Kimley»Horn

MEMORANDUM

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From:	Ace Malisos, Air Quality and Noise Manager, Kimley-Horn Noemi Wyss AICP, Environmental Planner, Kimley-Horn Kimley-Horn and Associates, Inc.
Date:	April 5, 2023
Subject:	Alameda County Rail Safety Enhancement Program – Acoustical Analysis Alameda County ISMND

1.0 PURPOSE

The purpose of this memorandum is to identify the acoustical impacts associated with construction and operations of eight at-grade rail crossings, located in the cities of San Leandro and Hayward in Alameda County and in unincorporated Alameda County, California. Crossings are existing and located from the central to southern portion of San Leandro to the southern portion of Hayward. This analysis has been undertaken to analyze whether the proposed project would result in any significant environmental impacts related to noise and vibration.

2.0 PROPOSED PROJECT DESCRIPTION

The proposed project is located in the cities of San Leandro and Hayward in Alameda County and in unincorporated Alameda County, California. The project site consists of eight existing at-grade rail crossings. The crossings are along Union Pacific Railroad (UPRR) tracks where UPRR tracks intersect with local streets. Each of the crossings are listed in **Table 1** below, noting the jurisdiction and local street intersections. The Map ID number corresponds to crossing locations shown on **Figure 1**.

Table 1: Crossing Locations

Jurisdiction	Intersection	Map ID
San Leandro	Marina Boulevard (Coast Subdivision)	1
San Leandro	Washington Avenue	2
San Leandro	Hesperian Boulevard	3
Unincorporated Alameda County	Lewelling Boulevard	4
Hayward	Liedig Court – Trespass Location 1	5
Hayward	Tennyson High School Pedestrian Crossing (near Schafer Road)	6
Hayward	Tennyson Road	7
Hayward	Industrial Parkway	8
Source: Alameda CTC, 2021		

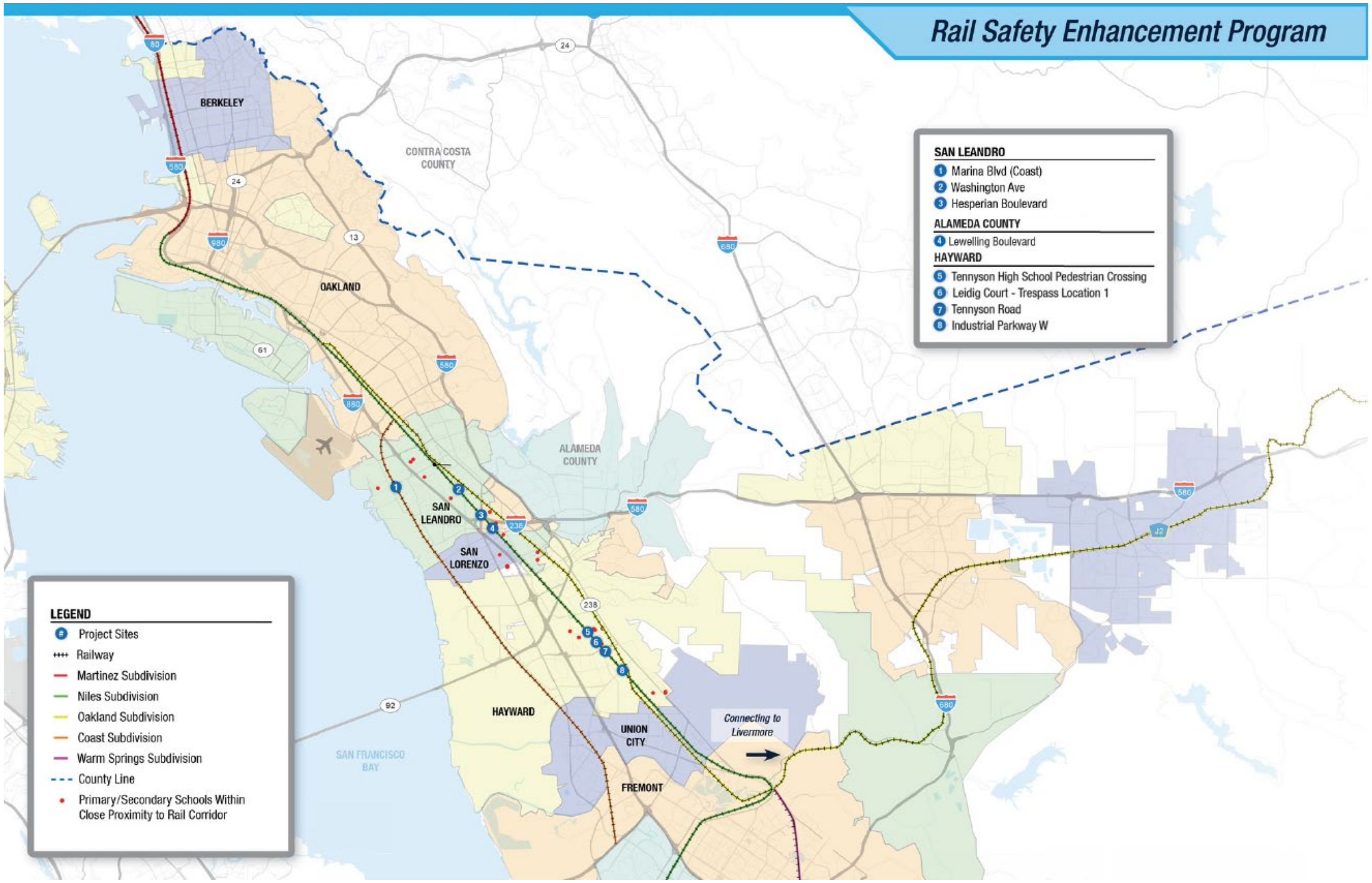

Figure 1: Project Site Map

The Hesperian Boulevard, Lewelling Boulevard, and Industrial Parkway crossings take place on major arterials while the rest of the crossing are located on smaller one- or two-lane streets. Each crossing location is largely paved and separated from adjacent land uses by walls or fencing. Each crossing generally includes a vehicular gate for each direction of travel, warning device, concrete crossing panels, and street lighting. The existing conditions at each crossing location are described in detail in **Table 2**.

Table 2: Existing Conditions

Intersection	Description	Map ID
Marina Boulevard (Coast Subdivision)	Marina Boulevard extends northeast-southwest through this crossing with two lanes of travel in either direction separated by striping. A continuous sidewalk is present along the north side of Marina Boulevard but the sidewalk on the south side does not extend through the rail crossing in the southwest direction. Vegetation is limited to landscaping associated with adjacent businesses on the north side of Marina Boulevard. A transmission tower for power lines is located approximately 50 feet east of the crossing. The UPRR corridor contains two parallel rail lines in this location.	1
Washington Avenue	Washington Avenue extends north-south through this crossing with two lanes of travel in either direction separated by a mix of concrete median and plastic pylons. The area between Washington Avenue and Chapman Road to the west is unpaved and contains several mature trees. Continuous sidewalks run along each side of Washington Avenue. The UPRR corridor contains a single rail line in this location.	2
Hesperian Boulevard	Hesperian Boulevard extends in a north-south direction through this crossing with three lanes of travel in either direction separated by a concrete median. Sidewalks extend along each side of Hesperian, allowing pedestrians to cross the tracks at-grade. Vegetation is limited to small-scale landscaping associated with adjacent businesses and homes. The UPRR corridor contains a single rail line in this location.	3
Lewelling Boulevard	Lewelling Boulevard extends east-west through this crossing with two lanes of travel in each direction separated by a landscaped median. San Lorenzo High School is located immediately to the north and a residential neighborhood abuts the crossing to the south. Continuous sidewalks extend along Lewelling Boulevard on each side. The UPRR corridor contains a single rail line in this location.	4
Liedig Court – Trespass Location 1	Liedig Court extends in a northeast direction through this crossing with one lane of travel in each direction. Cesar Chavez Middle School is located immediately east, and a residential neighborhood abuts the crossing the west. Continuous sidewalk extends along the western side of Liedig Court. The UPRR corridor contains a single rail line in this location.	5

Intersection	Description	Map ID
Tennyson High School Pedestrian Crossing (near Schafer Road)	The existing pedestrian crossing at Tennyson High School extends from the sidewalk northeast of Huntwood Avenue near Schafer Road, northeast across the UPRR tracks to the high school. Huntwood Avenue runs parallel to the UPRR tracks and contains one lane of travel in either direction with Class II bicycle lanes striped on both sides. The pedestrian crossing contains stairs and an ADA-accessible ramp along with signage and lighting to warn of trains crossing. Given that no automobile traffic crosses the UPRR tracks in this location, no vehicular gate or arm is present. Many mature trees associated with the high school are present on the northeast side of the UPRR tracks.	6
Tennyson Road	Tennyson Road extends in a northeast-southwest direction through this crossing with two lanes of travel in each direction separated by a vegetated median. Class II bicycle lanes are striped in both directions along Tennyson Road and sidewalk facilities allow pedestrians to cross the UPRR tracks at grade. Cesar Chavez Middle School is located immediately to the north of this intersection and a residential neighborhood is located immediately to the east behind a wall. The UPRR corridor contains a single rail line in this location.	7
Industrial Parkway	Industrial Parkway extends in a northeast-southwest direction through this crossing with three lanes of travel in either direction separated by a vegetated median. A drainage ditch runs parallel to Industrial Parkway along the southeastern side. A single-family residential neighborhood abuts the crossing to the west behind a wall. Sidewalks are present north and south of the UPRR tracks along the northwestern side of Industrial Parkway, but no pedestrian facilities extend across the tracks. The UPRR corridor contains a single rail line in this location.	8
Source: Circlepoint, 2021		

The project consists of rail safety improvements to existing at-grade rail crossings. The improvements are designed to increase safety for all motorists and pedestrians. This includes restricting access to UPRR tracks, improving signage, accessibility improvements, and other safety features. The proposed safety improvements at each crossing are listed in **Table 3**.

Table 3: Proposed Safety Improvements

Intersection	Description	Excavation/Grading	Map ID
Marina Boulevard (Coast Subdivision)	• Remove portions of existing pavement/concrete • Install new sidewalk, roadway striping/pavement marking, roadside signs, medians, security access gates/fencing (within UPRR ROW), pavement, ADA detectable pavers, "No Trespassing" signs, k-rail, and new curb along tracks	Minor excavation would be required to replace old pavement and sidewalks on the project site and create new medians.	1
Washington Avenue	• Remove portions of existing pavement/concrete • Install new roadway striping/pavement marking, roadside signs, medians, sidewalk, security access gates/fencing, ADA detectable pavers, and "No Trespassing" signs	Minor excavation and grading would be required to remove pavement and conform new sidewalks to existing. This work would generally be contained within UPRR right-of-way at this crossing.	2
Hesperian Boulevard	• Remove portions of existing pavement/concrete and portion of existing driveway • Install new sidewalk, roadway striping/pavement marking, roadside signs, curb and gutter, security access gates/fencing, pavement, and ADA detectable pavers. • Construct new driveway access	Excavation and grading would be required for the removal and installation of new pavement on either side of Hesperian Boulevard. Removal of the existing driveway and construction of a gutter on the southeast corner of the crossing would require grading within City of San Leandro right-of-way.	3
Lewelling Boulevard	• Install new roadway striping/pavement marking, security access gates/fencing, "No Trespassing" signs, and new pedestrian path	None	4
Liedig Court – Trespass Location 1	• Install new sidewalk, roadway striping/pavement marking, security access gates/fencing, pavement, ADA detectable pavers, and "No Trespassing" signs.	Excavation and grading would be required for the removal of existing sidewalk and installation/conformation of new sidewalk. All excavation and grading would be contained within	5

Intersection	Description	Excavation/Grading	Map ID
		UPRR right-of-way for this crossing.	
Tennyson High School Pedestrian Crossing (near Schafer Road)	• Remove portions of existing pavement/concrete • Install new trespass-resistant landscaping, sidewalk, pavement, security access gates/fencing, “No Trespassing” signs, new culvert, and ADA detectable pavers • Construct pedestrian overcrossing	Excavation and grading would be required for the removal of existing sidewalk and installation/conformation of new sidewalk. Conformation to the existing sidewalk along Huntwood Avenue would occur within City of Hayward right-of-way.	6
Tennyson Road	• Remove portions of existing pavement/concrete • Install new sidewalk, roadway striping/pavement marking, security access gates/fencing, pavement, ADA detectable pavers, and “No Trespassing” signs.	Excavation and grading would be required for the removal of existing sidewalk and installation/conformation of new sidewalk. All excavation and grading would be contained within UPRR right-of-way for this crossing.	7
Industrial Parkway	• Remove portions of existing pavement/concrete • Installation of new sidewalk, roadway striping/pavement marking, security access gates/fencing, curbs, extension of existing culvert, new median, replacement/addition of pavement, ADA-detectable pavers, “No Trespassing” signs	Excavation and grading would be required for the removal of existing sidewalk and installation/conformation of new sidewalk. While most of this work would occur within UPRR right-of-way, conformation to existing sidewalk on the northwest side of Industrial Parkway would occur within City of Hayward right-of-way.	8
Source: Alameda CTC, 2021			

Construction of the project is anticipated to take approximately 12 months, beginning in the fourth quarter of 2023 and concluding in 2024. Construction would occur in one phase with distinct activities/sub-phases (i.e., demolition, grading, paving). Construction noise levels have been quantified based upon the construction activity and equipment types. Construction at each crossing will generally include:

- Temporary closure of the crossing with an appropriate detour for vehicles and cyclists
- Removal of outdated or non-functioning crossing control equipment, fencing, signage, pavement, and other materials
- Installation of new fencing, crossing control equipment, signage, sidewalks and pavement, and other safety features

The following crossings have unique elements or requirements for their construction:

- Hesperian Boulevard: New driveway access along Springlake Drive
- Tennyson High School Pedestrian Crossing: New pedestrian overcrossing

3.0 EXISTING NOISE

The primary sources of existing noise in the project vicinity are those associated with the operations of railway and rail crossing and mobile sources. The noise associated with these sources may represent a single-event noise occurrence, short-term noise, or long-term/continuous noise.

Sensitive Receptors

Noise exposure standards and guidelines for various types of land uses reflect the varying noise sensitivities associated with each of these uses. Residences, hospitals, schools, guest lodging, libraries, and churches are treated as the most sensitive to noise intrusion and therefore have more stringent noise exposure targets than do other uses, such as manufacturing or agricultural uses that are not subject to impacts such as sleep disturbance.

The project site is located in an urban area in the cities of Hayward and San Leandro. The surrounding land uses are predominantly commercial and industrial uses, with some surrounding residential uses. **Table 4: Sensitive Receptors** lists the distances and locations of the nearby sensitive receptors.

Table 4: Sensitive Receptors

Crossing	Sensitive Receptor Description	Distance and Direction from the Crossing
Marina Boulevard (Coastal Subdivision)	Single-family Residential	780 feet west
Washington Avenue	Single-family Residential	50 feet northwest
Hesperian Boulevard	Single-family Residential	550 feet west
Lewelling Boulevard	Single-family Residential	115 feet southwest
Liedig Court	Multi-family Residential	20 feet west
Tennyson High School Pedestrian Crossing (near Schafer Road)	Sorensdale Park	20 feet north
	Multi-family Residential	50 feet southwest
Tennyson Road	Cesar Chavez Middle School	30 feet north
	Single-family Residential	30 feet east
Industrial Parkway	Single-family Residential	20 feet west

4.0 THRESHOLDS AND SIGNIGICANCE CRITERIA

Construction

Construction noise estimates are based upon noise levels on typical noise levels generated by construction equipment published by the Federal Transit Administration (FTA) and FHWA. Construction noise is assessed in dBA L_{eq}. This unit is appropriate because L_{eq} can be used to describe noise level from operation of each piece of equipment separately, and levels can be combined to represent the noise level from all equipment operating during a given period. The Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment Manual* (2018) (FTA Noise and Vibration Manual) identifies a maximum 1-hour noise level standard of 90 dBA L_{eq} at residential uses and 100 dBA L_{eq} at commercial and industrial uses for short-term construction activities.

Reference noise levels are used to estimate noise levels at nearby sensitive receptors based on a standard noise attenuation rate of 6 dB per doubling of distance (line-of-sight method of sound attenuation for point sources of noise). Construction noise level estimates do not account for the presence of intervening structures or topography, which may reduce noise levels at receptor locations. Therefore, the noise levels presented herein represent a conservative, reasonable worst-case estimate of actual temporary construction noise.

Operations

This analysis of the existing and future noise environments is based on noise prediction modeling and empirical observations. Reference noise level data are used to estimate the project operational noise impacts from stationary sources. Noise levels were collected from published sources from similar types of activities and used to estimate noise levels expected with the project's stationary sources. The reference noise levels are used to represent a worst-case noise environment as noise level from stationary sources can vary throughout the day. The traffic noise levels in the project vicinity were calculated using the FHWA Highway Noise Prediction Model (FHWA-RD-77-108).

5.0 REGULATORY SETTING

Vibration

Groundborne vibration levels associated with construction-related activities for the project were evaluated utilizing typical groundborne vibration levels associated with construction equipment, obtained from FTA published data for construction equipment. Potential groundborne vibration impacts related to structural damage and human annoyance were evaluated, considering the distance from construction activities to nearby land uses and typically applied criteria for structural damage and human annoyance.

City of San Leandro Municipal Code

Section 4-1-1115 of the San Leandro Municipal Code (SLMC) declares the following to be disturbing, excessive and offensive noises in violation of the Code:

- Construction-related Noise Near Residential Uses. Construction work or related activity which is adjacent to or across a street or right of way from a residential use, except between the hours of 7 a.m. and 7 p.m. on weekdays, or between 8 a.m. and 7 p.m. on Sunday and Saturday. No such construction is permitted on Federal holidays.
- Conflicts with Residential Uses. Subject to the restrictions on constructions contained in subdivision,
  - The sustained operation or use between the hours of 9 p.m. and 8 a.m. of any electric or gasoline powered motor or engine or the repair, modification, reconstruction, testing or operation of any automobile, motorcycle, sweeper, vacuum, public address system, whistle muffler, motorized scooter, machine or mechanical device or other contrivance or facility unless such motor, engine, automobile, motorcycle, sweeper, vacuum, public address system, whistle muffler, motorized scooter, machine or mechanical device is enclosed within a sound insulated structure so as to prevent noise and sound from being plainly audible from any residential property line.

City of Hayward Municipal Code

Section 4-1.03.4 of the Hayward Municipal Code (HMC) states that unless otherwise provided pursuant to a duly-issued permit or a condition of approval of a land use entitlement, the construction, alteration, or repair of structures and any landscaping activities, occurring between the hours of 10:00 a.m. and 6:00 p.m. on Sundays and holidays, and 7:00 a.m. and 7:00 p.m. on other days, shall be subject to the following:

a. No individual device or piece of equipment shall produce a noise level exceeding eighty-three (83) dBA at a distance of twenty-five (25) feet from the source. If the device or equipment is housed within a structure on the property, the measurement shall be made outside the structure at a distance as close as possible to twenty-five (25) feet from the equipment.
b. The noise level at any point outside of the property plane shall not exceed eighty-six (86) dBA.
c. During all other times, the decibel levels set forth in Section 4-1.03.1 shall control.

Caltrans Best Practices for Noise Control

Standard Caltrans measures that are used for all projects include that construction noise shall not exceed a maximum sound level of 86 dBA at 50 feet from job site activities between the hours of 9:00 p.m. to 6:00 a.m. The following standard measures will also be implemented to minimize or reduce the potential for noise impacts from project construction:

- Limit paving and demolition activities to 7:00 a.m. to 7:00 p.m., where feasible.
- Equip all internal combustion engine driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- Prohibit unnecessary idling (i.e., greater than 5 minutes in duration) of internal combustion engines within 100 feet of residences.
- Avoid staging of construction equipment within 200 feet of residences and locate all stationary noise-generating construction equipment, such as air compressors, portable

power generators, or self-powered lighting systems as far as practical from noise-sensitive receptors.
- Utilize “quiet” air compressors and other “quiet” equipment where such technology exists.

6.0 IMPACT ANALYSIS

6.1 Construction

Construction Noise

Construction noise typically occurs intermittently and varies depending on the nature or phase of construction (e.g. land clearing, grading, excavation, paving). Noise generated by construction equipment, including earth movers, material handlers, and portable generators, can reach high levels. During construction, exterior noise levels could affect the residential neighborhoods surrounding the construction site. Project construction would occur approximately 10 feet from existing single-family residences. However, construction activities would occur throughout the project site and would not be concentrated at a single point near sensitive receptors. Noise levels typically attenuate (or drop off) at a rate of 6 dB per doubling of distance from point sources, such as industrial machinery. During construction, exterior noise levels could affect the residential neighborhoods near the construction site.

Construction activities associated with development of the project would include demolition, site preparation, grading, paving, building construction, and architectural coating. Such activities would require graders, scrapers, and tractors during site preparation; graders, dozers, and tractors during grading; cranes, forklifts, generators, tractors, and welders during construction; pavers, rollers, mixers, tractors, and paving equipment during paving; and air compressors during architectural coating. Grading and excavation phases of project construction tend to be the shortest in duration and create the highest construction noise levels due to the operation of heavy equipment required to complete these activities. It should be noted that only a limited amount of equipment can operate near a given location at a particular time. Equipment typically used during this stage includes heavy-duty trucks, backhoes, bulldozers, excavators, front-end loaders, and scrapers. Operating cycles for these types of construction equipment may involve one or two minutes of full-power operation followed by three to four minutes at lower power settings. Other primary sources of noise would be shorter-duration incidents, such as dropping large pieces of equipment or the hydraulic movement of machinery lifts, which would last less than one minute. According to the applicant, no pile-driving would be required during construction.

Noise generated by construction equipment, including earth movers, material handlers, and portable generators, can reach high levels. Typical noise levels associated with individual construction equipment are listed in **Table 5: Typical Construction Equipment Noise Levels.**

As shown in **Table 5**, sensitive receptors near the project area include residences adjoining the project site. Noise impacts for mobile construction equipment are typically assessed as emanating from the center of the equipment activity or construction site. For the proposed project, this center point would be conservatively approximately 45 feet from the nearest sensitive receptor structure. These sensitive uses may be exposed to elevated noise levels during project construction. These assumptions represent the worst-case noise scenario because construction activities would typically be spread out throughout the project site, and thus some equipment would be further away from the affected receptors. In addition, construction noise levels are not constant, and in fact, construction activities and associated noise levels would fluctuate and generally be brief and sporadic, depending on the type, intensity, and location of construction activities. Construction noise would also be acoustically dispersed throughout the project site and will be masked by freeway noise and roadway noise.

Table 5: Typical Construction Equipment Noise Levels

Equipment	Typical Noise Level (dBA) at 50 Feet from the Source (reference level)
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Cranes	88
Dozer	85
Grader	85
Paver	85
Pump	77
Roller	85
Saw	76
Truck	84

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, September 2018.

Notes:

1. Calculated using the inverse square law formula for sound attenuation: $dBA_2 = dBA_1 + 20Log(d_1/d_2)$ Where: dBA_2 = estimated noise level at receptor; dBA_1 = reference noise level; d_1 = reference distance; d_2 = receptor location distance

Following the FTA's methodology for quantitative construction noise assessments, the FHWA Roadway Construction Noise Model (RCNM) was used to predict construction noise. Per the FTA Transit Noise and Vibration Manual, when calculating construction noise, all construction equipment is assumed to operate simultaneously at the center of the active construction zone. Because in reality, equipment would be operating throughout the site and not all of the equipment would be operating at the point closest to the sensitive receptors and considering the distance between the center of the project site and the sensitive receptors is a reasonable assumption. These assumptions represent the worst-case noise scenario because construction activities would typically be spread out throughout the project site, and thus some equipment would be further away from the affected receptors. In addition, construction noise levels are not constant, and in fact, construction activities and associated noise levels would fluctuate and generally be brief and sporadic, depending on the type, intensity, and location of construction activities. Construction noise would also be acoustically dispersed throughout the project site and will be masked by freeway noise and roadway noise. The noise levels identified in **Table 6**, show the exterior construction noise at the nearest sensitive receptors, without accounting for attenuation from existing physical barriers.

As described above in the Regulatory Setting section, the Alameda County General Plan, San Leandro Municipal Code, and the Hayward Municipal Code limit the hours of construction to the less sensitive hours of the day. The City of San Leandro restricts construction to between 7 a.m. and 7 p.m. on weekdays or between 8 a.m. and 7 p.m. on weekends. The City of Hayward restricts construction to between 10:00 a.m. and 6:00 p.m. on Sundays and holidays and 7:00 a.m. and 7:00 p.m. on other days). Therefore, construction would not occur during normal sleeping hours for residents, which is the most sensitive time for exposure to noise. As described in the Regulatory Setting Section, the Hayward Municipal Code also states that no individual device or piece of equipment shall produce a noise level exceeding 83 dBA at a distance of 25 feet from the source and that the noise level at any point outside of the property plane shall not exceed 86 dBA. Additionally, the FTA Transit Noise and Vibration Impact Assessment Manual (2018) (FTA Noise and Vibration Manual) identifies a maximum 1-hour noise level standard of 90 dBA L_{eq} at residential uses and 100 dBA L_{eq} at commercial and industrial uses for short-term construction activities. As shown in **Table 6**, it is anticipated that noise from construction of the proposed project would exceed these limits without implementation of noise reduction measures.

Table 6: Typical Construction Equipment Noise Levels

Construction Phase	Receptor Location		Worst Case Modeled Noise Level, dBA $L_{eq\ (8\text{-hour})}$ [2]	Jurisdiction	Noise Standard, dBA L_{eq} [3]	Exceeded?
	Land Use	Distance (feet)[1]				
Demolition	Washington Avenue Residential Receptor	300	68.3	San Leandro	90	**No**
	Lewelling Boulevard Residential Receptor	160	73.7	Alameda County		**No**
	Liedig Court Residential Receptor	100	77.8	Hayward	86	**No**
	Tennyson High School Pedestrian Crossing Residential Receptor	80	79.7			**No**
	Tennyson High School Pedestrian Crossing Park Receptor	80	79.7			**No**
	Tennyson Road School Receptor	125	75.9			**No**

Construction Phase	Receptor Location: Land Use	Receptor Location: Distance (feet)[1]	Worst Case Modeled Noise Level, dBA $L_{eq\ (8\text{-}hour)}$ [2]	Jurisdiction	Noise Standard, dBA L_{eq} [3]	Exceeded?
	Tennyson Road Residential Receptor	125	75.9			**No**
	Industrial Parkway Residential Receptor	140	74.9			**No**
Grading	Washington Avenue Residential Receptor	300	71.3	San Leandro	90	**No**
	Lewelling Boulevard Residential Receptor	160	76.8	Alameda County		**No**
	Liedig Court Residential Receptor	100	80.9	Hayward	86	**No**
	Tennyson High School Pedestrian Crossing Residential Receptor	80	82.8			**No**
	Tennyson High School Pedestrian Crossing Park Receptor	80	82.8			**No**
	Tennyson Road School Receptor	125	78.9			**No**
	Tennyson Road Residential Receptor	125	78.9			**No**
	Industrial Parkway Residential Receptor	140	77.9			**No**
Paving	Washington Avenue Residential Receptor	300	66.9	San Leandro	90	**No**
	Lewelling Boulevard Residential Receptor	160	72.4	Alameda County		**No**
	Liedig Court Residential Receptor	100	76.5	Hayward	86	**No**
	Tennyson High School Pedestrian Crossing Residential Receptor	80	78.4			**No**
	Tennyson High School Pedestrian Crossing Park Receptor	80	78.4			**No**
	Tennyson Road School Receptor	125	74.5			**No**
	Tennyson Road Residential Receptor	125	74.5			**No**
	Industrial Parkway Residential Receptor	140	73.5			**No**
Building Construction	Washington Avenue Residential Receptor	300	67.3	San Leandro	90	**No**

Construction Phase	Receptor Location		Worst Case Modeled Noise Level, dBA $L_{eq\ (8\text{-hour})}$ [2]	Jurisdiction	Noise Standard, dBA L_{eq} [3]	Exceeded?
	Land Use	Distance (feet)[1]				
	Lewelling Boulevard Residential Receptor	160	72.8	Alameda County		**No**
	Liedig Court Residential Receptor	100	76.8	Hayward	86	**No**
	Tennyson High School Pedestrian Crossing Residential Receptor	80	78.8			**No**
	Tennyson High School Pedestrian Crossing Park Receptor	80	78.8			**No**
	Tennyson Road School Receptor	125	74.9			**No**
	Tennyson Road Residential Receptor	125	74.9			**No**
	Industrial Parkway Residential Receptor	140	73.9			**No**

Source: Federal Highway Administration, *Roadway Construction Noise Model,* 2006.

1. Distance measured from the center of the project site to the receptor's nearest property line.
2. Modeled noise levels conservatively assume the simultaneous operation of all pieces of equipment.
3. The Hayward Municipal Code also states that the noise level at any point outside of the property plane shall not exceed 86 dB. Neither the City of San Leandro nor the County of Alameda has specific and/or quantitative regulatory standards for construction, therefore the FTA noise level standard of 90 dBA L_{eq} at residential uses for short-term construction activities is used.

As indicated in **Table 6**, construction noise levels at the project site would range between 67.3 dBA and 82.8 dBA at the nearest sensitive receptor and would not exceed the Hayward Municipal Code 86 dBA noise limit or the FTA noise level standard of 90 dBA L_{eq}. Further, these assumptions represent the worst-case noise scenario because construction activities would typically be spread out throughout the project site, and thus some equipment would be further away from the affected receptors. In addition, construction noise levels are not constant, and in fact, construction activities and associated noise levels would fluctuate and generally be brief and sporadic, depending on the type, intensity, and location of construction activities. Construction noise would also be acoustically dispersed throughout the project site and will be masked by freeway noise and roadway noise. However, the project contractor would implement **Mitigation Measure NOI-1** to ensure levels of construction noise for nearby sensitive receptors at all crossing locations do not exceed the applicable noise standards.

Implementation of **Mitigation Measure NOI-1** would minimize construction noise impacts on the off-site nearby sensitive receptors and would implement all technically and economically feasible measures to reduce construction noise, consistent with the requirements of San Leandro and Hayward Municipal Codes and the Alameda County General Code.

Mitigation Measure NOI-1: The project contractor shall implement the following measures during construction of the project:

- Equip all construction equipment, fixed of mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.
- Place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the active crossing.
- Locate equipment staging in areas that would create the greatest possible distance between construction-related noise sources and noise-sensitive receptors nearest the active crossing during all project construction.
- Construction haul trucks and materials delivery traffic shall avoid residential areas whenever feasible.
- Prohibit extended idling time of internal combustion engines by either shutting equipment off when not in use or reducing the maximum idling time to 5 minutes.
- Ensure that all general construction related activities are restricted to between the hours of 7:00 a.m. and 7:00 p.m. on Monday through Saturday and between the hours of 10:00 a.m. and 6:00 p.m. on Sundays and holidays.
- Designate a "disturbance coordinator" at the City of Hayward who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaint (e.g., starting too early, bad muffler) and would determine and implement reasonable measures warranted to correct the problem, and ensure noise levels do not exceed noise ordinances standards.

With implementation of **Mitigation Measure NOI-1** at all crossings, the level of noise generated during construction at all crossing locations would be less than significant.

Construction Vibration

Increases in groundborne vibration levels attributable to the project would be primarily associated with construction-related activities. Construction on the project site would have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and the operations involved. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. The effect on buildings located in the vicinity of the construction site often varies depending on soil type, ground strata, and construction characteristics of the receiver building(s). The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibration at moderate levels, to slight damage at the highest levels. Groundborne vibrations from construction activities rarely reach levels that damage structures.

The FTA has published standard vibration velocities for construction equipment operations. In general, depending on the building category of the nearest buildings adjacent to the potential pile driving area, the potential construction vibration damage criteria vary. For example, for a building constructed with reinforced concrete with no plaster, the FTA guidelines show that a vibration level of up to 0.50 inch per second (in/sec) peak particle velocity (PPV) is considered safe and would not result in any construction vibration damage. In general, the FTA architectural damage criterion for continuous vibrations (i.e. 0.2 in/sec) appears to be conservative. The types of construction vibration impacts include human annoyance and building damage. Human annoyance occurs when construction vibration rises significantly above the threshold of human perception for extended periods of time. Building damage can be cosmetic or structural. Ordinary buildings that are not particularly fragile would not experience cosmetic damage (e.g. plaster cracks) at distances beyond 30 feet. This distance can vary substantially depending on soil composition and underground geological layer between vibration source and receiver.

Table 7: Typical Construction Equipment Vibration Levels, lists vibration levels at 10 and 25 feet (reference level) for typical construction equipment. Groundborne vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. As indicated in **Table 7**, based on FTA data, vibration velocities from typical heavy construction equipment operations that would be used during project construction range from 0.003 to 0.192 in/sec PPV from 10 to 25 feet from the source of activity. The nearest sensitive receptors are the single-family residences approximately 10 feet from the active construction zone for the proposed project.

As shown in **Table 7**, the highest vibration levels are achieved with the large bulldozer operations. This construction activity is expected to take place during grading. As shown in **Table 7**, construction equipment vibration velocities would not exceed the FTA's 0.20 PPV threshold. In general, other construction activities would occur throughout the project site and would not be concentrated at the point closest to the nearest residential structure. Therefore, vibration impacts associated with the project would be less than significant.

Table 7: Typical Construction Equipment Vibration Levels

Equipment	Typical Level (dBA) 10 Feet from the Source[1]	Typical Level (dBA) 25 Feet from the Source[1] (Reference level)
Large Bulldozer	0.192	0.089
Loaded Trucks	0.164	0.076
Rock Breaker	0.127	0.059
Jackhammer	0.075	0.035
Small Bulldozer/Tractors	0.007	0.003

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, September 2018
Notes: Calculated using the inverse square law formula for sound attenuation: $dBA_2 = dBA_1+20Log(d_1/d_2)$Where: dBA_2 = estimated noise level at receptor; dBA_1 = reference noise level; d_1 = reference distance; d_2 = receptor location distance

6.2 Operations

Operational Noise and Vibration

During operation, the improved crossings would function similar to the existing conditions. Vehicular traffic and pedestrians would be able to use the crossings as they do under existing conditions, but with improved safety. Operation of the project would not change the frequency or speed of existing trains along UPRR tracks or effect the volume of vehicles using the crossing. Since no change in vehicle or train trips and no new vehicle trips are generated by the project there would be no impact to operational noise as a result of project operation.

The project would generate groundborne vibration that could be felt at surrounding uses. However, the project operations would not result in any changes in railroad use or train trips. As a result, impacts from vibration associated with project operation would be less than significant.

6.3 Cumulative Emissions

Noise by definition is a localized phenomenon, and drastically reduces as distance from the source increases. Cumulative noise impacts involve development of the project in combination with ambient growth and other related development projects. As noise levels decrease as distance from the source increases, only projects in the nearby area could combine with the project to potentially result in cumulative noise impacts.

Cumulative Construction Impacts. The project's construction activities, when properly mitigated, would still not result in a substantial temporary increase in ambient noise levels. The project construction would comply with Section 4-1-1115 of the SLMC, stating construction hours are limited to the hours of 7:00 a.m. and 7:00 p.m. on weekdays, or between 8:00 a.m. and 7:00 p.m. on Sunday and Saturday. With implementation of Caltrans Best Practices for Noise Control, the project would be consistent with the HMC which limits noise levels generated by an individual device or piece of equipment to no more than 83dBA at a distance of 25 feet from the source and the noise level at any point outside of the property plane should not exceed 86 dBA. There would be periodic, temporary, noise impacts that would cease upon completion of construction activities. The project would contribute to other proximate construction noise impacts if construction activities were conducted concurrently. However, based on the noise analysis above, the project's construction-related noise impacts would be less than significant following compliance with local regulations and mitigation measures outlined in this study.

Construction activities at other planned and approved projects would be required to take place during daytime hours, and the City and project applicants would be required to evaluate construction noise impacts and implement mitigation, if necessary, to minimize noise impacts. Each project would be required to comply with the applicable limitations of the SLMC and HMC on allowable hours of construction. Therefore, project construction would not contribute to cumulative impacts and impacts in this regard are not cumulatively considerable.

Cumulative Operational Impacts. Cumulative noise impacts describe how much noise levels are projected to increase over existing conditions with the development of the project and other foreseeable projects. Cumulative noise impacts would occur primarily as a result of increased traffic on local roadways due to buildout of the project and other projects in the vicinity. However, noise from generators and other stationary sources could also generate cumulative noise levels.

During operation, the improved crossings would function similar to the existing conditions. Operation of the project would not change the frequency or speed of existing trains along UPRR tracks or effect the volume of vehicles using the crossing. Since no change in vehicle or train trips and no new vehicle trips are generated by the project there would be no impact to operational noise as a result of project operation. The project would generate groundborne vibration that could be felt at surrounding uses. However, the project operations would not result in any changes in railroad use or train trips Therefore, the project, in combination with cumulative background traffic noise levels, would result in a less than significant cumulative impact. The project's contribution to noise levels would not be cumulatively considerable.

7.0 REFERENCES

1. California Department of Transportation, *California Vehicle Noise Emission Levels*, 1987.
2. California Department of Transportation, *Standard Specifications,* 2018.
3. California Department of Transportation, *Traffic Noise Analysis Protocol*, 2011.
4. California Department of Transportation, *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, 2013.
5. California Department of Transportation, *Transportation and Construction Vibration Guidance Manual*, 2013.
6. City of Hayward, *Municipal Code*, 2020.
7. City of San Leandro, *Municipal Code*, 2021.
8. Cyril M. Harris, *Handbook of Noise Control*, Second Edition, 1979.
9. Cyril M. Harris, *Noise Control in Buildings – A Practical Guide for Architects and Engineers*, 1994.
10. Elliott H. Berger, Rick Neitzel, and Cynthia A. Kladden. *Noise Navigator Sound Level Database with Over 1700 Measurement Values*, July 6, 2010.
11. Federal Highway Administration, *Roadway Construction Noise Model*, 2006.
12. Federal Highway Administration, Roadway *Construction Noise Model User's Guide Final Report*, 2006.
13. Federal Interagency Committee on Noise, *Federal Agency Review of Selected Airport Noise Analysis Issues*, 1992.
14. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018.
15. Kariel, H. G., *Noise in Rural Recreational Environments*, Canadian Acoustics 19(5), 3-10, 1991.
16. United States Environmental Protection Agency, *Protective Noise Levels (EPA 550/9-79-100)*, 1979.