Appendix D

Noise & Vibration Technical Report

Zero Emissions Bus Charging and Maintenance Facility Project

Noise and Vibration Technical Report

July 2025

Prepared for:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

The purpose of this report is to evaluate the potential for noise and groundborne vibration impacts associated with the proposed Zero Emissions Bus Charging and Maintenance Facility Project (Project), located at 1075 East Francisco Boulevard ("Project Site") in the City of San Rafael (City) in eastern Marin County (County). This report includes an evaluation of potential impacts associated with substantial temporary and permanent increases in ambient noise levels in the vicinity of the Project Site; exposure of people in the vicinity of the Project Site to excessive noise or groundborne vibration levels; and whether exposure is in excess of standards established in the City's General Plan or Noise Ordinance. This report has been prepared by Impact Sciences, in support of the environmental documentation being prepared pursuant to the California Environmental Quality Act (CEQA).

1.1 PROJECT LOCATION

The Project Site is located in the City of San Rafael in eastern Marin County. The site consists of two parcels, generally bordered by Castro Avenue to the north, Francisco Boulevard East to the west, commercial and industrial private parcels to the south, and Kerner Boulevard to the east. The site consists of two parcels identified by Assessor's Parcel Numbers (APN) 009-191-37 and 009-191-38. Interstate 580 (I-580) runs in a northwest-southeast orientation located adjacent to the west of Francisco Boulevard East (See **Figure 1, Aerial Photograph of the Project Site**).

SOURCE: Esri, 2025

FIGURE 1

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Aerial Photograph of the Project Site

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1.2 EXISTING CONDITIONS

The Project Site is in a highly urbanized area surrounded by Light Industrial, General Commercial, and Commercial Mixed-use, Public/Quasi Public, and General Industrial land uses. The zoning designations surrounding the Project Site include Light Industrial/Office, General Commercial, Planned Development, and Open Space designations.

Under the City's General Plan, the Project Site has a Land Use Designation of Community Commercial Mixed Use. The Project Site has a Zoning designation of General Commercial in the San Rafael Municipal Code of Ordinances.

Typical uses allowed for sites under this General Plan land use designation include general retail and service uses, restaurants, automobile sales and service uses, hotels/ motels, and other commercial activities. Offices are also permitted, except where specifically precluded by General Plan policies. Mixed-use projects that combine housing and commercial uses are encouraged. Projects that are entirely residential are permitted, although limitations may apply in certain zoning districts to ensure that adequate land is provided for activities generating sales tax, jobs, and local service opportunities. Residential development is subject to a maximum net density of 43.6 units per acre. The FAR limit of 0.3 applies to non-residential square footage only, and excludes square footage associated with housing in mixed-use projects.

1.3 PROJECT CHARACTERISTICS

Project Features and Operations

As part of the Project, Marin Transit would develop the site with a new building dedicated to District operations, visitor, employee, and bus parking, maintenance, and charging. The Project will support both diesel and electric vehicles, so a diesel refueling station will be included to service diesel buses until the transition to an all-electric fleet. The facility will maintain the District's 68 buses used for fixed route service and 32 vehicles for demand response services and park approximately two thirds of the total fleet. These components are discussed in greater detail below.

Building

The Project would construct an 18,600 square-foot building not to exceed 36 feet in height (see **Figure 2, Site Plan**), located in the approximate middle of the site. The southern side of the building would be dedicated to office space, a cash safe, two shower rooms, two restrooms, a breakroom, and a manager's office. The northern side of the building would be dedicated to driver's check-in, employee lockers,

breakroom, and utility rooms such as main electricity room, mechanical room, janitorial closet, copy room, and a Main Distribution Frame (MDF) room. Subsurface excavation of up to ten feet would occur to allow for the construction of the building foundation.

Bus Facilities

The bus facilities area would be located between the proposed building and the employee/visitor parking on the southern portion of the site. The bus facilities would be enclosed. The facilities would include five bus maintenance bays, storage for parts and tires, a bus washing station, fare exchange and vacuum island, and a single above-ground 10,000-gallon diesel tank and associated fuel pumps (located along the northern building façade). The bus maintenance bays would be equipped with mobile lifts for easier access to the underside of fleet vehicles.

Site Access and Parking

Access to visitor, employee, and bus facilities area (parking/maintenance/charging/fueling lots) would be provided via two dedicated driveways, one along Castro Avenue on the northeast corner of the site and along Francisco Boulevard East on the west side of the Project Site. The visitor parking lot would be accessible via the northeastern driveway and would provide up to 60 passenger-vehicle parking spaces for employees and visitors. The bus facilities area would be located between the proposed building and the employee/visitor parking on the southern portion of the site. Five bus maintenance bays would be constructed along with up to 50 bus parking stalls being accessible via the Francisco Boulevard E driveway and would allow for both ingress and egress. The bus parking spaces would be dedicated to bus charging, with canopies anticipated to be equipped for rooftop solar not to exceed 36 feet in height.

The City of San Rafael has begun a 2024-2025 Pavement Maintenance Project, which removes existing striping, places crack seal, slurry seal, and micro-surfacing along roadways, and installs new striping.[1] This project is being completed incrementally and would not substantially inhibit access to the project site or adversely impact the project and its progress.

[1] City of San Rafael, 2024/25 Pavement Maintenance Project, October 1 2024. Available online at: https://www.cityofsanrafael.org/2024-25-pavement-maintenance-project/, accessed July 28, 2025.

Other Infrastructure, Equipment, and Utilities

Water

Water service would be provided by the Marin Municipal Water District. Before service is provided to the project site, Marin Municipal Water District must approve the appropriate water service improvements and connections permits.

Wastewater

For areas south of Puerto Suello Hill, the San Rafael Sanitation District (SRSD) maintains and operates the City's sewer systems, which would provide sewer service for the project. Before sewer service would be provided to the project site, the appropriate sanitary sewer connection permits would be completed and approved.

Electricity and Natural Gas

Electricity and natural gas service would be provided to the project site by Pacific Gas & Electric (PG&E). Electrical improvements and connection permits must be approved before service is provided to the site. Various locations throughout the site would have light fixtures constructed (i.e., outdoor lighting on building, light poles throughout project site). PG&E manages two underground electric lines in the project vicinity: a 115 kV north-south electric line and a 60 kV east-west electric line. Electric service to the project site would be provided by connections to these lines.

The project would require one generator that would be used only during an emergency scenario to support building HVAC and would not be used for bus charging. The generator would be approximately 300 kilowatts and be located towards the southwest side of the building.

Other Infrastructure

The staff and visitor parking area would be fenced. Security cameras would be located throughout the Project Site, focusing on the building and entrances and exits to the Project Site. Exterior lighting would be constructed at various points throughout the Project Site and attached to the main building.

Stormwater Control and Landscaping

Site layout will be reviewed and designed to comply with the "Stormwater Quality Manual for Development Projects in Marin County." The City of San Rafael is a participating city in the Marin County Stormwater Pollution Prevention Program (MCSTOPPP).

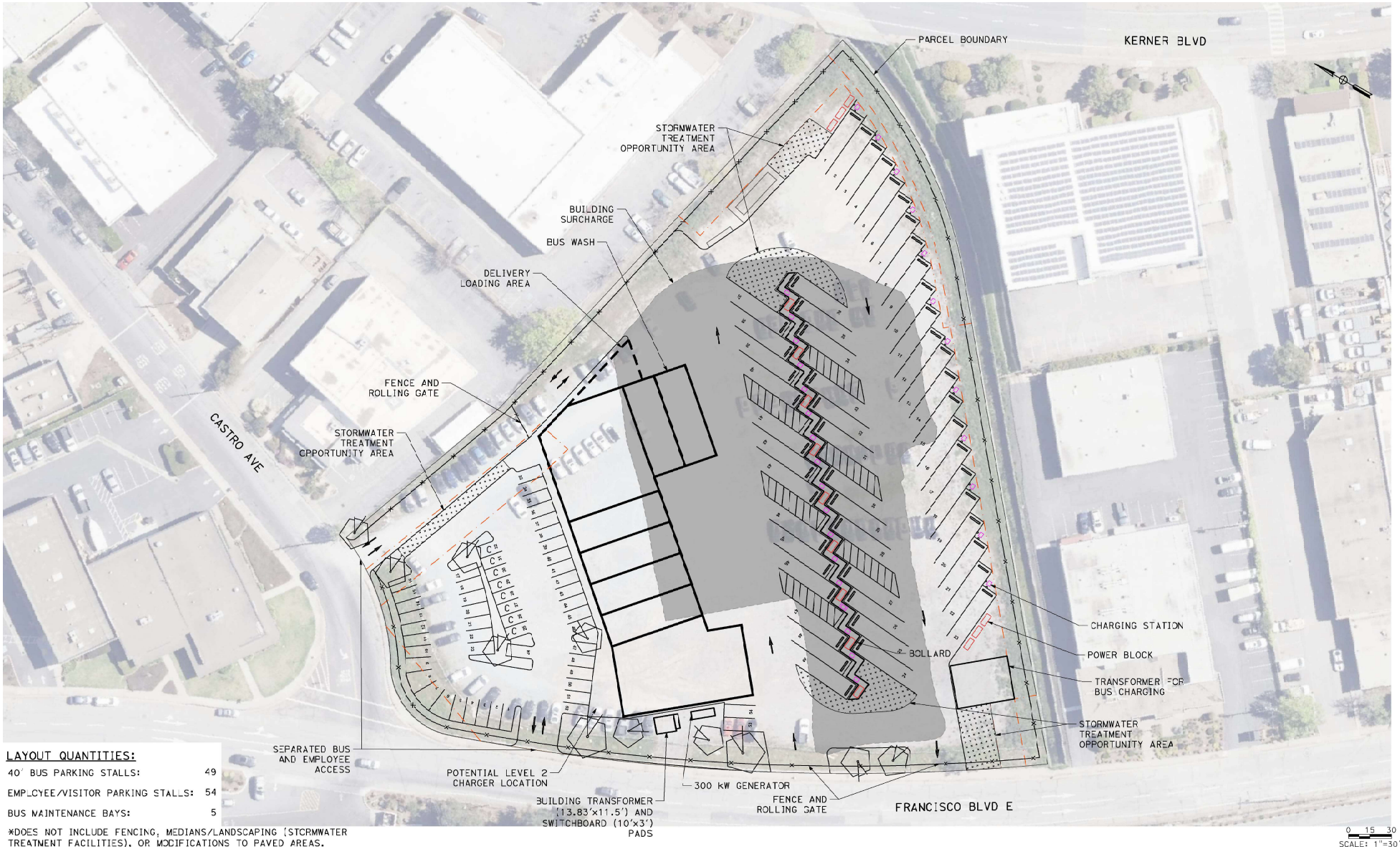
There is only one tree located on-site, which would be removed during construction and replaced with ornamental landscaping throughout the project site. Additionally, bioswales would be implemented to capture, treat, and infiltrate stormwater runoff.

Construction

Construction staging and activities would occur entirely within the boundaries of the Project Site. Construction would occur Monday through Friday from 7 a.m. to 6 p.m., consistent with the City's permitted construction days and hours. Equipment used for construction would include scrapers, blades, bulldozers, excavators, skid steers, loaders, concrete trucks, dump trucks, and a small crane. Public access to the Project Site during construction would be restricted, and materials would be stored and moved around on-site as needed. Construction of the aforementioned components would require subsurface work extending to depths of up to 10 feet below grade. See below for additional details regarding construction.

Operation

Upon the completion of construction, the zero emissions charging and maintenance facility would be used to conduct routine maintenance on the vehicle fleet. This routine maintenance would include, but is not limited to, general repairs, tire repairs, part replacements, refueling, charging, and cleaning of the interior and exterior of the buses. The number of buses traveling on roadways in the surrounding area would increase compared to current conditions as a result of buses traveling to and from the facility.



SOURCE: Mark Thomas, 2025

FIGURE 2

Project Site Plan

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1.4 PROJECT CONSTRUCTION SEQUENCING

For the purpose of analyzing impacts associated with construction activities, this analysis assumes a construction schedule of approximately 18-24 months beginning in 2027. This analysis assumes the Project will be fully operational in 2029. It should be noted that the construction assumptions identified herein are conceptual and are intended to identify worst-case daily impacts. If the Project is built out more slowly and at later dates than those assumed herein, the daily construction intensity would be reduced and associated daily impacts would be generally reduced. Construction activities associated with the Project would involve: (1) site preparation/grading/foundation preparation, and (2) building construction.

The grading and site preparation phase would occur for approximately one month and would require the import of approximately 9,000 cubic yards of soil and an export of approximately 8,000 cubic yards of soil to accommodate the proposed subsurface work extending to depths of up to 10 feet below grade.

Building construction would occur for approximately 17 months and would include the construction of the proposed structure, connection of utilities, laying irrigation for landscaping, architectural coatings, paving and landscaping the Project Site. Paving and architectural coatings would take place concurrently during the final month of building construction.

As stated previously, equipment used throughout the construction process would generally include scrapers, blades, bulldozers, excavators, skid steers, loaders, concrete trucks, dump trucks, and a small crane. Consistent with CalEEMod methodology for a 3.5-acre site, the following maximum daily equipment on site by phase will be assumed.

- Site Preparation/Grading/Foundation Preparation: 1 scraper, 1 excavator, 1 rubber tired dozer, and 3 tractors/loaders/backhoes
- Building Construction: 1 crane, 3 forklifts, 1 generator set, 3 tractors/loaders/backhoes, 1 welder
- Paving: 2 cement and mortar mixers, 1 paver, 2 paving equipment, 2 rollers, 1 tractor/loader/backhoe
- Architectural Coating: 1 air compressor

2.0 ENVIRONMENTAL SETTING

2.1 FUNDAMENTALS OF NOISE & VIBRATION

Noise

Noise is usually defined as unwanted sound that is an undesirable byproduct of society's normal day-to-day activities. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm, and/or when it has adverse effects on health. Noise is measured on a logarithmic scale of sound pressure level known as a decibel (dB). The human ear does not respond uniformly to sounds at all frequencies. For example, the human ear is less sensitive to low and high frequencies than medium frequencies, which more closely correspond with human speech. In response to the sensitivity of the human ear to different frequencies, the A-weighted noise level (or scale), which corresponds better with people's subjective judgment of sound levels, has been developed. This A-weighted sound level, referenced in units of dB(A), is measured on a logarithmic scale such that a doubling of sound energy results in a 3 dB(A) increase in noise level. Typically, changes in a community noise level of less than 3 dB(A) are not noticed by the human ear.[2] Changes from 3 to 5 dB(A) may be noticed by some individuals who are sensitive to changes in noise. A greater than 5 dB(A) increase is readily noticeable, while the human ear perceives a 10 dB(A) increase in sound level to be a doubling of sound.

On the A-weighted scale, the range of human hearing extends from approximately 3 to 140 dB(A). **Table 1, A-Weighted Decibel Scale**, provides examples of A-weighted noise levels from common sources. Noise sources occur in two forms: (1) point sources, such as stationary equipment or individual motor vehicles; and (2) line sources, such as a roadway with a large number of point sources (motor vehicles). Sound generated by a point source typically diminishes (attenuates) at a rate of 6 dB(A) for each doubling of distance from the source to the receptor at acoustically "hard" sites and 7.5 dB(A) at acoustically "soft" sites.[3] For example, if a noise source produces a noise level of 89 dB(A) at a reference distance of 50 feet, the noise level would be 83 dB(A) at a distance of 100 feet from the noise source, 77 dB(A) at a distance of 200 feet, and so on. Noise generated by a mobile source will decrease by approximately 3 dB(A) over hard surfaces and 4.5 dB(A) over soft surfaces for each doubling of distance.

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2 California Department of Transportation (Caltrans), *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, 2013. Available online at: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf, accessed April 23, 2025.

3 Federal Highway Administration, *Highway Noise Fundamentals*, (1980) 97. Examples of "hard" or reflective sites include asphalt, concrete, and hard and sparsely vegetated soils. Examples of acoustically "soft" or absorptive sites include soft, sand, plowed farmland, grass, crops, heavy ground cover, etc.

Table 1
A-Weighted Decibel Scale

Typical A-Weighted Sound Levels	Sound Level (dB(A), Leq)
Threshold of Pain	140
Jet Takeoff at 100 Meters	125
Jackhammer at 15 Meters	95
Heavy Diesel Truck at 15 Meters	85
Conversation at 1 Meter	60
Soft Whisper at 2 Meters	35

Source: United States Occupational Safety & Health Administration, Noise and Hearing Conservation Technical Manual, 1999.

Sound levels also can be attenuated by man-made or natural barriers (e.g., sound walls, berms, and ridges), as well as elevational differences. Noise is most audible when traveling by direct line-of-sight, an interrupted visual path between the noise source and noise receptor. Barriers, such as walls or buildings that break the line-of-sight between the source and the receiver, can greatly reduce noise levels from the source since sound can only reach the receiver by diffraction. However, if a barrier is not high or long enough to break the line-of-sight from the source to the receiver, its effectiveness is greatly reduced.

Solid walls and berms may reduce noise levels by 5 to 10 dB(A) depending on their height and distance relative to the noise source and the noise receptor.[4] Sound levels may also be attenuated 3 dB(A) by a first row of houses and 1.5 dB(A) for each additional row of houses.[5] The minimum noise attenuation provided by typical structures in California is provided in **Table 2, Building Noise Reduction Factors**.

4 Federal Highway Administration, *Highway Noise Mitigation*, (1980) 18.

5 California Department of Transportation (Caltrans), *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, 2013. Available at: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf

Table 2
Building Noise Reduction Factors

Building Type	Window Condition	Noise Reduction Due to Exterior of the Structure (dB(A))
All	Open	10
Light Frame	Ordinary Sash (closed)	20
	Storm Windows	25
Masonry	Single Glazed	25
	Double Glazed	35

Source: Federal Highway Administration, Highway Traffic Noise: Analysis and Abatement Guidance. December 2011.

Sound Rating Scales

Various rating scales approximate the human subjective assessment to the "loudness" or "noisiness" of a sound. Noise metrics have been developed to account for additional parameters, such as duration and cumulative effect of multiple events. Noise metrics are categorized as single event metrics and cumulative metrics, as summarized below.

In order to simplify the measurement and computation of sound loudness levels, frequency weighted networks have obtained wide acceptance. The A-weighted scale, discussed above, has become the most prominent of these scales and is widely used in community noise analysis. Its advantages are that it has shown good correlation with community response and is easily measured. The metrics used in this analysis are all based upon the dB(A) scale.

Equivalent Noise Level

Equivalent Noise Level (Leq) is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as several single event noise exposure level events during a given sample period. Leq is the "acoustic energy" average noise level during the period of the sample. It is based on the observation that the potential for noise annoyance is dependent on the total acoustical energy content of the noise. The equivalent noise level is expressed in units of dB(A). Leq can be measured for any period, but is typically measured for 15 minutes, 1 hour, or 24 hours. Leq for a 1-hour period is used by the Federal Highway Administration (FHWA) for assessing highway noise impacts. Leq for 1 hour is referred to as the Hourly Noise Level (HNL) in the California Airport Noise Regulations and is used to develop Community

Noise Equivalent Level values for aircraft operations. Construction noise levels and ambient noise measurements in this section use the Leq scale.

Community Noise Equivalent Level

Community Noise Equivalent Level (CNEL) is a 24-hour, time-weighted energy average noise level based on the A-weighted decibel. It is a measure of the overall noise experienced during an entire day. The term "time-weighted" refers to the penalties attached to noise events occurring during certain sensitive periods. In the CNEL scale, 5 decibels (dB) are added to measured noise levels occurring between the hours of 7 P.M. and 10 P.M. For measured noise levels occurring between the hours of 10 P.M. and 7 A.M., 10 dB are added. These decibel adjustments are an attempt to account for the higher sensitivity to noise in the evening and nighttime hours and the expected lower ambient noise levels during these periods. Existing and projected future traffic noise levels in this section use the CNEL scale.

Day-Night Average Noise Level

The day-night average sound level (Ldn) is another average noise level over a 24-hour period. Noise levels occurring between the hours of 10 P.M. and 7 A.M. are increased by 10 dB. This noise is weighted to take into account the decrease in community background noise of 10 dB(A) during this period. Noise levels measured using the Ldn scale are typically similar to CNEL measurements.

Adverse Effects of Noise Exposure

Noise is known to have several adverse effects on humans, which has led to laws and standards being set to protect public health and safety, and to ensure compatibility between land uses and activities. Adverse effects of noise on people include hearing loss, communication interference, sleep interference, physiological responses, and annoyance. Each of these potential noise impacts on people is briefly discussed in the following narrative.

Hearing Loss

Hearing loss is generally not a community noise concern, even near a major airport or a major freeway. The potential for noise-induced hearing loss is more commonly associated with occupational noise exposures in heavy industry, very noisy work environments with long-term exposure, or certain very loud recreational activities (e.g., target shooting and motorcycle or car racing). The Occupational Safety and Health Administration (OSHA) identifies a noise exposure limit of 90 dB(A) for 8 hours per day to protect from hearing loss (higher limits are allowed for shorter duration exposures). Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud enough to cause hearing loss.

Communication Interference

Communication interference is one of the primary concerns in environmental noise. Communication interference includes speech disturbance and intrusion with activities such as watching television. Noise can also interfere with communications such as within school classrooms. Normal conversational speech is in the range of 60 to 65 dB(A) and any noise in this range or louder may interfere with speech.

Sleep Interference

Noise can make it difficult to fall asleep, create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter stages, and cause awakening. Noise may even cause awakening that a person may or may not be able to recall.

Physiological Responses

Physiological responses are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, and other physical changes. Studies to determine whether exposure to high noise levels can adversely affect human health have concluded that, while a relationship between noise and health effects seems plausible, there is no empirical evidence of the relationship.

Annoyance

Annoyance is an individual characteristic and can vary widely from person to person. Noise that one person considers tolerable can be unbearable to another of equal hearing capability. The level of annoyance depends both on the characteristics of the noise (including loudness, frequency, time, and duration), and how much activity interference (such as speech interference and sleep interference) results from the noise. However, the level of annoyance is also a function of the attitude of the receiver. Attitudes may also be affected by the relationship between the person affected and the source of noise, and whether attempts have been made to abate the noise.

Vibration

Vibration consists of waves transmitted through solid material. Groundborne vibration propagates from a source through the ground to adjacent buildings by surface waves. Vibration may comprise a single pulse, a series of pulses, or a continuous oscillatory motion. The frequency of a vibrating object describes how rapidly it is oscillating and is measured in hertz (Hz). Most environmental vibrations consist of a composite, or "spectrum" of many frequencies, and are generally classified as broadband or random vibrations. The normal frequency range of most groundborne vibration that can be felt generally starts from a low frequency of less than one Hz to a high of about 200 Hz. Vibration is often measured in terms of the peak

particle velocity (PPV) in inches per second (in/sec) when considering impacts on buildings or other structures, as PPV represents the maximum instantaneous peak of vibration that can stress buildings. Because it is a representation of acute vibration, PPV is often used to measure the temporary impacts of short-term construction activities that could instantaneously damage-built structures. Vibration is often also measured by the root mean squared (RMS) because it best correlates with human perception and response. Specifically, RMS represents "smoothed" vibration levels over an extended period of time and is often used to gauge the long-term chronic impact of a Project's operation on the adjacent environment. RMS amplitude is the average of a signal's squared amplitude. It is most commonly measured in decibel notation (VdB).

Vibration energy attenuates as it travels through the ground, causing the vibration amplitude to decrease with distance away from the source. High frequency vibrations reduce much more rapidly than low frequencies, so that in the far-field from a source, the low frequencies tend to dominate. Soil properties also affect the propagation of vibration. When groundborne vibration interacts with a building, there is usually a ground-to-foundation coupling loss (i.e., the foundation of the structure does not move in sync with the ground vibration), but the vibration can also be amplified by the structural resonances of the walls and floors. Vibration in buildings is typically perceived as rattling of windows or items on shelves, or the motion of building surfaces. At high levels, vibration can result in damage to structures.

Manmade groundborne vibration is generally limited to areas within a few hundred feet of certain types of construction activities, especially pile driving. Road vehicles rarely create enough groundborne vibration to be perceptible to humans unless the road surface is poorly maintained and there are potholes or bumps. If traffic induces perceptible vibration in buildings, such as window rattling or shaking of small loose items (typically caused by heavy trucks in passing), then it is most likely an effect of low-frequency airborne noise or ground characteristics. Human annoyance by vibration is related to the number and duration of events. The more events or the greater the duration, the more annoying it will be to humans.

2.2 NOISE SENSITIVE RECEPTORS

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Recording studios and concert halls are also included in this category. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses. The closest noise-sensitive receptors to the Project Site are: 1) Commercial recording studio to the south (31 feet)

and 2) Marin Health and Wellness Campus to the east along Kerner Boulevard (461 feet). See **Figure 3, Sensitive Receptor Location Map.** It should also be noted the nearest residential uses are the single-family residences to the east, located more than 1,480 feet from the Project Site.

2.3 EXISTING CONDITIONS

Existing Vehicle Traffic Noise Levels

Existing roadway noise levels were calculated for primary roadway segments located in the vicinity of the Project Site. The roadways selected are representative of the segments that would be most impacted by an increase in traffic according to the Project's transportation engineer.[6]

Calculations of the existing roadway noise levels are based on the Federal Highway Administration Highway Noise Prediction Model (FHWA-RD-77-108) and traffic volumes from the Project's Transportation Analysis.[7] The model calculates the average noise level at specific locations based on traffic volumes, average speeds, roadway geometry, and site environmental conditions. The average vehicle noise rates (energy rates) utilized in the FHWA Model have been modified to reflect average vehicle noise rates identified for California by Caltrans. The Caltrans data show that California automobile noise is 0.8 to 1.0 dBA higher than national levels and that medium and heavy truck noise is 0.3 to 3.0 dBA lower than national levels. The average daily noise levels along study area roadway segments are presented in **Table 3, Existing Roadway Noise Levels**.

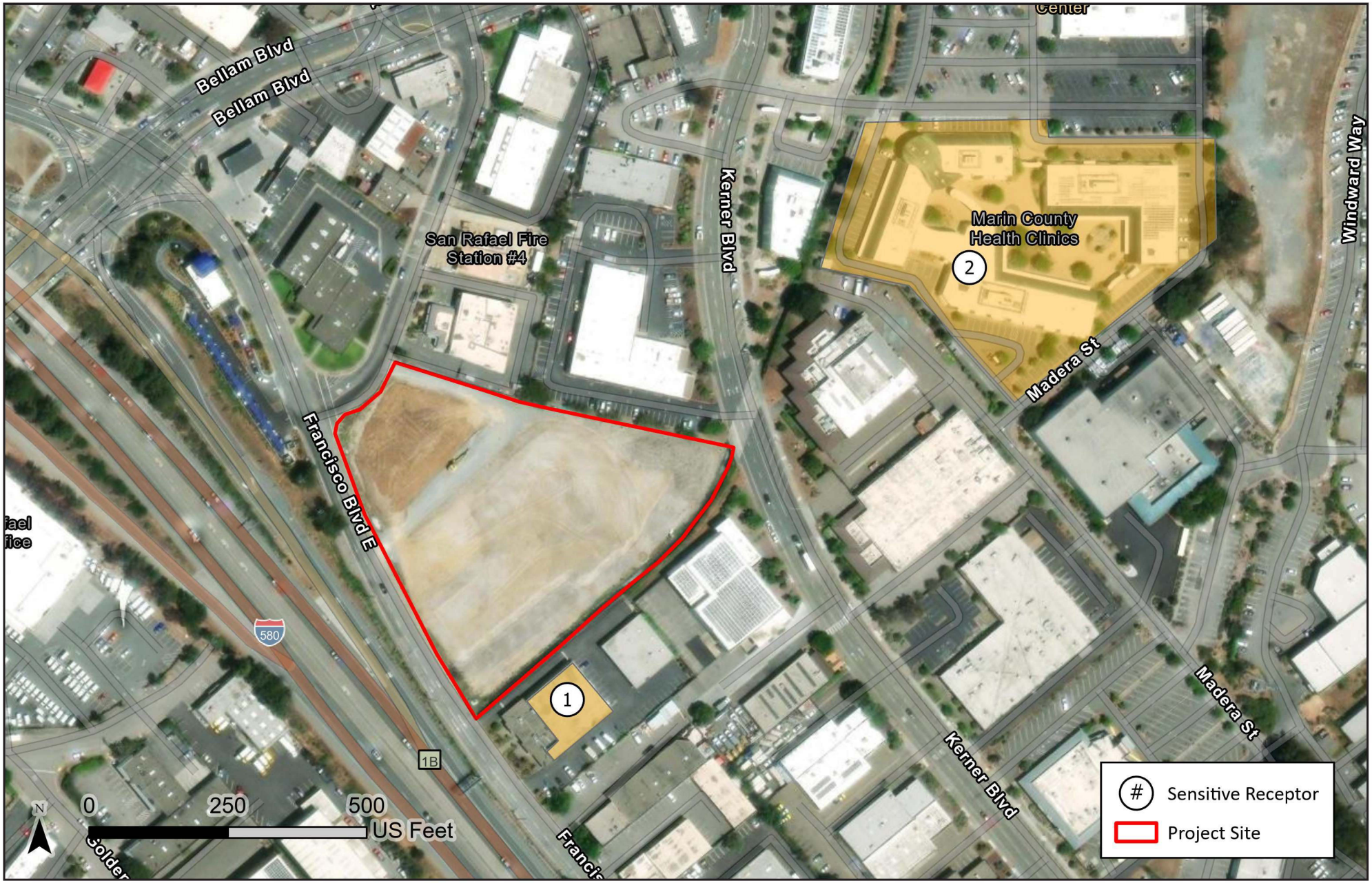
Table 3
Existing Roadway Noise Levels

Roadway	Roadway Segment	Existing Land Uses Along Segment	dBA Ldn
Bellam Blvd	east of Francisco Blvd E	Commercial	65.5
	west of Francisco Blvd E	Commercial	66.8
Francisco Blvd E	north of Bellam Blvd	Commercial	65.5
	south of Bellam Blvd	Commercial	61.1

*Source: Impact Sciences, May 2025. See **Appendix A, Noise Data**.*
Traffic data: idax, Marin Transit Facility at 1075 Francisco Boulevard East, San Rafael, Traffic Memorandum, May 2025.

6 Marin Transit Facility at 1075 Francisco Boulevard East, San Rafael, Traffic Memorandum, May 2025.

7 See **Appendix A** for roadway noise calculations.



SOURCE: Esri, 2025

FIGURE 3

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Sensitive Receptor Location Map

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Existing Groundborne Vibration

The main sources of groundborne vibration near the Project Site are heavy-duty vehicular travel (e.g., refuse trucks, delivery trucks, and transit buses) on local roadways and I-880. Trucks and buses typically generate groundborne vibration velocity levels of around 63 VdB at 50 feet, and these levels could reach 72 VdB where trucks and buses pass over bumps in the road.[8] In terms of PPV levels, a heavy-duty vehicle traveling at a distance of 50 feet can result in a vibration level of approximately 0.001 inch per second.

8 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*. 2018. Available online at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf, accessed April 14, 2025.

3.0 REGULATORY FRAMEWORK

3.1 FEDERAL REGULATIONS

Occupational Health and Safety Act of 1970

Under the Occupational Safety and Health Act of 1970 (29 U.S.C. §1919 et seq.), the Occupational Safety and Health Administration (OSHA) has adopted regulations designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise level exposure as a function of the amount of time during which the worker is exposed. The regulations further specify a hearing conservation program that involves monitoring noise to which workers are exposed, ensuring that workers are made aware of overexposure to noise, and periodically testing the workers' hearing to detect any degradation.[9]

Noise Control Act of 1972

Under the authority of the Noise Control Act of 1972, the United States Environmental Protection Agency (U.S. EPA) established noise emission criteria and testing methods published in Parts 201 through 205 of Title 40 of the Code of Federal Regulations (CFR) that apply to some transportation equipment (e.g., interstate rail carriers, medium trucks, and heavy trucks) and construction equipment. In 1974, U.S. EPA issued guidance levels for the protection of public health and welfare in residential areas of an outdoor Ldn of 55 dB(A) and an indoor Ldn of 45 dB(A). These guidance levels are not standards or regulations and were developed without consideration of technical or economic feasibility. There are no federal noise standards that directly regulate environmental noise related to the construction or operation of the Project. Moreover, the federal noise standards are not reflective of urban environments that range by land use, density, proximity to commercial or industrial centers, etc. As such, for purposes of determining acceptable sound levels to determine and evaluate intrusive noise sources and increases, this document utilizes the City of San Rafael Noise Regulations, discussed below.

Federal Transit Administration Vibration Standards

There are no federal vibration standards or regulations adopted by any agency that are applicable to evaluating vibration impacts from activities associated with the Project. However, the Federal Transit Administration (FTA) has adopted vibration criteria for use in evaluating vibration impacts from construction activities. The vibration damage criteria adopted by the FTA are shown in **Table 4, Construction Vibration Damage Criteria.**

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9 United States Department of Labor, *Occupational Safety and Health Act of 1970*. Available online at: https://www.osha.gov/laws-regs/oshact/completeoshact, accessed April 23, 2024.

Table 4
Construction Vibration Damage Criteria

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

Source: FTA, Transit Noise and Vibration Impact Assessment Manual, 2018.

The FTA has also adopted standards associated with human annoyance for determining the groundborne vibration and noise impacts from ground-borne noise on the following three off-site land-use categories: Vibration Category 1 – High Sensitivity, Vibration Category 2 – Residential, and Vibration Category 3 – Institutional.[10] The FTA defines Category 1 as buildings where vibration would interfere with operations within the building, including vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and university research operations. Vibration-sensitive equipment includes, but is not limited to, electron microscopes, high-resolution lithographic equipment, and normal optical microscopes. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment but that still potentially involve activities that could be disturbed by vibration. The vibration thresholds associated with human annoyance for these three land-use categories are shown in **Table 5, Indoor Ground-Borne Vibration and Ground Borne Noise Impact Criteria for General Vibration Assessment**. No thresholds have been adopted or recommended for commercial or office uses.

10 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, 2018. Available online at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf, accessed October 2, 2023.

Table 5
Indoor Ground-Borne Vibration (GBV) and Ground Borne Noise (GBN) Impact Criteria for General Vibration Assessment

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch/sec)			GBN Impact Levels (dBA re 20 micro Pascals		
	Frequent Events	Occasional Events	Infrequent Events	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB*	65 VdB*	65 VdB*	N/A**	N/A**	N/A**
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

* *This criterion is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a Detailed Vibration Analysis must be performed.*
** *Vibration -sensitive equipment is generally not sensitive to ground-borne noise; however the manufacturer's specifications should be reviewed for acoustic and vibration sensitivity*
Source: FTA, Transit Noise and Vibration Impact Assessment Manual, 2018.

3.2 STATE REGULATIONS

Office of Planning and Research Guidelines for Noise Compatible Land Use

The State of California has not adopted statewide standards for environmental noise, but the Governor's Office of Planning and Research (OPR) has established guidelines for evaluating the compatibility of various land uses as a function of community noise exposure. The City has adopted the compatibility guidelines in the Noise Element of the General Plan based on OPR Guidelines, see **Table 7,** later in this report. California Government Code Section 65302 requires each county and city in the State to prepare and adopt a comprehensive long-range general plan for its physical development, with Section 65302(f) requiring a noise element to be included in the general plan. The noise element must: (1) identify and appraise noise problems in the community; (2) recognize Office of Noise Control guidelines; and (3) analyze and quantify current and projected noise levels.

Caltrans Vibration / Groundborne Noise Standards

The State of California has not adopted Statewide standards or regulations for evaluating vibration or groundborne noise impacts from land use development projects. Although the State has not adopted any vibration standard, Caltrans recommends the following vibration thresholds.[11]

The state noise and vibration guidelines are to be used as guidance with respect to planning for noise, not standards and/or regulations to which the City of San Rafael must adhere.

Table 6
Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (inch/sec)	
	Transient Sources[1]	Continuous/Frequent Intermittent Sources[2]
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.20	0.10
Historic and some old buildings	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial buildings	2.00	0.50

Source: Table 19, Transportation and Construction Vibration Guidance Manual (Caltrans 2020).
1 Transient sources create a single, isolated vibration event, such as blasting or drop balls.
2 Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Title 24, California Code of Regulations

The California Noise Insulation Standards of 1988 (California Code of Regulations Title 24, Section 3501 et seq.) require that interior noise levels from the exterior sources not exceed 45 dB(A) Ldn/community noise equivalent level (CNEL)[12] in any habitable room of a multi-residential use facility (e.g., hotels, motels, dormitories, long-term care facilities, and apartment houses and other dwellings, except detached single-family dwellings) with doors and windows closed. Where exterior noise levels exceed 60 dB(A) CNEL/Ldn,

11 Caltrans, *Transportation and Construction Vibration Guidance Manual*, 2020.

12 Measurements are based on Ldn or CNEL.

an acoustical analysis is required to show that the building construction achieves an interior noise level of 45 dB(A) CNEL/Ldn or less.

3.3 LOCAL PLANS AND POLICIES

City of San Rafael General Plan

The City of San Rafael General Plan contains policies and programs to achieve and maintain noise levels compatible with various types of land uses. The Noise Element provides policy-level direction for the City to limit people's exposure to noise. The following policies are found in the Noise Element of the San Rafael General Plan:

Goal N-1 Acceptable Noise Levels. Protect the public from excessive unnecessary, and unreasonable noise

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.

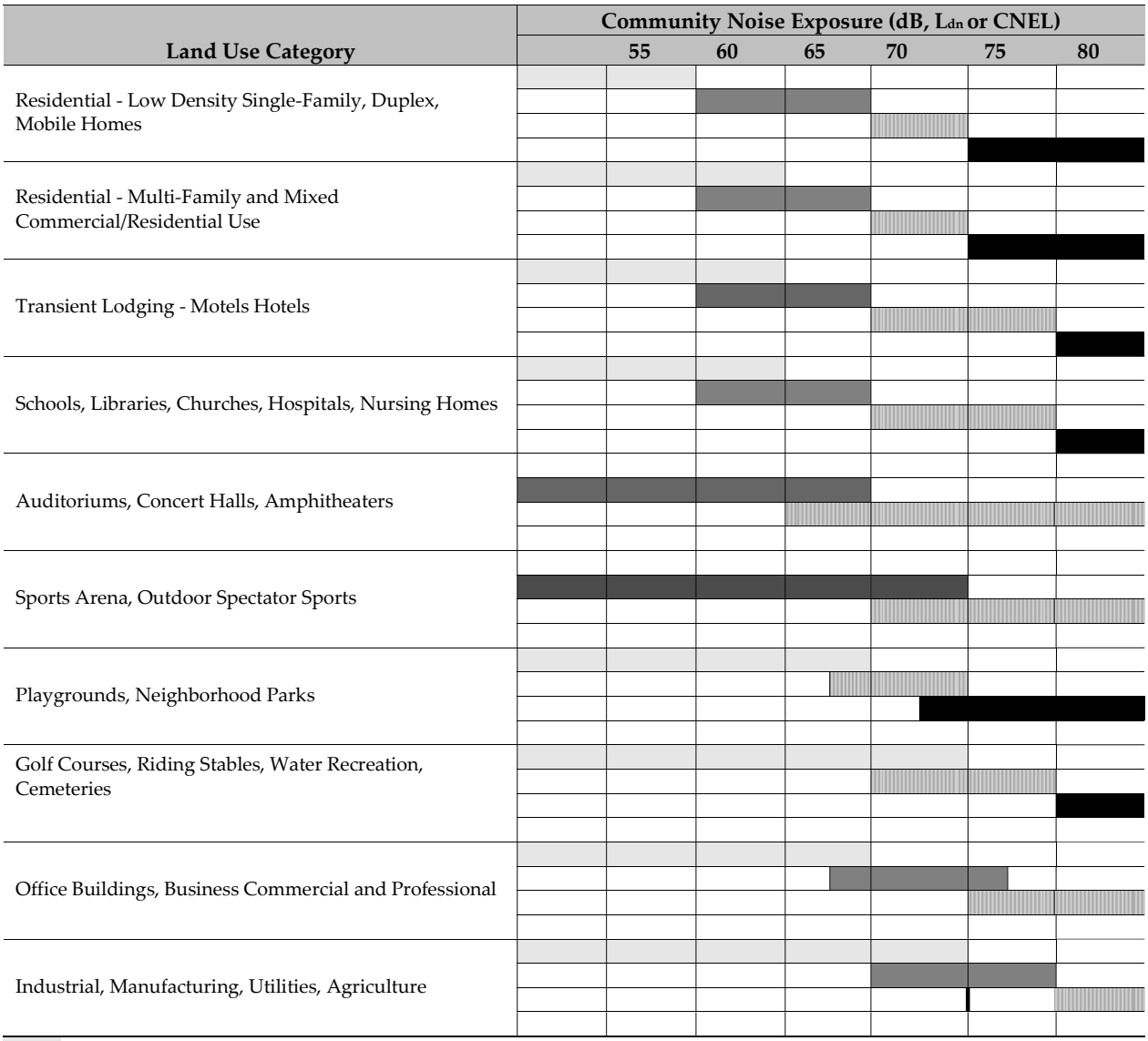
Policy N-1.2 Maintaining Acceptable Noise Levels. Use the following performance standards to maintain an acceptable noise environment in San Rafael: (a) New development shall not increase noise levels by more than 3 dB Ldn in a residential area, or by more than 5 dB Ldn in a non-residential area. (b) New development shall not cause noise levels to increase above the "normally acceptable" levels shown in Table 9-2 of the noise Element. (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-1.6 Traffic Noise. Minimize traffic noise through land use policies, law enforcement, street design and improvements, and site planning and landscaping.

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-1.11 Vibration. Ensure that the potential for vibration is addressed when transportation, construction, and non-residential projects are proposed, and that measures are taken to mitigate potential impacts.

Table 7
Land Use Compatibility for Community Noise Environments



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

Normally Acceptable - New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply system or air conditioning will normally suffice.

Conditionally Acceptable - If new construction or development proceeds, an analysis of the noise reduction requirements should be made and needed noise insulation features included in the design.

Normally Unacceptable - New construction or development should generally not be undertaken, unless it can be demonstrated that an interior level of 45 dBA can be achieved.

**Please note that these guidelines are general and may not apply to specific sites.*

Source: California General Plan Guidelines, 1998, as modified by the City of San Rafael General Plan Noise Element, 2021.

City of San Rafael Municipal Code

The City of San Rafael Municipal Code, Chapter 8.13, specifies noise regulations within the City. Specifically, Section 8.13.040 presents general nose limits for various land uses. The noise limits that pertain to the Project are presented in **Table 8, General Noise Limits** below**.**

Table 8
General Noise Limits

Land Use	Daytime Noise Limits[1]	Nighttime Noise Limits[2]
Residential	60 dBA Intermittent	50 dBA Intermittent
	50 dBA Constant	40 dBA Constant
Mixed Use	65 dBA Intermittent	55 dBA Intermittent
	55 dBA Constant	45 dBA Constant
Multifamily residential (interior sound source)	40 dBA Intermittent	35 dBA Intermittent
	35 dBA Constant	30 dBA Constant
Commercial	65 dBA Intermittent	65 dBA Intermittent
	55 dBA Constant	55 dBA Constant
Industrial	70 dBA Intermittent	70 dBA Intermittent
	60 dBA Constant	60 dBA Constant
Public Property	Most restrictive noise limit applicable to adjoining private property	Most restrictive noise limit applicable to adjoining private property

Source: City of San Rafael Municipal Code (SRMC)
1 Daytime means the period between seven a.m. (7:00 a.m.) and nine p.m. (9:00 p.m.) Sunday through Thursday and between seven a.m. (7:00 a.m.) and ten p.m. (10:00 p.m.) on Friday and Saturday.
2 Nighttime means the period between nine p.m. (9:00 p.m.) and seven a.m. (7:00 a.m.) Sunday through Thursday and between ten p.m. (10:00 p.m.) and seven a.m. (7:00 a.m.) on Friday and Saturday

Section 8.13.050 includes construction noise standards which allows construction Monday through Friday from 7:00 a.m. to 6:00 p.m. and on Saturdays from 9:00 a.m. to 6:00 p.m. Construction is prohibited on Sundays and Holidays. Additionally, noise levels at any point outside of the construction property plane shall not exceed 90 dBA.

4.0 NOISE ANALYSIS

4.1 THRESHOLDS OF SIGNIFICANCE

The impacts of the Project related to noise and vibration would be considered significant if they would exceed any of the following Thresholds of Significance, in accordance with Appendix G of the *California Environmental Quality Act (CEQA) Guidelines*:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the Project Site in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Generation of excessive ground-borne vibration or ground-borne noise levels; and
- For a project located within the vicinity of a private airstrip or 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.

For purposes of this analysis the following thresholds are based on several sources, including the City's General Plan EIR,[13] the FTA's *Transit Noise and Vibration Impact Assessment Manual*,[14] and recent CEQA documentation prepared by the City.

Construction Noise

As discussed previously, SRMC Section 8.13.050 establishes the construction noise thresholds that limits the maximum noise level from construction activity to 90 dBA outside the property line. The City's General Plan EIR interprets this to be at the property line of the nearest noise-sensitive receptor.

Stationary Noise

As with construction noise, the SRMC sets operational noise limits from stationary sources. The SRMC Section 8.13.040 operational noise limits are shown previously in **Table 8**. These limits are used to determine significance for operational noise from stationary and on-site noise sources.

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13 City of San Rafael General Plan 2040 Draft EIR, see Chapter 4.13 (Noise and Vibration). https://storage.googleapis.com/proudcity/sanrafaelca/uploads/2021/01/4.13_Noise.pdf, accessed May 8, 2025.

14 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018.

Mobile Noise

A project will normally have a significant effect on the environment related to mobile noise sources such as traffic if it will substantially increase the ambient noise levels for adjoining areas. Most people can detect changes in sound levels of approximately 3 dBA under normal, quiet conditions, and changes of 1 to 3 dBA are detectable under quiet, controlled conditions. Changes of less than 1 dBA are usually undetectable. A change of 5 dBA is readily audible to most people in an exterior environment. Based on this, the following thresholds of significance are used to assess mobile noise impacts from traffic at sensitive receptor locations:

- Greater than 1.5 dBA increase for ambient noise environments of 65 dBA Ldn and higher
- Greater than 3 dBA increase for ambient noise environments of 60 to 64 dBA Ldn
- Greater than 5 dBA increase for ambient noise environments of less than 60 dBA Ldn

Construction and Operational Vibration

As described previously, there are two types of vibration related impacts; vibration damage to buildings and vibration annoyance to people. The City does not have specific limits or thresholds for vibration.

The FTA provides criteria for acceptable levels of groundborne vibration for various types of buildings identified as Category I, II, and III buildings based on the type of materials they are constructed from. These criteria are used for this analysis and are shown previously in **Table 4**.

The FTA provides criteria associated with human annoyance for determining the groundborne vibration and noise impacts from ground-borne noise on the following three off-site land-use categories: Vibration Category 1 – High Sensitivity, Vibration Category 2 – Residential, and Vibration Category 3 – Institutional. The FTA defines Category 1 as buildings where vibration would interfere with operations within the building, including vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and university research operations. Vibration-sensitive equipment includes, but is not limited to, electron microscopes, high-resolution lithographic equipment, and normal optical microscopes. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment but that still potentially involve activities that could be disturbed by vibration. The vibration thresholds associated with human annoyance for these three land-use categories are shown previously in **Table 5**. No criteria have been adopted or recommended for commercial or office uses.

4.2 METHODOLOGY

Noise levels associated with Project-related construction activities were calculated using the FHWA Roadway Construction Noise Model (RCNM). Noise levels were also compared to the City's noise ordinance, which includes provisions regarding construction noise levels. Specifically, SRMC Section 8.13.050 includes construction noise standards which allows construction Monday through Friday from 7:00 a.m. to 6:00 p.m. and on Saturdays from 9:00 a.m. to 6:00 p.m. Construction is prohibited on Sundays and Holidays. Construction noise and vibration levels have been compared to the thresholds discussed above.

Calculation of Project roadway noise levels was based on the FHWA Noise Prediction Model (FHWA-RD-77-108) and traffic volumes from the Project's traffic analysis. The calculations include the noise level (Ldn) for a particular reference set of input conditions, based on site-specific traffic volumes, distances, speeds and/or noise barriers. Based on the traffic analysis prepared for the Project in combination with an analysis of the surrounding land uses, roadway noise levels were forecasted to determine if the Project's vehicular traffic would result in a significant impact at off-site locations. Roadway noise level increases have been compared to the thresholds discussed above.

The Project's potential to result in significant noise impacts from on-site operational noise sources was assessed by identifying sources of on-site noise sources and considering the impact that they could produce given the nature of the source (i.e., loudness and whether noise would be produced during daytime or more-sensitive nighttime hours), distances to nearby sensitive receptors, surrounding ambient noise levels, the presence of similar noise sources in the vicinity, and maximum allowable noise levels permitted by the SRMC. On-site operational noise levels have been compared to the thresholds discussed above.

4.3 IMPACT ANALYSIS

Impact NOI-1 **Would the Proposed Project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the Project Site in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? *(Less than Significant With Mitigation).***

Construction Impacts

Construction activities associated with the Project would result in temporary noise level increases in the vicinity of the Project Site on an intermittent basis and, as such, could expose nearby sensitive receptors to increased noise levels. The increase in noise at off-site sensitive receptors during construction of each phase of construction under the Project would be temporary in nature and would not generate continuously high

noise levels, although occasional single-event disturbances from construction would occur. Construction noise would typically be higher during the heavier periods of initial construction (i.e., site preparation and grading work) and reduced in the later construction phases (i.e., interior building construction) because the physical structure of the building would break line-of-sight noise transmission from the construction area to the nearby sensitive receivers. Noise levels would fluctuate depending on the construction phase, equipment type and duration of use, distance between the noise source and receivers, and presence or absence of intervening structures, terrain, or other noise attenuation barriers. As shown in **Table 9**, the FHWA RCNM has compiled data regarding the noise-generating characteristics of specific types of construction equipment.

Table 9
Outdoor Construction Equipment Noise Levels

Construction Equipment	Noise Level at 50 Feet (dBA, L_{max})
Auger Drill Rig	84
Backhoe	78
Compactor (ground)	83
Compressor (air)	78
Concrete Mixer Truck	79
Concrete Pump Truck	81
Concrete Saw	90
Crane	81
Dozer	82
Drill Rig Truck	84
Drum Mixer	80
Dump Truck	76
Excavator	81
Flat Bed Truck	74
Front End Loader	79
Generator	81
Gradall	83
Grader	85
Jackhammer	89
Man Lift	75
Mounted Impact Hammer (hoe ram)	90
Paver	77
Pneumatic Tools	85
Pump	81
Roller	80
Scraper	84
Trenching Machine	80
Tractor	84
Vacuum Street Sweeper	82
Welders	74

Source: FHWA Roadway Construction Noise Model User's Guide, 2006.

Table 10, Estimated Construction Noise Levels, shows the maximum expected noise levels at sensitive receptors in the vicinity of the Project Site. The analysis shows the maximum noise levels from the use of equipment anticipated to be used during site preparation, grading and building construction.

Table 10
Estimated Construction Noise Levels

Sensitive Land Uses [a]	Distance to Project Site (feet) [b]	Estimated Construction Noise Levels [dBA Lmax]	Exceed Threshold of 90 dBA Lmax?
1. Commercial Buildings south of the Project Site (recording studio)	31	71.0	No
2. Marin Health and Wellness Facility	461	62.4	No

[a] *See **Figure 3** for locations of sensitive receptors.*
[b] *While the project would include construction activities up to the adjacent property lines, consistent with FTA methodology, these calculations are based on the two loudest pieces from the center of the site. See **Appendix A** to this report.*

As shown in **Table 10**, construction activity would generate noise levels of up to 71.0 dBA Lmax at the nearest sensitive receptor. As such, temporary construction noise would not exceed the City's construction noise threshold of 90 dBA Lmax at the exterior of any sensitive receptor. Furthermore, the Project would be consistent with Section 8.13.050 construction noise standards which allows construction Monday through Friday from 7:00 a.m. to 6:00 p.m. and on Saturdays from 9:00 a.m. to 6:00 p.m. As such, impacts associated with exterior noise during construction would be less than significant.

With respect to potential interior noise levels for Sensitive Receptor No. 1 (recording studio) during Project construction, the FTA has established an interior noise impact criteria of 25 dBA for recording studios.[15] The recording studio operates at 1101 Francisco Boulevard East within a one-story concrete building with no windows on the northern façade fronting the Project Site. Based on these characteristics, the building shell alone would provide an exterior-to-interior attenuation of at least 35 dBA,[16] resulting in an approximate interior noise level of 36 dBA Lmax (71.0 dBA minus 35 dBA). These noise levels would be even further attenuated by insulation associated with recording studio uses. Nevertheless, as the studio-specific noise attenuation is unknown, Project construction has the potential to exceed the FTA's interior noise impact criteria of 25 dBA for recording studios and implementation of **Mitigation Measure (MM) NOI-1** would be required. **MM NOI-1** would reduce construction noise levels by up to approximately 15 dBA, which would reduce exterior construction noise levels to 56.0 dBA Lmax (71.0 dBA minus 15 dBA) at Sensitive Receptor No. 1 (recording studio). As stated above, the building shell alone would provide an

15 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, Table 6-4 (Indoor Ground-Borne Vibration and Noise Impact Criteria for Special Buildings), September 2018.

16 See Table 2, Building Noise Reduction Factors, based on Federal Highway Administration, Highway Traffic Noise: Analysis and Abatement Guidance. December 2011.

exterior-to-interior attenuation of at least 35 dBA, resulting in an approximate interior noise level of 21 dBA Lmax (56.0 dBA minus 35 dBA). Thus, with the implementation of **MM NOI-1**, Project construction noise levels would not exceed the FTA's interior noise impact criteria of 25 dBA at Sensitive Receptor No. 1. This impact would be ***less than significant with mitigation***.

Operational Impacts

On-Site Noise

On-site noise sources during operation of the Project would include parking/vehicular circulation, mechanical equipment (such as HVAC equipment), and facility operations such as bus maintenance and washing. Each of these noise sources is discussed below.

Parking/Vehicular Circulation. The Project will include parking which would be accessible via the northeastern driveway and would provide parking spaces for employees, visitors, and buses. Various noise events would occur periodically from the Project's parking uses. Such periodic events would include activation of car alarms, sounding of car horns, slamming of car doors, engine revs, and tire squeals. It should be noted that the existing urban environment of the Project Site currently generates noise levels associated with these parking and vehicular noise sources. Although the Project would increase the number of vehicles parking in the area, the types of noise would be similar to those currently occurring in the vicinity of the Project Site. Furthermore, pursuant to SRMC Section 8.13.070, the operation of municipal vehicles is exempt from standards established in Chapter 8.13 of the Municipal Code, including the general noise limits provided previously in **Table 8**. Therefore, impacts would be ***less than significant.***

Mechanical Equipment. The operation of the Project would also generate on-site stationary noise from HVAC equipment. Noise from HVAC equipment serving the Project would typically generate noise in the range of 60 to 70 dBA Leq at a reference distance of 15 feet from the building source.[17] Based on the Project Site Plan, the Project's building placement would be located more than 150 from the nearest sensitive receptor to the south of Project Site. Noise from HVAC equipment would attenuate at a rate of approximately 6 dBA per doubling of distance from the source. Thus, HVAC related noise would not exceed 52 dBA Leq at the nearest sensitive receptor, which would be below the 55 dBA standard for commercial uses shown previously in **Table 8**. Furthermore, HVAC units and equipment would likely be located within the mechanical room of the building or shielded from surrounding land uses, serving to block line-of-sight noise transmission to sensitive receptors. Impacts would be ***less than significant***.

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17 Illingworth & Rodkin. *Environmental Noise Assessment for Wal-Mart Expansion, Williamson Ranch Plaza – Antioch, California*. Available at: https://www.antiochca.gov/fc/community-development/planning/Walmart/DEIR-VOLII-APPENDICES-C-H/Appendix%20G%20Noise%20Assessment.pdf Accessed on April, 23, 2024.

The operation of the Project would also generate on-site stationary noise from an emergency generator. Per SRMC Section 8.13.070, stationary generators installed and used during emergencies, utility power outages or routine testing per manufacturer's recommendations are exempt from City of San Rafael Noise Regulations. The emergency generator would adhere to the requirements outlined in Ordinance Number 1977 which describes a portable generator as any UL 2200 listed natural gas and/or propane fired generator permanently connected to the building's electrical system and only intended to provide power during emergencies or utility power outages. Per Ordinance Number 1977, the emergency generators must not exceed 69 dBA during full speed diagnostics and normal operations when measured at 7 meters with no loads, must meet setback requirements for mechanical equipment provided in the City of San Rafael Zoning Ordinance, San Rafael Municipal Code Title 14.[18] Therefore, impacts due to the operation of the emergency generator on site would be ***less than significant***.

Bus Maintenance and Washing. The Project will include maintenance bays and a bus washing station. Noise measurements conducted at an automotive repair shop indicate noise levels from such activities reach approximately 62.1 dBA Leq at a distance of 60 feet.[19] Based on the Project Site Plan, the bus maintenance bays and bus washing station would be enclosed and would be located more than 250 feet from the nearest sensitive receptor to the south of Project Site. Noise from these sources would attenuate at a rate of approximately 6 dBA per doubling of distance from the source. Thus, noise associated bus maintenance and washing would not exceed 50 dBA Leq at the nearest sensitive receptor, which would be below the 55 dBA standard for commercial uses shown previously in **Table 8**. Furthermore, it should be noted that numerous existing adjacent land uses in the vicinity of the Project Site include automotive repair operations and car washing facilities. Thus, the type of noise sources associated with Project operations would not be considered new to the Project area. Impacts would be ***less than significant***.

Off-Site Traffic Noise

The increase in traffic resulting from implementation of the Project would increase ambient noise levels at off-site locations in the Project vicinity. Calculation of Project roadway noise levels was based on the FHWA Noise Prediction Model (FHWA-RD-77-108) and traffic volumes from the Project's traffic analysis. The Calculations include the Ldn noise level for a particular reference set of input conditions, based on site-specific traffic volumes, distances, speeds and/or noise barriers. Based on the traffic analysis prepared for

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18 City of San Rafael, Ordinance Number 1977, available at: https://library.municode.com/ca/san_rafael/ordinances/code_of_ordinances?nodeId=1005826 , accessed July 28, 2025

19 City of Santa Clarita, Noise Report for Residential Project Located at 24753 Valley Street, 2015. Observed noise sources included from vehicle repair such as cars starting/revving, slamming doors, use of power tools, hammering, and hydraulic wrenches.

the Project in combination with an analysis of the surrounding land uses, roadway noise levels were forecasted to determine if the Project's vehicular traffic would result in a significant impact at off-site locations. As the Project would have the potential to add 176 vehicle trips per day, which includes 64 daily bus trips and 112 daily employee car trips to the area, the "Plus Project" scenarios reflect the potential increases along roadways that would accommodate future passenger vehicle and bus trips. The Project-related increases in noise levels at the primary roadway segments located in proximity to the Project Site are identified in **Table 11, Existing Plus Project Roadway Noise Levels**.

Table 11
Existing Plus Project Roadway Noise Levels

		dBA Ldn		
Roadway	**Roadway Segment**	**Existing** [1]	**Existing Plus Project** [2]	**Project Net Increase** [2] – [1]
Bellam Blvd	east of Francisco Blvd E	65.5	65.5	0.0
	west of Francisco Blvd E	66.8	66.8	0.0
Francisco Blvd E	north of Bellam Blvd	65.8	65.8	0.0
	south of Bellam Blvd	61.1	61.2	0.1

*Source: Impact Sciences, May 2025. See **Appendix A, Noise Data**.*
Traffic data: idax, Marin Transit Facility at 1075 Francisco Boulevard East, San Rafael, Traffic Memorandum, May 2025.

As shown in **Table 11**, the Project would increase local roadway noise levels by a maximum of 0.1 dBA Ldn during the Project buildout scenario, which would be less than the 1.5 dBA Ldn threshold identified previously. As such, the Project's traffic-related noise level increases would not exceed thresholds of significance, and off-site traffic noise levels associated with the Project would be ***less than significant***.

Mitigation Measures (Impact NOI-1)

NOI-1: Barriers, such as plywood structures or flexible sound control curtains shall be erected along the southern perimeter of the construction site, and around stationary equipment as feasible (i.e., generators, air compressors, etc.) to minimize the amount of noise during construction on Sensitive Receptor No. 1. Perimeter barriers shall be at least eight (8) feet

in height and constructed of materials achieving a Transmission Loss (TL) value of at least 15 dB(A), such as ½ inch plywood.[20]

Impact NOI-2 **Would the Proposed Project result in the generation of excessive groundborne vibration or groundborne noise levels? *(Less than Significant With Mitigation).***

Construction Impacts

As stated previously, the FTA provides ground-born vibration impact criteria with respect to building damage during construction activities. PPV, expressed in inches per second, is used to measure building vibration damage. Construction vibration damage criteria are assessed based on structural category (e.g., reinforced-concrete, steel, or timber). See **Table 4**, above. It should be noted there are no known off-site historic buildings or buildings that are extremely susceptible to vibration damage within proximity to the Project Site.

Equipment used throughout the Project's construction process would generally include scrapers, blades, bulldozers, excavators, skid steers, loaders, concrete trucks, dump trucks, and a small crane. Based on FTA data,[21] a large bulldozer generates the highest vibration levels of these equipment, measuring at 0.089 PPV and 87 VdB at a distance of 25 feet. Based on this FTA vibration source data, construction vibration levels were calculated for the nearest off-site buildings to the Project Site and are shown below in **Table 12, Vibration Levels at Off-Site Structures from Project Construction.**

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20 Based on the FHWA Noise Barrier Design Handbook, Table 3, Approximate sound transmission loss values for common materials, February 2000, updated August 24, 2017.

21 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018, see Table 7-4, Vibration Source Levels for Construction Equipment.

Table 12
Vibration Levels at Off-Site Structures from Project Construction

Off-Site Structures[a]	Distance to Project Site (ft)	Receptor Significance Threshold PPV (in./sec)/RMS (VdB)	Estimated PPV (in/sec)/RMS (VdB)
1. Commercial buildings south of the Project Site (including recording studio)	31	0.3/65	0.064/84
2. Commercial buildings northeast of the Project Site	56	0.3/--[b]	0.027/76

[a] *See **Figure 3** for locations of off-site structures.*
[b] *There is no applicable annoyance threshold for commercial buildings without sensitive interior operations.*
*These calculations are based on distance from the site boundary to the structures. See **Appendix A** to this report.*

The vibration velocities predicted to occur at the nearest buildings to the Project Site would be 0.064 inch/sec PPV. The building to the northeast was built in 1978, and the structures to the south were built in 1971.[22] According to City records, all adjacent buildings are commercial structures. For these reasons, this analysis applies the vibration damage criterion of 0.30 inch/sec PPV for "engineered concrete and masonry" to all nearby buildings pursuant to FTA guidance. As shown in **Table 12,** vibration levels at these structures would not exceed the vibration damage criterion of 0.30 inch/sec PPV during construction activities at the Project Site. It should also be noted that if the FTA's more protective vibration damage criterion of 0.20 inch/sec PPV for "non-engineered timber and masonry buildings" is applied for the nearby structures, the Project's construction-related vibration levels would also not exceed that criterion. As such, construction vibration impacts associated with building damage would be ***less than significant***.

With regard to human annoyance, this analysis uses the FTA's vibration impact criteria as thresholds for human annoyance. These criteria utilize the root mean square (RMS) velocity to describe human response and is measured using vibration decibels (VdB). See **Table 4**, above. As shown in **Table 12**, vibration levels at off-site structure No. 1 (recording studio) could reach 84 VdB when heavy equipment, such as a large bulldozer, operates along the southern property line (i.e., within 31 feet of the receptor). Based on FTA guidance, recording studios are considered a Cateogry I land use and have a groundborne vibration impact criteria of 65 VdB. As such, the FTA's 65 VdB impact criteria could be exceeded at off-site structure No. 1 (recording studio) and implementation of **MM NOI-2** and **MM NOI-3** is required. It is noted that all other uses operating within the adjacent commercial buildings do not have vibration-sensitive interior

22 County of Marin, MarinMap, 2025. Available at: https://www.marinmap.org/Html5Viewer/Index.html?viewer=smmdataviewer , accessed April 30, 2025.

operations, and construction-related vibration impacts associated with human annoyance on those uses would be less than significant.

With respect to construction-related vibration impacts at off-site structure No. 1 (recording studio), **MM NOI-2** would prohibit the use of heavy construction equipment, such as a large bulldozer, to areas at a minimum distance of 140 feet from off-site structure No. 1 (recording studio), or approximately 109 feet from the Project Site's southern property line. Smaller equipment, such as a small bulldozer, can be used up to the Project Site's southern property line without exceeding the FTA's 65 VdB impact criteria at off-site structure No. 1 (recording studio). See **Table 13, Mitigated Vibration Levels at Off-Site Structure No. 1 (Recording Studio)**.

In the event that heavy construction equipment, such as a large bulldozer or any piece of equipment capable of generating vibration levels of 0.089 PPV and 87 VdB or greater at a distance of 25 feet, is required to be used within 140 feet from off-site structure No. 1 (recording studio), or approximately 109 feet from the Project Site's southern property line, implementation of **MM NOI-3** is required. Implementation of **MM NOI-3** would ensure that the use of any heavy construction equipment within 140 feet of off-site structure No. 1 (recording studio) would be appropriately scheduled, noticed, and coordinated so as not to conflict with planned operations within the recording studio. As such, with the implementation of **MM NOI-2** and **MM NOI-3**, construction-related vibration impacts at off-site structure No. 1 (recording studio) would be ***less than significant with mitigation***.

Table 13
Mitigated Vibration Levels at Off-Site Structure No. 1 (Recording Studio)

Off-Site Structure No. 1 (Recording Studio)	Distance from Activity (ft.)	Receptor Significance Threshold RMS (VdB)	Estimated RMS (VdB)
Use of small bulldozer	31	65.0	55.2
Use of large bulldozer	140	65.0	64.6

[a] *See **Figure 3** for locations of off-site structures. See **Appendix A** to this report.*

Operational Impacts

Project operations would not involve activities that result in substantial vibration levels (e.g., blasting operations). Operational groundborne vibration in the vicinity of the Project Site would be primarily associated with vehicular travel, including buses, on local roadways. However, according to the FTA *Transit Noise and Vibration Impact Assessment* guidance document, rubber tires and suspension systems

dampen vibration levels to a level that is rarely perceptible.[23] Therefore, impacts related to operational vibration would be ***less than significant***.

Mitigation Measures (Impact NOI-2)

MM NOI-2: The construction contractor shall prohibit the use of heavy construction equipment (such as a large bulldozer or any piece of equipment capable of generating vibration levels of 0.089 PPV and 87 VdB or greater at a distance of 25 feet) to areas at a minimum distance of 140 feet from off-site structure No. 1 (recording studio), or approximately 109 feet from the Project Site's southern property line. Smaller equipment, such as a small bulldozer, can be used up to the Project Site's southern property line.

MM NOI-3: If heavy construction equipment (such as a large bulldozer or any piece of equipment capable of generating vibration levels of 0.089 PPV and 87 VdB or greater at a distance of 25 feet) is required to be used within 140 feet of off-site structure No. 1 (recording studio), or approximately 109 feet from the Project Site's southern property line, the construction contractor shall provide written notice to the recording studio 60 days in advance of such activity. The written notice shall identify the dates of activity, the hours of activity, types of equipment to be used, and the vibration levels anticipated at off-site structure No. 1 (recording studio).

Impact NOI-3 **For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport, would the project expose people residing or working in the project area to excessive noise levels? *(No Impact).***

The Project Site is not in the vicinity of a private airstrip or airport land use plan. Likewise, the Project Site is not located within an airport land use plan or within two miles of a public airport or public use airport. The closest airport is the San Rafael Airport which is located approximately 6.3 miles from the Project Site. As such, the Project would not expose people residing or working in the project area to excessive airport-related noise levels. ***No impact would occur***.

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23 Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, 2018. Available online at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf, accessed March 21, 2025.

4.4 CUMULATIVE ANALYSIS

This cumulative impact analysis considers development of the Project in combination with ambient growth and other development projects within the vicinity. As noise is a localized phenomenon and decreases in magnitude as distance from the source increases, only projects and ambient growth in the nearby area could combine with the Project to result in cumulatively considerable noise impacts.

Construction

Construction activities associated with the Project may overlap with construction activities for other development projects that are in the vicinity of the Project Site. Typically, if a development site is 500 feet or more away from another site, then noise levels would have attenuated to a point that they would not combine to produce a cumulative noise impact. Therefore, construction noise levels would potentially become cumulative if two development sites were to have construction occurring within 500 feet of each other. According to the City of San Rafael Planning Division,[24] the nearest related project to the Project Site is located approximately 1.1 miles (6,042 feet) north of the Project Site. Based on the distance to this related project, construction impacts would not have the potential to create a cumulative noise impact at any sensitive receptors. Furthermore, like the Project, all related projects in the City would be required to comply with the SRMC, which limits the hours of allowable construction activities. In addition, each of the related projects could be subject to additional project-specific mitigation measures aimed at the reduction of construction noise and vibration levels. As such, cumulative impacts with respect to construction noise and vibration would be ***less than significant***.

Operational

Cumulative mobile source noise impacts would occur primarily as a result of increased traffic on local roadways due to the Project, ambient growth, and related projects/cumulative development within the study area. As discussed in the Project's traffic analysis, a horizon year of 2040 is utilized to evaluate cumulative conditions, which captures projects in the nearby area that are anticipated to be built in the horizon. **Table 14, Future (2040) Roadway Noise Levels**, identifies cumulative traffic-generated noise impacts based on the contribution of the Project to the Future Without Project (2040) volumes on the roadway segments in the Project vicinity. **Table 14**, column [3] minus column [1], illustrates the increase in cumulative roadway noise levels with the Project for future year 2040 compared to existing conditions (i.e., existing conditions, plus project, plus ambient growth, plus related projects/cumulative development).

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24 City of San Rafael Planning Division, Major Planning Projects, available at: https://www.cityofsanrafael.org/major-planning-projects-2025/ , accessed May 5, 2025.

As described previously, a significant impact would occur when noise levels increase by more than 1.5 dBA for ambient noise environments of 65 dBA Ldn and higher, or by more than 3 dBA for ambient noise environments of 60 to 64 dBA Ldn. As shown in **Table 14**, the cumulative 2040 scenario (i.e., Future 2040 With Project minus existing conditions) would generate a maximum increase of 2.6 dBA Ldn for the roadway segment of Francisco Boulevard East south of Bellam Boulevard, which would not exceed the 3 dBA Ldn threshold for ambient noise environments of 60 to 64 dBA Ldn. Also shown in **Table 14**, the cumulative 2040 scenario (i.e., Future 2040 With Project minus existing conditions) would generate a maximum increase of 1.1 dBA Ldn for the roadway segment of Francisco Boulevard East north of Bellam Boulevard, which exceeds the 1.5 dBA increase for ambient noise environments of 65 dBA Ldn and higher. However, as shown in **Table 14**, the Project would not contribute any noise increase to this roadway segment (see column [3] minus column [2]), and the noise increase to this roadway segment is due to cumulative conditions without the Project (see column [2]). As such, Project traffic would not make a considerable contribution to cumulative traffic-related noise levels and cumulative impacts would be ***less than significant***.

Table 14
Future (2040) Roadway Noise Levels

		dBA Ldn				
Roadway	**Roadway Segment**	**Existing [1]**	**Future 2040 Without Project [2]**	**Future 2040 With Project [3]**	**Project Net Increase [3] – [2]**	**Cumulative Future With Project Net Increase [3] – [1]**
Bellam Blvd	east of Francisco Blvd E	65.5	65.5	65.5	***0.0***	***0.0***
	west of Francisco Blvd E	66.8	67.2	67.3	***0.1***	***0.5***
Francisco Blvd E.	north of Bellam Blvd	65.8	66.9	66.9	***0.0***	***1.1***
	south of Bellam Blvd	61.1	63.7	63.7	***0.0***	***2.6***

Source: Impact Sciences, May 2025. See ***Appendix A, Noise Data****.*
Traffic data: idax, Marin Transit Facility at 1075 Francisco Boulevard East, San Rafael, Traffic Memorandum, May 2025.

5.0 REFERENCES

California Department of Transportation (Caltrans), *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, 2013. Available online at: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf, accessed April 23, 2025.

Caltrans, *Transportation and Construction Vibration Guidance Manual*, 2020.

City of San Rafael General Plan 2040 Draft EIR, see Chapter 4.13 (Noise and Vibration). https://storage.googleapis.com/proudcity/sanrafaelca/uploads/2021/01/4.13_Noise.pdf, accessed May 8, 2025.

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City of San Rafael Planning Division, Major Planning Projects, available at: https://www.cityofsanrafael.org/major-planning-projects-2025/ , accessed May 5, 2025.

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Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual.* 2018. Available online at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf, accessed April 14, 2025.

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Marin Transit Facility at 1075 Francisco Boulevard East, San Rafael, Traffic Memorandum, May 2025.

United States Department of Labor, *Occupational Safety and Health Act of 1970*. Available online at: https://www.osha.gov/laws-regs/oshact/completeoshact, accessed April 23, 2024.

APPENDIX A

Noise and Vibration Technical Data

Report date: 5/8/2025
Case Description: Bus Charging and Maintenance Facility (Construction)

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Commercial Recording Studio	Commercia	60	60	60

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	251	0
All Other Equipment > 5 HP	No	50	85		251	0

Results

Calculated (dBA)

Equipment	*Lmax	Leq
Crane	66.5	58.6
All Other Equipment > 5 HP	71	68
Total	71	68.4

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Marin Health and Wellness Facility	Commercia	60	60	60

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	676	0
All Other Equipment > 5 HP	No	50	85		676	0

Results

Calculated (dBA)

Equipment	*Lmax	Leq

Crane		57.9	50
All Other Equipment > 5 HP		62.4	59.4
	Total	62.4	59.8

*Calculated Lmax is the Loudest value.

Report date: 5/8/2025
Case Description: Bus Charging and Maintenance Facility (Grading)

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Commercial Recording Studio	Commercia	60	60	60

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Scraper	No	40		83.6	251	0
Excavator	No	40		80.7	251	0

Results

Calculated (dBA)

Equipment	*Lmax	Leq
Scraper	69.6	65.6
Excavator	66.7	62.7
Total	69.6	67.4

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Marin Health and Wellness Facility	Commercia	60	60	60

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Scraper	No	40		83.6	676	0
Excavator	No	40		80.7	676	0

Results

Calculated (dBA)

Equipment	*Lmax	Leq

Scraper		61	57
Excavator		58.1	54.1
	Total	61	58.8

*Calculated Lmax is the Loudest value.

TRAFFIC NOISE LEVELS

Project Name: Zero Emissions Bus Charging and Maintenance Facility Project

Background Information

Model Description:	FHWA Highway Noise Prediction Model with California Vehicle Noise (CALVENO) Emission Levels.
Analysis Scenario(s):	Existing, Existing Plus Project, Cummulative without Project, Cummulative with Project
Source of Traffic Volumes:	Marin Transit Facility Traffic Impact Analysis, idax, 2025.
Community Noise Descriptor:	x

Assumed 24-Hour Traffic Distribution:	(Ldn) Day	Evening	(CNEL) Night
Total ADT Volumes	77.70%	12.70%	9.60%
Medium-Duty Trucks	87.43%	5.05%	7.52%
Heavy-Duty Trucks	89.10%	2.84%	8.06%

Traffic Noise Levels

Analysis Condition / Roadway Name / Roadway Segment	Lanes	Median Width	Peak Hour Volume	ADT Volume	Design Speed (mph)	Dist. from Center to Receptor[1]	Alpha Factor	Barrier Attn. dB(A)	Vehicle Mix Medium Trucks	Vehicle Mix Heavy Trucks	24-Hour dB(A) Ldn
Existing Traffic Noise											
Bellam Blvd											
east of Fracisco Blvd E	5	10	2,086	20,855	25	50	0	0	1.8%	0.7%	65.5
west of Francisco Blvd E	5	10	2,841	28,405	25	50	0	0	1.8%	0.7%	66.8
Francisco Blvd E											
north of Bellam Blvd	2	0	1,092	10,920	30	30	0	0	1.8%	0.7%	65.8
south of Bellam Blvd	2	0	551	5,505	25	30	0	0	1.8%	0.7%	61.1
Existing Plus Project Traffic Noise											
Bellam Blvd											
east of Fracisco Blvd E	5	10	2,090	20,895	25	50	0	0	1.9%	0.7%	65.5
west of Francisco Blvd E	5	10	2,845	28,450	25	50	0	0	1.9%	0.7%	66.8
Francisco Blvd E											
north of Bellam Blvd	2	0	1,093	10,930	30	30	0	0	1.9%	0.7%	65.8
south of Bellam Blvd	2	0	564	5,640	25	30	0	0	1.9%	0.7%	61.2
Cummulative without Project (2040 GP)Traffic Noise											
Bellam Blvd											
east of Fracisco Blvd E	5	10	2,100	21,000	25	50	0	0	1.8%	0.7%	65.5
west of Francisco Blvd E	5	10	3,145	31,450	25	50	0	0	1.8%	0.7%	67.2
Francisco Blvd E											
north of Bellam Blvd	2	0	1,415	14,150	30	30	0	0	1.8%	0.7%	66.9
south of Bellam Blvd	2	0	1,000	10,000	25	30	0	0	1.8%	0.7%	63.7
Cummulative Plus Project (2040 GP) Traffic Noise											
Bellam Blvd											
east of Fracisco Blvd E	5	10	2,104	21,040	25	50	0	0	1.9%	0.7%	65.5
west of Francisco Blvd E	5	10	3,150	31,495	25	50	0	0	1.9%	0.7%	67.3
Francisco Blvd E											
north of Bellam Blvd	2	0	1,416	14,160	30	30	0	0	1.9%	0.7%	66.9
south of Bellam Blvd	2	0	1,004	10,035	25	30	0	0	1.9%	0.7%	63.7

[1] Distance in feet from the roadway centerline to nearest receptor location.

[2] Typical noise levels for truck @ 50 feet is 84 dBA per FTA table 7-1; According to FTA Table 4-11 diesel powered bus noise levels @ 50 feet is 82 dBA
While medium duty trucks present a higher noise level than diesel busses, this analysis conservatively utilizes the FTA guidelines for medium duty trucks to analyze diesel bus roadway noise levels

Zero Emissions Bus Charging and Maintenance Facility			Commercial Buildings and recording
Ref=	Reference vibration level (PPV)		studio south of the Project Site
RefD=	Reference distance for Reference vibration level (Feet)		
	Vibration PPV		
	Ref=	0.089	Based on type of equipment
	RefD=	25	
	D=	31	Distance from equipment to sensitive receptor
	Equip=	0.064	
	Annoyance VdB		
	Ref=	87	Based on type of equipment
	RefD=	25	
	D=	31	Distance from equipment to sensitive receptor
	Equip=	84	

Peak construction vibration based on utilizing a large bulldozer.

Source: FTA Tranist Noise and Vibration Impact Assessment, 2018

Zero Emissions Bus Charging and Maintenance Facility Commercial Buildings northeast of the Project Site

Ref= Reference vibration level (PPV)

RefD= Reference distance for Reference vibration level (Feet)

Vibration PPV		
Ref=	0.089	Based on type of equipment
RefD=	25	
D=	56	Distance from equipment to sensitive receptor
Equip=	0.027	
Annoyance VdB		
Ref=	87	Based on type of equipment
RefD=	25	
D=	56	Distance from equipment to sensitive receptor
Equip=	76	

Peak construction vibration based on utilizing a large bulldozer.

Source: FTA Tranist Noise and Vibration Impact Assessment, 2018

Zero Emissions Bus Charging and Maintenance Facility Commercial Buildings and
Ref= Reference vibration level (PPV) recording studio south of the Project
RefD= Reference distance for Reference vibration level (Feet)

Vibration PPV		
Ref=	0.003	Based on type of equipment
RefD=	25	
D=	31	Distance from equipment to sensitive receptor
Equip=	0.002	
Annoyance VdB		
Ref=	58	Based on type of equipment
RefD=	25	
D=	31	Distance from equipment to sensitive receptor
Equip=	55.2	

Peak construction vibration based on utilizing a small buldozer.
Source: FTA Tranist Noise and Vibration Impact Assessment, 2018

Zero Emissions Bus Charging and Maintenance Facility — Commercial Buildings and recording studio south of the Project Site

Ref= Reference vibration level (PPV)

RefD= Reference distance for Reference vibration level (Feet)

Vibration PPV		
Ref=	0.089	Based on type of equipment
RefD=	25	
D=	140	Distance from equipment to sensitive receptor
Equip=	0.007	
Annoyance VdB		
Ref=	87	Based on type of equipment
RefD=	25	
D=	140	Distance from equipment to sensitive receptor
Equip=	64.6	

Peak construction vibration based on utilizing a large bulldozer.

Source: FTA Tranist Noise and Vibration Impact Assessment, 2018