divided into Categories 1, 2, or 3 per the FTA standard for transit noise, as described in Section 3.11.2.1.

Vibration-Sensitive Historic Buildings

Historic buildings are also considered potentially sensitive to vibration according to the FTA manual. Section 3.4, Cultural Resources, identified ~~four~~ five built environmental resources that qualify as historic sites for the purposes of California Environmental Quality Act (CEQA) review: 1011 Irwin Street, 709–711 4th Street, 927 Tamalpais Avenue, 633 5th Avenue, and 637 5th Avenue. As further described in Section 3.4, depending on the build alternative, cultural resources would either be relocated or removed.

The Move Whistlestop Alternative would involve the demolition of the historic building at ~~two historic-aged buildings:~~ 927 Tamalpais Avenue. An older building of no historic status at 703–705 4th Street would also be demolished. ~~and 927 Tamalpais Avenue (Barrel House). As described in Section 3.4.1.2, neither of the historic-aged buildings proposed for demolition under this alternative qualifies as a historic resource under CEQA.~~ This alternative would utilize the existing alley that runs adjacent to the east façade of 709–711 4th Street as a vehicular circulation path. The Move Whistlestop Alternative proposes to relocate the Whistlestop building at 930 Tamalpais Avenue, which does not qualify as a CEQA historic resource, to the west side of Tamalpais Avenue. The relocated Whistlestop building would be in the vicinity of the historic buildings at 709–711 4th Street. Furthermore, the alternative would not alter the physical features that allow 709–711 4th Street to convey its historical significance.

The Adapt Whistlestop Alternative would occur adjacent to one historic building: the circa 1889 commercial building at 709–711 4th Street. The Adapt Whistlestop Alternative would involve similar project activities as the Move Whistlestop Alternative. Project activities would not result in a substantial adverse change in the significance of 709–711 4th Street.

The 4th Street Gateway Alternative plans to relocate buildings at 633 5th Avenue and 637 5th Avenue prior to or during construction to accommodate transportation facilities. However, there is no currently identified receiving site for either building and the method for relocation has not yet been determined.

The Under the Freeway Alternative contains one historic building: a residence at 1011 Irwin Street. The City has evaluated the residence as eligible for listing in the National Register of Historic Places and California Register of Historical Resources due to its hipped-roof cottage. This alternative would demolish this historical resource, thus destroying all the characteristics that qualify it for inclusion in the National Register of Historic Places and California Register of Historical Resources. As described further in Section 3.4, the demolition of 1011 Irwin Street would therefore be considered a substantial adverse change in the significance of the resources.

Table 3.11-11. Sensitive Receptors within 0.5 Mile of the Alternatives

Sensitive Receptor Type	Name	Address
Category 1		
Outdoor Amphitheatre	Forest Meadows Amphitheatre	890 Belle Avenue
Category 2		
Residential	Various	All surrounding zoning that falls into the following categories: Any zoning with an "R" and Downtown residential zoning including but not limited to the following: 4SRC, HO, CSMU, 2/3 MUE, 2/3, 2/3 MUW, WEV, and 5/MR/O.
Hospitals	Marin Treatment Center, Inc	1466 Lincoln Avenue
	Kaiser Permanente San Rafael Medical Center	99 Montecillo Road
Hotel	Panama Hotel	4 Bayview Street
Senior Homes	Goldenaires Senior Citizens	618 B Street
	San Rafael Commons	302 4th Street
	Aldersly Retirement Community	326 Mission Avenue
	Senior Assistance, LLC	14 Tierra Vista Way
	Home Safety Bath's	448 Du Bois Street
	Greenwood Assisted Living	233 West End Avenue
	San Rafael Healthcare & Wellness Centre	1601 5th Avenue
Category 3		
Churches	Trinity Community Church	1675 Grand Avenue
	Lincoln Hill Community Church	1411 Lincoln Avenue
	Thailao Baptist Church	1411 Lincoln Avenue
	St. Paul's Episcopal Church	1123 Church Street
	Church of Saint Raphael/Mission San Rafael Arcangel	1104 5th Avenue
	El Renuevo De Jehova Los Arcangeles	calle San Rafael 613 los Arcángeles García, N, L
	First Church of Christ Scientist	1618 5th Avenue
	Church of the Open Door	1104 5th Avenue
	Victory Christian Center	555 Francisco Boulevard E
	Trinity Lutheran Church	333 Woodland Avenue

Sensitive Receptor Type	Name	Address
Schools	Saint Raphael School	1100 5th Avenue
	Madrone High School	185 Mission Avenue
	San Rafael High School	150 3rd Street
	Coleman Elementary School	800 Belle Avenue
	Dominican University of California	50 Acacia Avenue
	Parkside Children's Center	51 Albert Park Lane
Parks and Open Spaces	Mountain Park	
	Beach Park	200 Yacht Club Drive
	Boyd Memorial Park Playground	341 Laurel Place
	Albert Park	155 Andersen Drive
	City Plaza	Plaza in former Court Street right-of-way
	Falkirk	Lower portion of site only; includes historic mansions/lawns. Excludes 8-acre upper open space.
	Marin Tennis Club	925 Belle Avenue
	John F. Allen Athletics Complex and Kennelly Field	890 Belle Avenue
Cultural Resources		709–711 4th Street
		633 5th Avenue
		637 5th Avenue
Libraries	San Rafael Public Library	1100 E Street

Source: Google Maps 2021

3.11.3 Environmental Impacts

This section describes the environmental impacts associated with noise that would result from implementation of the proposed project. It describes the methods used to determine the effects of the proposed project and lists the thresholds used to conclude whether an impact would be significant. Impacts for the build alternatives are presented together unless they differ substantially among alternatives. Measures to mitigate (i.e., avoid, minimize, rectify, reduce, eliminate, or compensate for) significant impacts are provided.

3.11.3.1 Methodology

Construction Noise

The noise study area includes areas within a half-mile radius of the project area. The assessment of potential construction noise levels was based on methodology developed by FTA (2018) and construction noise criteria from applicable local guidance (such as local general plan documents or noise ordinances). Noise levels produced by commonly used construction equipment are shown in Table 3.11-12. Individual types of construction equipment are expected to generate maximum noise levels ranging from 80 to 90 dBA at a distance of 50 feet. The construction noise level at a given

receiver location depends on the type of construction activity and the distance and shielding between the activity and noise-sensitive receivers.

Updated Table 3.11-12. Commonly Used Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 Feet from Source
Heavy truck	84
Excavator	85
Bulldozer	85
Pump	81
Generator	81
Mixer	80
Grader	85
Compactor	82
Impact hammer (hoe ram)	90
Back-hoe	80
Crane	83
~~Drill rig~~	~~85~~
Pavement saw	90

Source: FTA 2018

The construction equipment used would vary by component or construction phase of the proposed project and would involve the use of excavators, bulldozers, heavy trucks, pumps, generators, graders, compactors, impact hammers, and other heavy equipment. The source levels used to calculate noise exposure are based on the L_{max} of equipment noise levels developed by FTA. Usage factors for construction noise are used in the analysis to develop reasonable worst-case L_{eq} noise exposure values. The L_{eq} value accounts for the energy-average of noise over a specified interval (usually 1 hour), and usage factors represent the amount of time a type of equipment is used during a typical interval.

Potential noise levels resulting from construction of the proposed project were evaluated by combining the noise levels of the two loudest pieces of equipment that would likely operate at the same time (for example, an excavator, bulldozer, and truck being operated simultaneously during the site preparation phase) and applying the appropriate usage factor (percentage of time equipment is in operation) to each piece of equipment. Sound levels from construction activities are calculated as a function of distance from the source(s), based on point-source attenuation over hard (i.e., acoustically reflective) ground, noting that 6 dB of reduction per doubling of distance can be assumed over hard ground.

Construction Haul Truck Noise

Construction haul truck noise is assessed qualitatively based on the likelihood of a noticeable increase in traffic noise at sensitive land uses along proposed project haul routes. It is assumed that all build alternatives would have the same construction schedule and on-road equipment fleet.

Based on the average number of trips per day during construction for other projects in the Bay Area utilizing the California Emissions Estimator Model (CalEEMod), as described in detail in Section 3.2, Air Quality, it is conservatively estimated that up to 12 one-way daily trips would be made by haul trucks during construction. These trucks are assumed to access or leave the station option sites by

way of Lincoln Avenue or Hetherton Street, connecting to 3rd Street or Mission Avenue to access US-101.

A substantial increase in noise from haul trucks during construction would occur if a project-related increase of 3 dB (L_{dn}) or more would occur where the existing and/or resulting noise levels are in any category other than "acceptable," according to the land use compatibility chart.

Operational Noise

Alternative Bus Operations

The noise and vibration assessment was conducted in accordance with the FTA *Transit Noise and Vibration Impact Assessment Manual* guidelines (described in Section 3.11.2.1). The FTA manual specifies that criteria are applied for a comparison between future project noise and existing noise, and not between future project noise and projections of future "no-build" noise exposure.

Following FTA guidelines, a screening assessment was used to select applicable receptors that are located within the FTA screening distance of 250 feet of the alignment for a busway with intervening buildings (described in Section 3.10, Land Use and Planning). Receptors were selected from land uses within this screening distance to represent sensitive land uses identified along the corridor. Existing noise levels for receptor locations were taken from results of the noise-monitoring program conducted in the area. Project buses were assumed to operate at up to 30 miles per hour. Calculated project noise levels were then compared with the "moderate impact" and "severe impact" criteria based on the existing ambient conditions recorded for a given receptor location.

Transit Center

Stationary equipment associated with the proposed project, such as backup generators and heating, ventilation, and air-conditioning (HVAC) equipment, could potentially result in noticeable levels of noise at nearby sensitive land uses. Sound level specifications for building equipment are unknown. As such, the analysis assumes typical equipment source levels at a reference distance of 50 feet. These types of equipment would be required to comply with the San Rafael Municipal Code and the Noise Element of ~~The *City of*~~ *San Rafael General Plan 204*0~~*20*~~ and were considered in the analysis.

Vehicle Traffic

To determine whether the proposed project would result in a substantial permanent increase in ambient noise levels from traffic, model calculations were developed to determine the change in project-related traffic volumes along segments adjacent to the build alternatives. An increase of 3 dB would be considered a noticeable increase in noise levels relative to existing conditions. Ambient noise levels obtained from sound level monitoring are also considered to determine whether an increase in traffic along a given roadway segment would result in a noticeable increase in noise levels, based on all sources of noise present in the area.

Traffic noise modeling for existing conditions and Year 2040 conditions was conducted using standard acoustical methods. For the assessment of project-level traffic noise impacts, p.m. peak hour traffic volumes were used to determine traffic noise levels under existing and Year 2040 conditions. The model assumes that the proposed project would alter traffic circulation on local streets but would not generate traffic, as the proposed project would not change the amount of bus service provided and new vehicle trips are not assumed to be generated by the proposed project.

Although the proposed project would improve the efficiency of bus operations and create operational flexibility for bus movements into and out of the transit center, no future expansion of transit service is currently programmed or planned and thus cannot be reasonably forecasted.

Construction Vibration

Potential vibration impacts during construction were evaluated using the construction vibration modeling methods recommended by the U.S. Department of Transportation, along with construction equipment data provided by the project engineering team. Reasonable worst-case construction vibration levels are provided and compared to the Caltrans vibration guidelines for damage and annoyance (refer to Tables 3.11-4 and 3.11-5).

Vibration source levels for a variety of typical construction equipment types are shown in Table 3.11-2. Source levels are shown in terms of PPV at 25 feet, 50 feet, 75 feet, and 100 feet, based on FTA guidelines.

The potential for damage to adjacent architectural resources from project-related construction vibration was investigated, in addition to the modeled noise- and vibration-sensitive receivers discussed above. Using assumptions provided by the project engineers and the FTA methodology, as outlined above, the potential for construction vibration damage to historic structures was analyzed.

3.11.3.2 Thresholds of Significance

The following State CEQA Guidelines Appendix G thresholds identify significance criteria to be considered for determining whether a project could have significant impacts related to noise and vibration.

Would the proposed project result in:

- Generation of substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?
- Generation of excessive groundborne vibration or groundborne noise levels?
- Placement of project-related activities in the vicinity of a private airstrip or an airport land use plan, or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, resulting in exposure of people residing or working in the project area to excessive noise levels?

The City of San Rafael Municipal Code states that noise from construction equipment outside of the daytime hours of 7:00 a.m. to 6:00 p.m. would be prohibited unless approved by the City. Potential noise impacts at noise-sensitive uses from temporary use of construction equipment may occur where noise from a construction site exceeds 90 dBA L_{eq} during daytime hours, or 55 dBA L_{eq} during nighttime hours (based on the City noise limit for mixed use development).

A project is considered to contribute to a significant cumulative impact if future (Year 2040) traffic noise levels would result in an increase of 3 dB relative to future no-project conditions at a location where traffic noise exceeds 60 L_{dn}. A 3-dB increase in the ambient noise level is a noticeable increase (Caltrans 2020).

Note that there would be no impacts related to the influence of noise from aircraft or airports for the proposed project. The nearest two airports to the proposed project site are San Rafael Airport, a private airport, and Marin Ranch Airport, a public airport, directly east of San Rafael Airport, both approximately 3 miles north of the project area. The proposed project would not add sensitive uses that would potentially be affected by aircraft noise. Therefore, there would be no impact, and this topic related to aircraft noise at public airports or private airstrips is not discussed further in this section.

3.11.3.3 Impacts

Impact NOI-1: Generation of Substantial Temporary or Permanent Increase in Ambient Noise Levels in the Vicinity of the Project in Excess of Standards Established in the Local General Plan or Noise Ordinance, or Applicable Standards of Other Agencies

Construction

To characterize the overall noise level of the worst-case noise condition during a given phase of construction, the two loudest pieces of equipment were assumed to operate simultaneously at the construction site perimeter at a receiver distance of 50 feet. Heavy equipment, such as excavators and trucks, were assumed to operate for up to 50 percent of a given hour during construction hours. Pumps and generators were assumed to operate up to 100 percent of the time during construction hours. Sound levels by project phase are shown in Table 3.11-13.

Updated Table 3.11-13. Construction Noise Levels by Activity and Distance to Allowable Sound Levels

Construction Activity	Equipment Used[a]	Combined Source Level at 50 Feet (L_{eq}, dBA)[b]	Distance to Exceedance of Daytime Sound Level Limit of 90 dBA L_{eq} (feet)[c]	Distance to Exceedance of Nighttime Sound Level Limit of 55 dBA L_{eq} (feet)[d]
Demolition	Hoe ram, truck	88	40	2,200
Excavation	Excavator, ~~drill~~bulldozer	85	30	1,600
Foundation	Grader, crane	84	25	1,400
Building construction	Grader, crane	84	25	1,400
Site improvements	Backhoe, concrete saw	87	40	2,100
Exterior closeout	Grader, crane	84	25	1,400

Note: Distance calculation does not include the effects, if any, of local shielding from walls, topography, or other barriers, which may further reduce sound levels.

[a] The two loudest pieces of equipment that may operate in one location simultaneously.

[b] Based on usage factors of 50 percent to 100 percent for the types of equipment used.

[c] The maximum distance where the combined equipment level may potentially exceed the City daytime construction noise limit of 90 dBA L_{eq}. Daytime is defined as the hours between 7:00 a.m. and 6:00 p.m. (9:00 a.m. to 6:00 p.m. on Saturdays).

[d] The maximum distance where the combined equipment level may potentially exceed the City nighttime threshold of 55 dBA L_{eq}. Nighttime is defined as the hours between 10:00 p.m. and 7:00 a.m. For the purpose of this analysis, it is

assumed construction done outside of City-allowed hours may be bound by this limit. The distances shown in this column assume temporary nighttime permits would be obtained, if nighttime work is determined to be necessary.

Move Whistlestop and Adapt Whistlestop Alternatives

The nearest residential units are in a mixed-use office and residential building adjacent to these project sites on the western side. The nearest portion of the excavation perimeter is about 10 feet from these residences. Construction noise levels could be as high as 102 dBA at a distance of 10 feet during site demolition, which would likely be the loudest phase of construction. A noise level of this magnitude would be readily noticeable above ambient levels at this location. Utility work may be required at night on an intermittent basis. This would exceed City nighttime noise limits at receptors up to 2,200 feet from work sites. This would include several residential units and mixed-use buildings adjacent to the project sites. This impact would be **significant** due to exceedance of the City daytime and nighttime noise limits during construction. Implementation of Mitigation Measure MM-NOI-CNST-1 would reduce this impact to a ***less-than-significant level with mitigation***.

4th Street Gateway Alternative

The nearest residential units are north of the project site at the intersection of 5th Avenue and Tamalpais Avenue. The nearest portion of the excavation perimeter is approximately 50 feet from these residences. Construction noise levels could be as high as 88 dBA at a distance of 50 feet during site demolition, which would likely be the loudest phase of construction. A noise level of this magnitude would be readily noticeable above ambient levels at this location, but would only occur where equipment is used near the perimeter of the construction site relative to the receiver of the noise. Additionally, heavy equipment use would be temporary and would cease once construction is complete.

Utility work may be required at night on an intermittent basis. This would exceed City nighttime noise limits at receptors up to 2,200 feet from work sites. This would include several residential units as near as approximately 50 feet from the northern boundary of the site. This impact would be **significant** due to a potential exceedance of the City nighttime noise limit during construction. Implementation of Mitigation Measure MM-NOI-CNST-1 would reduce this impact to a ***less-than-significant level with mitigation***.

Under the Freeway Alternative

The nearest residential units are east of the project site on Irwin Street. The nearest portion of the excavation perimeter is approximately 50 feet from these residences. Construction noise levels could be as high as 88 dBA at a distance of 50 feet during site demolition, which would likely be the loudest phase of construction. A noise level of this magnitude would be readily noticeable above ambient levels at this location. Utility work may be required at night on an intermittent basis. This would potentially exceed City nighttime noise limits at receptors 2,200 feet from work sites. This would include several mixed-use residential units as near as approximately 50 feet from the eastern boundary of the site. This impact would be **significant** due to a potential exceedance of the City nighttime noise limit during construction. Implementation of Mitigation Measure MM-NOI-CNST-1 would reduce this impact to a ***less-than-significant level with mitigation***.

Operations

All Build Alternatives

Bus Operations

The proposed transit center would provide bus service consistent with existing bus trip volumes and fleet assignments. The model also assumed that up to eight buses may idle engines for up to 3 minutes each in a given hour. The new transit center would be in an urban area with high levels of vehicle traffic and overall ambient noise levels would be influenced by vehicle traffic on surface streets and the adjacent elevated section of US-101, which would be less than 100 feet from the transit center under all build alternatives, including its current location.

Noise analysis results are shown in Table 3.11-14. The results indicate that transit center operations would result in an increase of 0.5 dB or less (in terms of L_{dn}) at all receiver locations across all four build alternatives. This is primarily due to the presence of existing traffic and train sources in the area, as recorded by monitoring. The noise from these sources would overshadow noise from the new transit center, similar to the noise environment observed at the existing transit center. Noise levels from the transit center would result in moderate impacts at the nearest receptors for the 4th Street Gateway and Under the Freeway Alternatives. There would be no severe impacts. Generally, FTA considers mitigation as a requirement only for severe impacts. Mitigation for moderate impacts may be considered on a case-by-case basis. Mitigation would not be acoustically feasible for this location, as any measure specific to either of the transit center locations would only provide up to 0.5 dB of noise reduction and would not mitigate vehicle noise from existing sources.

The greatest noise level increase from the transit center would be 0.5 dB. An increase of this magnitude would not be perceptible over existing ambient noise levels at these locations. Noise levels would not exceed the threshold for severe impacts as defined by FTA. Therefore, this impact is considered to be ***less than significant***. No mitigation is required.

Table 3.11-14. Predicted Noise Levels from Transit Center Bus Operations under Each Alternative

Receiver	Existing Ambient Level	Project Noise Level	Combined Level	Increase over Existing	Moderate Impact Threshold (Project Noise)	Severe Impact Threshold (Project Noise)	Impact?	Moderate Contour Distance (feet)	Severe Contour Distance (feet)
Move Whistlestop and Adapt Whistlestop Alternatives									
Nearest receptor	75.1	65.7	75.6	+0.5	66 L_{dn}	73 L_{dn}	None	58	27
LT-1	68.8	51.9	68.9	+ 0.1	64 L_{dn}	69 L_{dn}	None		
LT-2	78.1	52.9	78.1	0.0	66 L_{dn}	75 L_{dn}	None		
LT-3	75.1	54.6	75.1	0.0	66 L_{dn}	73 L_{dn}	None		
4th Street Gateway Alternative									
Nearest receptor	78.1	69.3	78.6	+0.5	66 L_{dn}	75 L_{dn}	Moderate	61	28
LT-1	68.8	53.4	68.9	+ 0.1	64 L_{dn}	69 L_{dn}	None		
LT-2	78.1	67.7	78.5	+ 0.4	66 L_{dn}	75 L_{dn}	Moderate		
LT-3	75.1	53.1	75.1	0.0	66 L_{dn}	73 L_{dn}	None		
Under the Freeway Alternative									
Nearest receptor	79.5	69.3	79.9	+ 0.4	66 L_{dn}	75 L_{dn}	Moderate	83	21
LT-4	79.5	62.4	79.6	+ 0.1	66 L_{dn}	75 L_{dn}	None		

Transit Center

Station platform noise sources would include a public announcement system and chiming sounds in ticket vending machines. Noise associated with these sources would occur for brief periods of time and is not likely to result in an exceedance of FTA or local standards. Sound levels from announcement systems would vary, as they are typically designed to automatically adjust volume levels to a few dB above ambient noise. Chiming sounds from ticket machines are designed to provide an audible prompt to the person using the machine and are not typically audible above ambient levels except in the area directly next to the machine. Noise associated with these sources would occur intermittently and for brief periods of time and would not result in an exceedance of FTA or local standards.

The new building in the project area would require HVAC systems. Although specific sound level data for this type of equipment are not available, typical HVAC equipment can produce sound levels in the range of about 70 dBA at 50 feet, depending on the size of the equipment. However, rooftop HVAC units would attenuate both vertically and horizontally relative to surrounding uses, and also would be shielded by the edge of the building. As such, noise from HVAC equipment is unlikely to be noticeable in the urban setting of the proposed project, given that average measured noise levels are 67 dBA L_{eq} and above in this area of the city. Although this equipment noise is likely to be overshadowed by noise from surrounding transit and traffic noise, the equipment is required to meet City noise standards and should not exceed the applicable noise limits at the property line (65 dBA during daytime hours or 55 dBA during nighttime hours for residential mixed-use properties). Because noise levels from the equipment are not known, the building engineer should confirm that City noise limits would be met. This impact is potentially **significant**. Implementation of Mitigation Measure MM-NOI-OP-2 would reduce this impact to a ***less-than-significant level with mitigation***.

Vehicle Traffic

The proposed project would not affect traffic volumes except for buses. While there would be no increase in traffic volumes, traffic may be recirculated such that there is an increase in traffic volumes on roadways in the vicinity as employees and visitors travel to and from the project area. Traffic noise increases with increasing traffic volumes. A 100-percent increase (i.e., a doubling) in volume of traffic equates to a 3-dB increase in noise. As discussed in the beginning of this section, an increase of 3 dB is just noticeable by the human ear and, as such, an increase of less than 3 dB is not considered to be a substantial increase.

Traffic noise levels were calculated using peak-hour traffic volume data provided by the project traffic consultant and standard acoustical methods.

As shown in Table 3.11-15, traffic noise levels along street segments in the vicinity of the project area would increase by up to 2 dB under both existing with-project conditions and future with-project conditions under all build alternatives. An increase of this magnitude would not be noticeable. Therefore, noise level increases from a redistribution of vehicle traffic are considered to be ***less than significant***. No mitigation is required.

Table 3.11-15. Increase in Traffic Noise Along Project Street Segments

		Existing versus No Project Increase, dB			Future versus No Project Increase, dB		
Street	Segment Location	4th Street Gateway Alternative	Move and Adapt Whistlestop Alternatives	Under Freeway Alternative	4th Street Gateway Alternative	Move and Adapt Whistlestop Alternatives	Under Freeway Alternative
Hetherton Street	2nd Street to 3rd Street	+2	+2	+2	+2	+2	+2
Hetherton Street	3rd Street to 4th Street	0	0	0	0	0	0
Hetherton Street	4th Street to 5th Avenue	0	0	0	0	0	0
Hetherton Street	5th Street to Mission Avenue	0	0	0	0	0	0
Irwin Street	2nd Street to 3rd Street	-2	-2	-2	-2	-2	-2
Irwin Street	3rd Street to 4th Street	0	0	0	0	0	0
Irwin Street	4th Street to 5th Avenue	0	0	0	0	0	0
Irwin Street	5th Street to Mission Avenue	0	0	0	0	0	0
Grand Avenue	2nd Street to 3rd Street	0	0	0	0	0	0
Grand Avenue	3rd Street to 4th Street	0	0	0	0	0	0
Grand Avenue	4th Street to 5th Avenue	0	0	0	0	0	0
Grand Avenue	5th Street to Mission Avenue	0	0	0	0	0	0
Lincoln Avenue	2nd Street to 3rd Street	0	0	0	0	0	0
Lincoln Avenue	3rd Street to 4th Street	0	+1	0	0	0	0
Lincoln Avenue	4th Street to 5th Avenue	0	0	0	0	0	0
Lincoln Avenue	5th Street to Mission Avenue	0	0	0	0	0	0
Tamalpais Avenue	2nd Street to 3rd Street	0	0	0	0	0	0
Tamalpais Avenue	3rd Street to 4th Street	+1	0	0	0	0	0
Lindaro Street	Anderson Drive to 2nd Street	0	0	0	0	0	0
Lindaro Street	2nd Street to 3rd Street	0	0	0	0	0	0
Cijos Street	3rd Street to 4th Street	+1	0	0	+1	0	0
Lootens Place	3rd Street to 4th Street	0	0	0	0	0	0
Tamalpais Avenue	5th Street to Mission Avenue	0	0	0	0	0	0
Tamalpais Avenue	4th Street to 5th Avenue	0	0	0	0	0	0
2nd Street	Hetherton Street to Irwin Street	0	0	0	0	0	0

		Existing versus No Project Increase, dB			Future versus No Project Increase, dB		
Street	Segment Location	4th Street Gateway Alternative	Move and Adapt Whistlestop Alternatives	Under Freeway Alternative	4th Street Gateway Alternative	Move and Adapt Whistlestop Alternatives	Under Freeway Alternative
3rd Street	Hetherton Street to Irwin Street	-2	-2	-2	-2	-2	-2
4th Street	Hetherton Street to Irwin Street	-1	-1	-1	-1	-1	-1
5th Street	Hetherton Street to Irwin Street	0	0	0	0	0	0
Mission Avenue	Hetherton Street to Irwin Street	0	0	0	0	0	0
2nd Street	Irwin Street to Grand Avenue	0	0	0	0	0	0
3rd Street	Irwin Street to Grand Avenue	-4	-4	-4	-4	-4	-4
4th Street	Irwin Street to Grand Avenue	0	0	0	0	0	0
5th Street	Irwin Street to Grand Avenue	0	0	0	0	0	0
Mission Avenue	Irwin Street to Grand Avenue	0	0	0	0	0	0
2nd Street	Lincoln Avenue to Hetherton Street	0	0	0	0	0	0
3rd Street	Lincoln Avenue to Hetherton Street	0	0	0	0	0	0
4th Street	Lincoln Avenue to Hetherton Street	0	0	0	0	0	0
5th Street	Lincoln Avenue to Hetherton Street	0	0	0	0	0	0
Mission Avenue	Lincoln Avenue to Hetherton Street	0	0	0	0	0	0
2nd Street	Lindaro Street to Lincoln Avenue	0	0	0	0	0	0
3rd Street	Lindaro Street to Lincoln Avenue	0	0	0	0	0	0
4th Street	Lootens Place to Lincoln Avenue	0	0	0	0	0	0
5th Street	Lootens Place to Lincoln Avenue	+1	0	0	+1	0	0
Mission Avenue	Nye Street to Mission Avenue	0	0	0	0	0	0

Mitigation Measures

Under any build alternative that is selected and constructed, the following measures would be implemented.

MM-NOI-CNST-1. Use Best Noise Control Practices During Construction

Best practices to minimize construction noise include the following:

- Limiting heavy equipment use to daytime hours not regulated by the City, between 7:00 a.m. and 6:00 p.m. Monday to Friday, and 9:00 a.m. to 6:00 p.m. on Saturday
- Locating stationary equipment (e.g., generators, pumps, cement mixers, idling trucks) as far as possible from noise-sensitive land uses
- Requiring that all construction equipment powered by gasoline or diesel engines have sound-control devices such as exhaust mufflers that are at least as effective as those originally provided by the manufacturer and that all equipment be operated and maintained to minimize noise generation
- Using equipment powered by electric motors instead of gasoline or diesel powered engines
- Preventing excessive noise by shutting down idle vehicles or equipment
- Using noise-reducing enclosures around noise-generating equipment
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (e.g., terrain, structures) to block sound transmission to noise-sensitive land uses. The barriers should be designed to obstruct the line of sight between the noise-sensitive land use and on-site construction equipment.
- Notifying adjacent residents in advance of construction work

MM-NOI-OP-2: Provide Acoustical Treatments for Mechanical Equipment as Needed to Comply with City Noise Standards

The applicant shall provide acoustical treatments as needed for the proposed HVAC equipment to ensure noise levels do not exceed the nighttime noise limit of 55 dBA L_{eq} at the property line. These limits are in accordance with the noise limitations specified in the City Municipal Code. Any required acoustical treatments can be specified by retaining a qualified acoustical consultant. Treatments may include, but are not limited to:

- Installing stationary equipment as far as possible from offsite noise-sensitive land uses and the property line to reduce noise levels at adjacent parcels
- Constructing enclosures around noise-generating mechanical equipment
- Placing barriers around the equipment
- Using mufflers or silencers on equipment exhaust fans
- Orienting or shielding equipment to protect sensitive uses to the greatest extent feasible

Impact NOI-2: Generation of Excessive Groundborne Vibration or Groundborne Noise Levels

Construction

All Build Alternatives

Construction of the proposed project would involve the use of construction equipment that could generate groundborne vibration. Typical vibration levels associated with construction equipment as a function of distance are shown in Table 3.11-16.

Table 3.11-16. Construction Equipment Vibration Levels by Distance

	Bulldozer, Hoe Ram		Truck	
Distance (feet)	VdB[a]	PPV[b]	VdB[a]	PPV[b]
10	99	0.352	98	0.300
15	94	0.191	92	0.164
20	90	0.124	88	0.106
25	87	0.089	86	0.076
30	85	0.068	83	0.058
35	83	0.054	81	0.046
40	81	0.044	79	0.038
45	79	0.037	78	0.031
50	78	0.031	77	0.027
55	77	0.027	75	0.023
60	76	0.024	74	0.020
63	75	0.022	74	0.019
65	74	0.021	73	0.018
70	74	0.019	72	0.016
75	73	0.017	71	0.015

[a] RMS Velocity Level re 1 micro-inch per second
[b] Peak particle velocity, inch per second

Groundborne vibration from heavy equipment such as a bulldozer or hoe ram could periodically exceed the FTA vibration criterion at nearby residences and historic buildings. As shown in Table 3.11-16, vibration levels from operation of a bulldozer or hoe ram would exceed the FTA criterion for annoyance of 0.04 inch per second PPV at 40 to 45 feet from a sensitive receptor. Vibration from heavy equipment would potentially be perceptible within building structures during short intervals when equipment is operated near structures.

Construction of the Move Whistlestop and Adapt Whistlestop Alternatives would require operation of heavy equipment near (possibly as close as 10 feet) a historic building at 709–711 4th Street. The results in Table 3.11-16 indicate that construction-induced vibration could exceed 0.08 inch per second PPV at 20 to 25 feet from the building structure, which would exceed Caltrans vibration criteria for fragile buildings. Therefore, vibration levels during use of heavy equipment would potentially exceed annoyance thresholds and building damage thresholds under the Move Whistlestop and Adapt Whistlestop Alternatives. This impact is therefore considered to be **significant**. Implementation of Mitigation Measure MM-NOI-CNST-3 would reduce these impacts to a ***less-than-significant level with mitigation***.

Construction of the 4th Street Gateway and Under the Freeway Alternatives would also require use of heavy equipment near building structures, but these structures are of modern construction, and

operation of heavy equipment would not exceed the more stringent vibration standard of 0.5 inch per second PPV at a distance of 10 feet. Therefore, vibration levels during use of heavy equipment would not exceed annoyance thresholds or building damage thresholds under the 4th Street Gateway and Under the Freeway Alternatives and the impact would be ***less than significant***.

Other historic buildings in the vicinity of the build alternatives would be relocated, depending on the selected alternative. The relocation of buildings would be addressed under Mitigation Measure MM-CULT-1, Prepare and Implement Relocation Plans.

Operations

All Build Alternatives

No conditions exist that would result in a significant vibration impact from rubber-tired vehicles. Operation conditions would be similar to existing conditions. As such, this vibration impact would be ***less than significant***.

Mitigation Measures

Under any build alternative that is selected and constructed, the following measure would be implemented.

MM-NOI-CNST-3: Implement Vibration-Reducing Practices During Construction

During construction, the contractor shall employ best practices to reduce construction vibration at adjacent buildings such that vibration at the building façades does not exceed 0.08 inch per second. Measures that can be used to limit construction vibration include, but are not limited to, the following:

- Locating high-vibration-generating equipment as far as possible from buildings
- Using low-vibration equipment within 45 feet of buildings

A vibration control plan shall be prepared that will describe the specific methods that the contractor will use to control vibration. Because of the historic status of the 709–711 4th Street building, the plan shall provide additional detail on how construction vibration near this building will be addressed. The plan may include the following measures:

- A preconstruction survey of the building to document pre-existing damage such as plaster cracks, shifted foundation, and concrete cracks
- Real-time monitoring of ground vibration
- If vibration monitoring indicates an exceedance of 0.08 inch per second during construction, alternative low-vibration construction methods shall be used, such that any subsequent exceedance is avoided.

A designated complaint coordinator shall be responsible for handling and responding to any complaints received during such periods of construction. A reporting program shall be required that documents complaints received, actions taken, and the effectiveness of these actions in resolving disputes.