Kimley»Horn

MEMORANDUM

To: Brianna Bohonok, Associate Principal, Circlepoint

From: Ace Malisos, Air Quality and Noise Manager, Kimley-Horn
Noemi Wyss AICP, Environmental Planner, Kimley-Horn
Kimley-Horn and Associates, Inc.

Date: September 12, 2022

Subject: Alameda County Rail Safety Enhancement Program – Acoustical Analysis
Oakland ISMND

1.0 PURPOSE

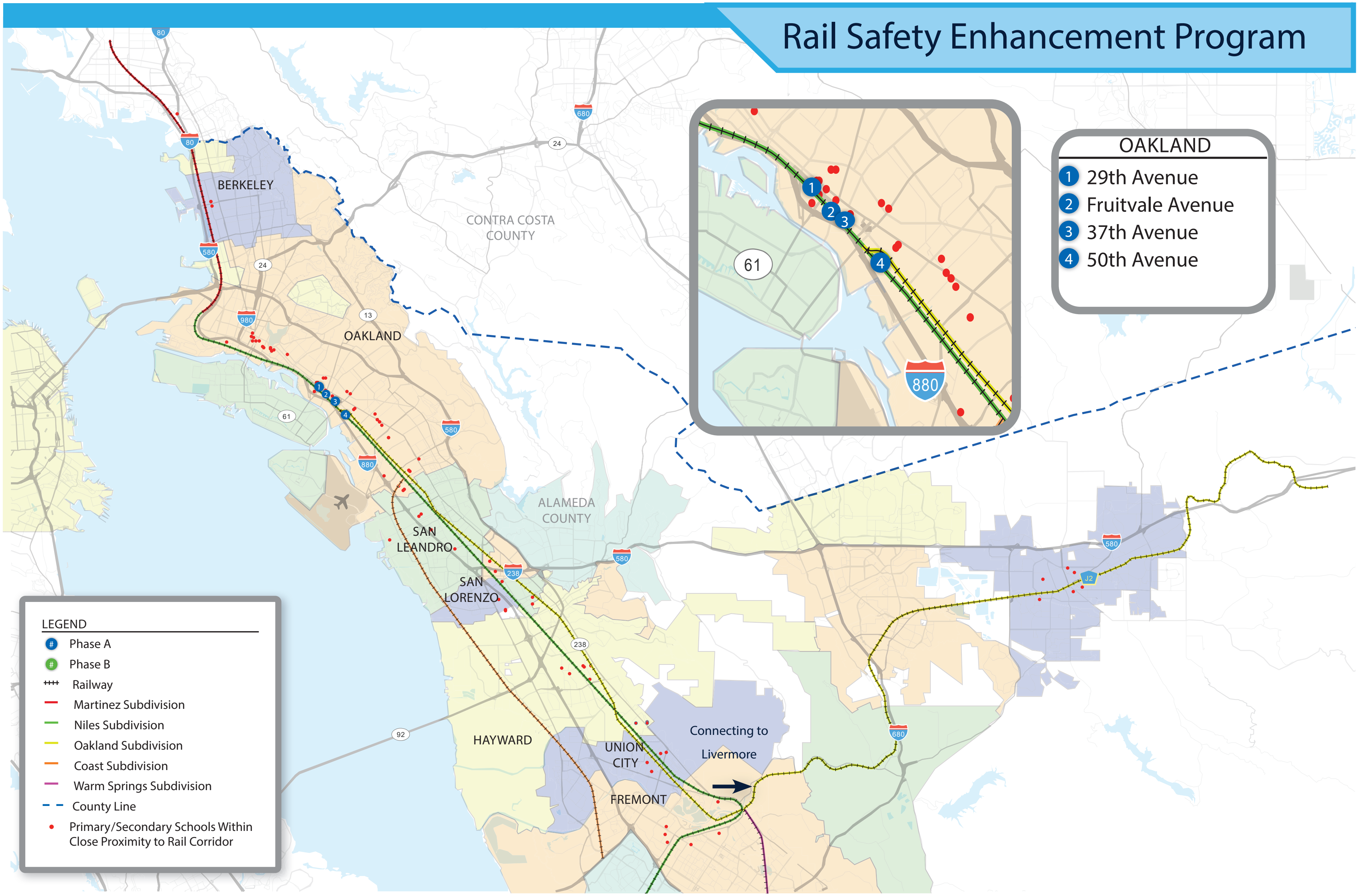
The purpose of this memorandum is to identify the acoustical impacts associated with construction and operations of four at-grade rail crossings, located in the City of Oakland (City), California. The four crossings are currently existing and are located in the eastern portion of the City.

2.0 PROPOSED PROJECT DESCRIPTION

The project site consists of four existing at-grade rail crossings in the City of Oakland, California. Alameda County Transportation Commission (Alameda CTC) is the lead agency under the California Environmental Quality Act (CEQA). All four crossings are in the same general area of east Oakland surrounded predominantly by business, commercial, and light industrial uses. Residential areas are located near 29th Avenue and 37th Avenue, adjacent to the project site. The crossings are located along Union Pacific Railroad (UPRR) tracks where UPRR tracks intersect with local streets. Each of the crossings is listed from north to south in **Table 1** below, noting the local street intersections. The Map ID number corresponds to crossing location shown on **Figure 1**.

Table 1: Crossing Locations

Jurisdiction	Intersection	Map ID
City of Oakland	29th Avenue	1
City of Oakland	Fruitvale Avenue	2
City of Oakland	37th Avenue	3
City of Oakland	50th Avenue	4
Source: Alameda CTC, 2022		



Source: Kimley-Horn, 2022

Figure 1: Project Site Map

Alameda CTC Rail Safety Enhancement Project

Memorandum

The four crossings consist of entirely developed area. The project sites are predominantly impervious except for the semi-pervious gravel shoulder next to UPRR tracks. Site conditions vary between crossings. The 29th Avenue and Fruitvale Avenue crossings take place on major arterials while the 37th Avenue and 50th Avenue crossings are along smaller two-lane streets. 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: Existing Conditions**

Table 2: Existing Conditions

Intersection	Description	Map ID
29th Avenue	29th Avenue extends in a northeast direction through this crossing with two lanes of travel in each direction. Latitude High School is located immediately to the east. Continuous sidewalks extend along 29th Avenue on each side. There are single-arm gates in each direction of traffic.	1
Fruitvale Avenue	Fruitvale Avenue extends in a northeast direction through this crossing with two lanes of travel in each direction. Parking lots are located immediately north of this crossing, with vacant parcels to the south. Continuous sidewalks extend along Fruitvale Avenue on each side with Class II bicycle lanes striped on both sides. There are single-arm gates in each direction of traffic.	2
37th Avenue	37th Avenue extends in a northeast direction through this crossing with one lane of travel in each direction. Landscaping associated with Interstate 880 (Nimitz Freeway) is located south of the crossing. Sidewalks are present north of the UPRR tracks along 37th Avenue, but no pedestrian facilities extend across the tracks. There are single-arm gates in each direction of traffic.	3
50th Avenue	50th Avenue extends in a northeast direction through this crossing with one lane of travel in each direction. Sidewalks are present south of the UPRR tracks along 50th Avenue, but no pedestrian facilities extend across the tracks. There are single-arm gates in each direction of traffic.	4
Source: Circlepoint, 2022		

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
29th Avenue	The following improvements are proposed: • Remove portions of existing pavement/concrete • Remove existing overhead catenary system pole • Install new security access gates/fencing, medians, pavement markings, pavement, roadside signs, ADA detectable pavers, warning devices, and "No Trespassing" signs	Minor excavation and grading would be required to construct new pavement and curbs and gutters on the project site, to conform new sidewalks to existing, and to create new medians.	1

Intersection	Description	Excavation/Grading	Map ID
Fruitvale Avenue	The following improvements are proposed: • Remove portions of existing sidewalk and existing pedestrian crossing light • Install new pavement markings (including dynamic envelope markings), pavement, security access gates/fencing, delineators, warning devices, and "No Trespassing" signs	Minor grading would be required to conform new sidewalks to existing.	2
37th Avenue	The following improvements are proposed: • Remove portions of existing pavement/concrete • Replace existing damaged fence • Install new security access gates/fencing, medians, pavement markings, roadside signs, ADA detectable pavers, warning devices, and "No Trespassing" and "No Parking" signs	Minor excavation and grading would be required to construct curbs and gutters on the project site, to conform new sidewalks to existing, and to create new medians.	3
50th Avenue	The following improvements are proposed: • Remove portions of existing pavement/concrete and regrade surface • Remove existing guard rail and signal foundation • Install new headwall, curb and gutter, and drainage pipe • Install new pavement markings, pavement, security access gates/fencing, warning devices, and "No Trespassing" signs	Minor excavation and grading would be required to construct new pavement and regrade surface on the project site, install a new headwall, curbs and gutters, and drainage pipe, and to conform new sidewalks to existing.	4
Source: Alameda CTC, 2022			

Construction of the project is anticipated to take approximately 12 months, beginning in the third quarter of 2023 and concluding in the third quarter of 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:

- 29th Avenue – Construct new median, curb and gutter, and pavement along 29th Avenue. An existing overhead catenary system pole would be removed adjacent to the southbound track.
- Fruitvale Avenue – Remove existing sidewalk north and south of Fruitvale Avenue. Dynamic envelope markings would be installed on both sides of tracks.

- 37th Avenue – Construct new median and curbs and gutters along 37th Avenue. An existing damaged fence along the UPRR ROW on the southbound track will be replaced.
- 50th Avenue– Construct new curbs and gutters along 50th Avenue. A new headwall and drainage pipe would be installed, and surface regrading would occur adjacent to the northbound track.

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.

Within Oakland, land use and zoning surrounding the crossings consist of General Plan designations of Mixed Housing Type Residential, Community Commercial, Regional Commercial, Housing and Business Mix, and General Industry and Transportation. Zoning consists of Industrial, General (M-30 and IG), Housing and Business Mix (HBX-1 and HBX-2), Community Commercial (CC-1), and Commercial Neighborhood Center (CN-3). Parcels abutting the rail crossings consist of predominantly commercial, warehouse, aggregate distribution, and parking lot uses, interspersed with residential and storage uses. Schools are located near the 29th Avenue crossing and include Latitude High School (adjacent to east; 115 feet) and Epic Middle School (430 feet east). **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
29th Avenue	Latitude High School Epic Middle School	115 feet east 430 feet east
Fruitvale Avenue	Residential	190 feet southeast
37th Avenue	Residential	105 feet east
50th Avenue	Residential	300 feet west

Notes:
1. Distances are measured from the project site to the sensitive receptor property line

Source: Google Earth, 2022.

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. The analysis was also prepared in accordance with Federal Railroad Administration (FRA) categorical exemption checklist requirements.

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.

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 Oakland Municipal Code

Section 8.18.020 of the Oakland Municipal Code declares that failure to comply with the following shall constitute a nuisance in violation of the code:

- All construction equipment powered by internal combustion engines shall be properly muffled and maintained
- Unnecessary idling of internal combustion engines is prohibited
- All stationary noise- generating construction equipment such as tree grinders and air compressors are to be located as far as is practical from existing residences
- Quiet construction equipment, particularly air compressors, are to be selected whenever possible
- Use of pile drivers and jack hammers shall be prohibited on Sundays and holidays, except for emergencies and as approved in advance by the Building Official

Section 17.120.050 of the Oakland Municipal code declares that all activities shall be so operated that the noise level inherently and regularly generated by these activities across real property lines shall not exceed the applicable values indicated in Subsection A, B, or C. as modified where applicable by the adjustments indicated in Subsection D or E.

- The maximum allowable noise levels received by any residential zone are described in Table 17.120.01 of the OMC.
- The maximum allowable noise levels received by any land use activity within any Commercial zone are described in table 17.120.02 of the OMC.
- The daytime noise level received by any Residential, Commercial, or Industrial land use which is produced by any nonscheduled, intermittent, short-term construction or demolition operation (less than ten (10) days) or by any repetitively scheduled and relatively long-term construction or demolition operation (ten (10) days or more) shall not exceed the maximum allowable receiving noise levels described in Table 17.120.04 of the OMC.
- The nighttime noise level received by any land use and produced by any construction or demolition activity between weekday hours of seven (7) p.m. and seven (7) a.m. or between eight (8) p.m. and nine (9) a.m. on weekends and federal holidays shall not exceed the applicable nighttime noise level standards outlined in this Section.
- All construction activity including grading in a residential area is allowable from 7:00 am to 9:00 pm at 70 dB for five minutes maximum sound level in one hour.

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 105 feet from existing single-family residences, 115 feet from an existing high school, and 430 feet from an existing middle school. 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 and schools near the construction site.

Construction activities associated with development of the project would include demolition, site preparation, grading, paving, and building construction. 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; and pavers, rollers, mixers, tractors, and paving equipment during paving. 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.**

Table 5: Typical Construction Equipment Noise Levels

Equipment	Typical Noise Level (dBA) at 50 Feet from the Source	Typical Noise Level (dBA) at 200 Feet from the Source
Concrete Mixer	85	73
Concrete Pump	82	70
Concrete Vibrator	76	64
Dozer	85	73
Grader	85	73
Loader	86	68
Paver	85	73
Pump	77	65
Roller	85	73
Saw	76	64
Scraper	85	73
Shovel	82	70
Truck	84	72

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

The nearest sensitive receptors to the project area include the residences located approximately 105 feet east of the project site. Noise impacts for mobile construction equipment are typically assessed as emanating from the center of the equipment activity or construction site.[1] For the proposed project, this center point would be conservatively approximately 200 feet from the nearest sensitive receptor structure. As shown in **Table 5**, 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.

As indicated in **Table 5**, construction noise levels from the project site would range between 64 dBA and 73 dBA at the sensitive receptors approximately 200 feet from the center point of the project site. The highest anticipated construction noise level of 73 dBA is expected to occur during the building construction and paving phases from the use of dozers, grader, pavers, rollers, scrapers, and concrete mixer. Therefore, construction noise would not exceed the FTA's standards of 90 dBA L_{eq} at residential

[1] For the purposes of this analysis, the construction area is defined as the center of the project site per the methodology in the FTA Transit Noise and Vibration Impact Assessment Manual (September 2018). Although some construction activities may occur at distances closer 200 feet from the nearest properties, construction equipment would be dispersed throughout the project site during various construction activities. Therefore, the center of the project site represents the most appropriate distance based on the sporadic nature of construction activities.

uses and 100 dBA L_{eq} at commercial and industrial uses. The proposed project would be required to adhere to the Caltrans Standard Conditions that ensure that all construction equipment is equipped with properly operating and maintained mufflers and other state required noise attenuation devices, helping to reduce noise at the source. The City's noise standard prohibits construction outside the hours of 7:00 am and 7:00 pm Monday through Friday and requires long-term construction activity (more than 10 days) to remain below 65 dBA at receiving residential land uses (17.120.050). The City allows construction noise to reach 70 dBA if the noise does not last more than five minutes every hour or 75 dBA if the noise does not last for more than one minute every hour. Equipment, such as dozers, graders, pavers, and scrapers, have operating cycles of about one or two minutes on full power operation followed by three to four minutes at lower power settings. This, in addition to mufflers and noise attenuating devices required by the Caltrans and City's Standard Conditions, would ensure that construction noise levels do not exceed the City's standards and that time-of-day restrictions are adhered to. Therefore, with implementation of these conditions, construction noise impacts to nearby receptors 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 6: Typical Construction Equipment Vibration Levels, lists vibration levels at 25 and 105 feet 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 6**, based on FTA data, vibration velocities from typical heavy construction equipment operations that would be used during project construction range from 0.003 to 0.089 in/sec PPV from 25 feet from the source of activity. The nearest sensitive receptor are the residences approximately 105 feet away from the active construction zone for the proposed project.

As shown in **Table 6**, 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 6**, 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 6: Typical Construction Equipment Vibration Levels

Equipment	Typical Level (dBA) 25 Feet from the Source[1]	Typical Level (dBA) 105 Feet from the Source[1]
Large Bulldozer	0.089	0.010
Loaded Trucks	0.076	0.009
Rock Breaker	0.059	0.001
Jackhammer	0.035	0.004
Small Bulldozer/Tractors	0.003	0.000

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, along with the standard conditions to be implemented, would still not result in a substantial temporary increase in ambient noise levels. The project construction would comply with Sections 17.120.050 and 15.04.780 of the Oakland Municipal Code, stating construction hours are limited to the hours of 7:00 a.m. to 9:00 p.m. With implementation of Caltrans Best Practices for Noise Control, the project would be consistent with the Section 8.18.020 of the Oakland Municipal Code which requires all construction equipment powered by internal combustion engines to be properly muffled and maintained, prohibits unnecessary idling of internal combustion, and encourages the use of quiet construction equipment, particularly air compressors. 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 Oakland Municipal Code 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 Oakland, *Municipal Code*, 2021.
7. Cyril M. Harris, *Handbook of Noise Control*, Second Edition, 1979.
8. Cyril M. Harris, *Noise Control in Buildings – A Practical Guide for Architects and Engineers*, 1994.
9. Elliott H. Berger, Rick Neitzel, and Cynthia A. Kladden. *Noise Navigator Sound Level Database with Over 1700 Measurement Values*, July 6, 2010.
10. Federal Highway Administration, *Roadway Construction Noise Model*, 2006.
11. Federal Highway Administration, Roadway *Construction Noise Model User's Guide Final Report*, 2006.
12. Federal Interagency Committee on Noise, *Federal Agency Review of Selected Airport Noise Analysis Issues*, 1992.
13. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018.
14. Kariel, H. G., *Noise in Rural Recreational Environments*, Canadian Acoustics 19(5), 3-10, 1991.
15. United States Environmental Protection Agency, *Protective Noise Levels (EPA 550/9-79-100)*, 1979.