APPENDIX F

Noise Measurement Calculation Details and Supporting Information

Appendix F-1

Noise and Vibration Assessment Methodology

NOISE AND VIBRATION ASSESSMENT METHODOLOGY

28 JULY 2020

POTRERO YARD MODERNIZATION PROJECT
San Francisco, California

For:
San Francisco Planning Department
San Francisco, California

18202-00.02709

BASELINE ENVIRONMENTAL CONSULTING
5900 Hollis Street, Suite D, Emeryville, CA 94608 | P: (510) 420-8686 | www.baseline-env.com

TRANSMITTAL

To: Peter Mye, SWCA

Date: 28 July 2020

Project No: 18202-00.02709

Subject: **Noise and Vibration Assessment Methodology for Potrero Yard Modernization Project, California**

Enclosed:

1	Electronic Distribution

Comments:

Disposition:

- [ ] As requested
- [ ] For signature
- [x] For review and comment
- [ ] Returned after loan to us

Via:

- [ ] Mail
- [ ] Overnight
- [ ] UPS ground
- [ ] Courier
- [x] Electronic

Transmitted By:

NOISE AND VIBRATION ASSESSMENT METHODOLOGY

28 JULY 2020

POTRERO YARD MODERNIZATION PROJECT
San Francisco, California

FOR:
San Francisco Planning Department
San Francisco, California

18202-00.02709

BASELINE ENVIRONMENTAL CONSULTING
5900 Hollis Street, Suite D, Emeryville, CA 94608 | P: (510) 420-8686 | www.baseline-env.com

TABLE OF CONTENTS

APPENDIX

FIGURE

NOISE AND VIBRATION ASSESSMENT METHODOLOGY

Potrero Yard Modernization Project

1. INTRODUCTION

At the request of the San Francisco Municipal Transportation Agency (SFMTA), Baseline Environmental Consulting (Baseline) will evaluate the potential noise and vibration impacts associated with implementation of the proposed Potrero Yard Modernization Project (proposed project). Baseline has prepared this document to describe the scope and methodology for the evaluation of noise and vibration impacts from construction and operational sources. Further, a cumulative analysis is described for construction (noise and vibration) and operation (noise). This assessment will be used to support environmental review of the proposed project under the California Environmental Quality Act (CEQA).

1.1 Project Description

The proposed project is an SFMTA capital project to rebuild and expand the Potrero Yard transit facility at 2500 Mariposa Street in San Francisco (Figure 1). The proposed project is a part of the SFMTA's 20-year Building Progress Program to expand and modernize its facilities to meet growing transportation demands and changing technologies. The project is proposed to accommodate bus maintenance, operation, and administrative uses within a modern, energy-efficient, and seismically-safe transit facility. The proposed program would incorporate modern bus technologies, facilitate the transition to a future all-electric battery-powered bus fleet, improve work conditions, increase the efficiency and timeliness of bus maintenance and repairs, and promote resiliency and flexibility in the face of climate change and natural disasters. The proposed project would also include a joint development program, with residential uses within and atop the transit facility podium and ground floor commercial/active uses along Bryant Street.

Under the proposed project, the existing bus storage yard (including the bus wash area and running repair station) and the maintenance and operations building (including the second-floor parking deck) would be demolished and replaced with one new, approximately 75- to 150-foot-tall and approximately 1,300,000-gross-square-foot structure. Commercial and residential uses would be along the perimeter of the podium on six floors, and three to seven floors of residential development atop the transit facility podium. The proposed project would consist of the following project components:

- The transit facility would be located in an approximately 75-foot tall podium with three transit levels. The proposed transit facility would include 52,000 square feet of administrative, training, and office space (e.g., offices, conference rooms, break rooms/kitchenettes, and training rooms). The remaining 671,000 square feet of space would include bus service, storage, and circulation space. The facility would be designed to include parking for 213 buses, 18 maintenance bays and maintenance support areas, operations, an SFMTA operator training center, storage (parts and battery-electric infrastructure), administrative uses/common areas (e.g., offices, conference rooms, break rooms), and joint development uses. A total of 310 vehicle spaces would be provided: 63 spaces for the 40-foot-long buses, 150 spaces for the articulated 60-foot-long buses, and 97 parking spaces for large and standard non-revenue vehicles. The proposed transit facility would also include a basement to accommodate transit facility and joint development service functions.

- Residential apartments would include three to seven levels of up to 575 residential units developed atop the proposed transit facility.
- Commercial/retail uses would include up to approximately 33,000 square feet along the perimeter of the proposed replacement transit facility.

1.1.1 Construction

The SFMTA estimates that construction of the proposed project would occur in one phase and take three to four years to complete, with construction beginning in 2023 and building occupancy likely by the end of 2026. Demolition would last about 2 months and site preparation would last about 5 months. Installation of the foundation system would last about 2 months. Above-ground building construction, exterior finishing, and interior finishing would take a total of about 27 months, with some work overlap. Construction-related activities would typically occur Monday through Saturday, between 7 a.m. and 8 p.m., with most work occurring between Monday and Friday. Nighttime construction is anticipated for certain activities such as major concrete pours; however, construction on Sundays and major legal holidays is not anticipated. The most intensive concrete pour activities would occur during foundation work. It is anticipated that 3,300 concrete pours would occur during 42 work days within two months. It is also anticipated that most concrete pour activities would occur during daytime. If pouring concrete during nighttime is necessary, each nighttime concrete pour would not last longer than two successive nights. Throughout the construction period, construction staging would occur on site and on the surrounding sidewalks.

1.1.2 Operations

The SFMTA estimates that operation of the proposed project would begin as early as 2026. The proposed transit facility would operate 24 hours per day, 7 days a week. The proposed transit facility and residential apartments would include heating/ventilation/air conditioning systems. Upon commencement of operation, the SFMTA expects that the Potrero Yard facility would have parking space for 213 trolley and battery-electric buses and 97 non-revenue vehicles, a total of 18 maintenance bays, three bus wash areas, and an employment population of approximately 829 full-time equivalent persons, including 383 operators. The existing Potrero Yard transit facility, which consists of the maintenance and operations building and the bus storage yard, provides parking spaces for 158 trolley buses, 56 non-revenue vehicles and employee vehicles, 52 stripped parking spaces for trolley bus parking, and 10 additional non-revenue vehicles. It also includes 26 maintenance bays and a trolley bus wash rack along its northern edge. The existing Potrero Yard transit facility has approximately 400 employees, including approximately 295 trolley bus operators.

1.1.3 Project Variant

The proposed project includes three proposed variants:

- Variant 1: Internal relocation of ramps from the north portion of site to a more southerly location allowing for the activation of the 17th Street frontage.
- Variant 2: Relocation of proposed emergency exit from 17th Street west of Hampshire Street to Hampshire Street south of 17th Street, or other measures to mitigate potential conflicts with the bicycle track.
- Variant 3: Relocation of joint development lobby away from Mariposa Street to Hampshire Street, to reduce pedestrian/vehicular conflicts.

Each of the variants modify one limited feature or aspect of the proposed project and do not alter the development program. Therefore, noise and vibration emissions from the construction and operation of the proposed variants are anticipated to be similar to the proposed project.

1.2 Overview of Assessment Approach

In accordance with guidelines established by the City of San Francisco's General Plan, Article 29 of the San Francisco Police Code, California Department of Transportation (Caltrans), and the United States Federal Transit Administration (US FTA), the noise and vibration assessment will support the evaluation of potential noise and vibration impacts associated with construction and operation of the proposed project.[1,2,3] The noise and vibration assessment for the proposed project will include (additional details are provided in subsequent sections):

- *Description of existing noise conditions.* Baseline will collect up to two 24-hour noise measurements and up to four short-term 15-minute noise level measurements (the exact number and location of the measurements will be determined during the site reconnaissance based on the conditions observed in the field) in order to help characterize ambient noise conditions.
- *Identification of sensitive receptors.* Noise-sensitive receptors may include residents, hospitals, convalescent homes, schools, churches and sensitive wildlife habitat (e.g., nesting birds, marine mammals, protected fish species [for projects that generate underwater noise such as pile driving in San Francisco Bay] and the habitat of rare,

---

[1] City of San Francisco, 1996. General Plan: Environmental Protection Element. Available at: https://generalplan.sfplanning.org/I6_Environmental_Protection.htm. Accessed: April 20, 2020.

[2] Caltrans, 2013. Transportation and Construction Vibration Guidance Manual. September.

[3] Federal Transit Administration, 2018. Transit Noise and Vibration Impact Assessment Manual. September. Available 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 20, 2020.

threatened or endangered species).[4] The proposed project would not include pile driving within 200 feet of the shoreline and therefore protected fish species are not considered in this analysis. Hotels and motels are also considered noise-sensitive receptors. Vibration-sensitive receptors may include structures (especially older masonry structures), people (especially residents, the elderly, and the sick), and equipment (e.g., magnetic resonance imaging equipment, high resolution lithographic, optical and electron microscopes).[5] Historic resources in the vicinity of the project site are: the Verdi Club at 2424 Mariposa Street, the SGI Cultural Center at 2450 17th Street, and the Leyser-Green Co. Building at 2401-25 17th Street.[6]

- *Assessment of noise impacts during construction.* This analysis will include an evaluation of estimated construction noise levels relative to the limits identified in Article 29 of the San Francisco Police Code and according to the guidelines from US FTA and San Francisco Planning Department.
- *Assessment of vibration impacts during construction.* This analysis will assess potential construction vibration effects according to the guidelines from US FTA and Caltrans.
- *Assessment of noise impacts during operation.* This analysis will compare estimated project noise levels during operation relative to the limits identified in Article 29 of the San Francisco Police Code.
- *Assessment of cumulative noise and vibration impacts during construction.*
- *Assessment of cumulative noise impacts during operation.*

The proposed project is not anticipated to generate substantial vibration during operation and therefore an assessment of operational vibration and cumulative operation is not proposed.

2. SOUND LEVEL MEASUREMENTS

2.1 Duration and Locations

Due to the COVID-19 stay at home order issued March 17, 2020, Baseline will use noise measurements from nearby noise studies to characterize exiting noise conditions per San Francisco Planning Department's guidance in an email dated May 14, 2020.[7] Nearby noise studies include 2000-2070 Bryant Street project and other studies that may become available. If permitted by the environmental review schedule, Baseline will collect sound level measurements in the vicinity of the proposed project to verify the accuracy of the existing noise

---

[4] Governor's Office of Planning and Research, *State of California 2017 General Plan Guidelines, Page 136*, 2017. Available at: http://www.opr.ca.gov/docs/OPR_COMPLETE_7.31.17.pdf. Accessed April 20, 2020.

[5] Federal Transit Administration, 2018. Transit Noise and Vibration Impact Assessment Manual. September. Available 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 20, 2020.

[6] VerPlanck, 2017. Historic Resource Evaluation, Potrero Trolley Coach Division Facility. October 2.

[7] Chelsea Fordham, Principal Planner at San Francisco Planning Department, 2020. Email correspondence with San Francisco Planning Department Qualified Environmental Consultant Pool and Acoustical Consultants. May 14.

conditions characterized with noise measurements from nearby noise studies. Long-term measurements (i.e., at least 24 hours in duration) will be collected at up to two locations, and short-term (i.e., 15-minute) measurements will be collected at up to four locations.

Figure 1 provides an illustration of the approximate proposed locations of these long-term and short-term measurement locations. The exact number and location of the measurements will be determined during the site reconnaissance based on the conditions observed in the field.

2.2 Measurement Equipment and Parameters

Consistent with Article 29 of the San Francisco Police Code (section 2901), Baseline will collect sound level measurements using Type 1[8] sound level meters, using slow response and "A" weighting. Consistent with Article 29 of the San Francisco Police Code (section 2902), the microphones will be positioned at least four feet above ground and protected from the effects of wind noises and other extraneous sounds by the use of appropriate windscreens. The meters will have been factory calibrated within the previous 12 months and will be field calibrated immediately prior to use.

Noise parameters collected during long-term (at least 24 hours in duration) measurements will include, at a minimum, L90[9], hourly Leq[10], and hourly L90. One-second sound level data will be collected for additional analysis, if warranted. 24-hour noise metrics (e.g.,) will be computed from hourly measurement data.

Noise parameters collected during short-term (15-minute) measurements will include, at a minimum, Leq, L90, and Lmax. One-second sound level data will be collected for additional analysis, if warranted.

2.3 Observations

Observations will be made during deployment and retrieval of long-term measurement equipment, as well as during the entire short-term measurements. Observations will document existing major sound sources, weather conditions, traffic observations, and other parameters.

2.4 Data Analysis

Measurement data will be used in the noise and vibration assessment outlined in this scope of work. For example, long-term measurements will be used to characterize the existing noise conditions at the project site and will be used to determine if the project site is consistent with the City's Land Use Compatibility guidelines. Short-term measurements are used to characterize existing noise from the project site and existing noise conditions at the nearest noise-sensitive receptors that may be affected by the proposed project.

[8] A type of sound level meter defined by American National Standards Institute Standard 1.4 as being to measure steady broadband noise in a reverberant sound field to an accuracy within 1.5 dB.

[9] L90 is a statistical noise level, which is exceeded during 90 percent of the measurement period.

[10] Equivalent Noise Level. The average A-weighted noise level during the measurement period.

3. CONSTRUCTION NOISE ASSESSMENT

The construction noise assessment will include the evaluation of noise from temporary construction-related equipment and activities. The assessment will include the following:

- evaluate noise from individual pieces of construction equipment (Appendix A) relative to the limits identified in Article 29 of the San Francisco Police Code (section 2907);
- for daytime construction, evaluate temporary noise emissions from construction equipment as received at the nearest noise-sensitive receptors per the US FTA's guidelines for assessing noise impact[11] and relative to the existing noise environment. Specifically, the assessment will determine if the noise level resulting from the simultaneous operation of the two loudest pieces of equipment (including impact equipment) would be greater than 90 dBA or 10 dBA above the background noise level at sensitive receptor locations;
- for nighttime construction, evaluate temporary noise emissions from construction equipment relative to the limits identified in Article 29 of the San Francisco Police Code (section 2908) and interior sound levels limits of 45 dBA[12] at residential receptors. This assumes a typical attenuation for exterior noise inside of a building with windows closed is 25 dBA.
- discuss the noise effects of construction trucks along haul routes qualitatively.

A description of the existing regulatory framework and guidelines is provided below.

3.1 Applicable Regulations

3.1.1 Article 29 of the San Francisco Police Code

The city regulates noise through Article 29 of the San Francisco Police Code, which states that the city's policy is to prohibit unnecessary, excessive, and offensive noises from all sources subject to police power. Article 29 of the San Francisco Police Code contains noise limits that are specific to construction activities in section 2907(a) and section 2908.

Section 2907(a) limits noise from construction equipment to 80 dBA when measured at a distance of 100 feet from such equipment, or an equivalent sound level at some other convenient distance. Exemptions from this requirement include impact tools with approved mufflers, pavement breakers and jackhammers with approved acoustic shields, and construction equipment used in connection with emergency work.

---

[11] Federal Transit Administration, 2018. Transit Noise and Vibration Impact Assessment Manual. September. Available 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 20, 2020.

[12] A-weighted decibel, a system for weighting measured sound levels to reflect the frequencies that people hear best.

Section 2908 prohibits nighttime construction (between 8:00 p.m. and 7:00 a.m.) that generates noise exceeding the ambient noise level by 5 dBA at the nearest property line unless a special permit has been issued by the city.

3.1.2 United States Federal Transit Administration

Construction-related noise impacts will be assessed using the US FTA methodology for general quantitative noise assessment. This methodology calls for estimating a combined noise level from the simultaneous operation of the two noisiest pieces of equipment expected to be used in each construction phase. The daytime construction criterion is 90 dBA Leq at the nearest noise-sensitive receptors.[13]

3.2 Methodology for Construction Noise Assessment

A usage factor will be applied to each piece of equipment analyzed to account for the time that the equipment would likely be in use over the specified time period. Construction noise sources will be grouped according to construction phase, and the maximum hourly Leq will be determined using the two noisiest pieces of equipment which could be operated simultaneously in any given hour. These two noise sources will be added together at the same location, and the corresponding noise levels at the nearest receptors to the project site will be then predicted based on quantitative calculations that considered the approximate distance between the nearest receptors and the noise sources. The estimated noise levels at the nearest receptors are based on the attenuation of noise with distance, which will decrease by 6 dB for each doubling of distance. The calculations do not consider the attenuation potentially provided by barriers (e.g., intervening walls, buildings and other structures) due to variations in the height and composition of such barriers. The attenuation from barriers will be described qualitatively, if appropriate.

4. CONSTRUCTION VIBRATION ASSESSMENT

The construction vibration assessment will include the evaluation of vibration from temporary construction-related equipment and activities. The assessment will evaluate vibration from each piece of construction equipment as received at the nearest vibration-sensitive receptors:

- relative to the limits identified in the US FTA's guidelines for assessing vibration disturbance to people or interference with vibration-sensitive equipment (if any);[14] and

[13] Although this Federal Transit Administration standard is specifically applicable to residential receptors, this standard can be applied to other noise-sensitive receptors including school students and hospital patients.

[14] Federal Transit Administration, 2018. Transit Noise and Vibration Impact Assessment Manual. September. Available 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 20, 2020.

- relative to the limits identified in the Caltrans guidelines for assessing vibration damage to buildings.[15]

General information on groundborne vibration and a description of existing regulatory framework and guidelines is provided below.

4.1 General Information on Groundborne Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Several different methods are used to quantify vibration. Typically, groundborne vibration generated by human activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors to vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration-sensitive equipment. Vibration amplitudes are usually expressed as either peak particle velocity (PPV) or as root-mean-square (RMS) velocity. PPV is defined as the maximum instantaneous peak of the vibration signal, while the RMS value can be considered an average value over a given time interval. PPV is appropriate for evaluating potential damage to buildings, but it is not suitable for evaluating human response to vibration because it takes the human body time to respond to vibration signals. The response of the human body to vibration is dependent on the average amplitude of a vibration. Thus, RMS is more appropriate for evaluating human response to vibration. PPV and RMS are normally described in units of inches per second (in/sec), and RMS is also often described in vibration decibels (VdB).

A description of the existing regulatory framework and guidelines is provided below.

4.2 Regulations and Guidelines

4.2.1 US FTA

US FTA recommends vibration thresholds to prevent disturbance of occupants, which are presented in Table 1 below.

Table 1 Indoor Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB)		
	Frequent Events[a]	**Occasional Events[b]**	**Infrequent Events[c]**
Special Buildings	65-72	65-80	65-80
Category 1: Buildings where vibration would interfere with interior operations.	65	65	65

[15] Caltrans, 2013. Transportation and Construction Vibration Guidance Manual. September.

Category 2: Residences and buildings where people normally sleep.	72	75	80
Category 3: Institutional land uses with primarily daytime use.	75	78	83

Notes:
[a] More than 70 vibration events of the same source per day.
[b] Between 30 and 70 vibration events of the same source per day.
[c] Less than 30 vibration events of the same source per day.
Source: Federal Transit Administration, 2018. Transit Noise and Vibration Impact Assessment Manual. September. Available 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 20, 2020.

4.2.2 Caltrans

Caltrans recommends vibration thresholds to prevent damage to buildings, which are presented in Table 2 below.

Table 2 Vibration Damage Impact Criteria

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

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.
Source: Caltrans, 2013. Transportation and Construction Vibration Guidance Manual. September.

4.3 Methodology for Construction Vibration Assessment

The vibration level from each piece of construction equipment as received at the nearest vibration-sensitive receptors will be predicted based on quantitative calculations that considered the approximate distance between the nearest receptors and the construction equipment. The following propagation adjustment will be applied to estimate vibration levels in RMS, which is based on the FTA methodology:

RMS2 = RMS1 – 30 Log10 (D2/D1)
Where:
RMS1is the reference vibration level at a specified distance.
RMS2 is the calculated vibration level.
D1 is the reference distance.
D2 is the distance from the equipment to the receiver.

For this assessment, vibration levels in RMS would be calculated at category 1 buildings (presented in Table 1 above) during both daytime and nighttime construction. Vibration levels in RMS would also be calculated at category 2 buildings during nighttime construction if necessary.

The following propagation adjustment will be applied to estimate vibration levels in PPV, which is based on the Caltrans methodology:

PPV2 = PPV1 x $(D1/D2)^n$
Where:
PPV1 is the reference vibration level at a specified distance.
PPV2 is the calculated vibration level.
D1 is the reference distance.
D2 is the distance from the equipment to the receiver.
n is related to the attenuation rate through ground.

5. OPERATIONAL NOISE ASSESSMENT

The operational noise assessment will:

- Evaluate noise relative to the limits identified in Article 29 of the San Francisco Police Code. The limits are based on both absolute permanent increases over existing conditions due to operation of the proposed project (section 2909[a], [b], and [c]) and interior sound levels limits at residential receptors (section 2909[d]).
- Evaluate if the proposed project would result in a substantial permanent increase in traffic noise levels. Traffic noise increase would be evaluated to determine if the proposed project would result in an increase of:
    - 3 dBA Ldn or more where the existing and/or resulting noise levels are in any category other than "Satisfactory" according to the "Land Use Compatibility Guidelines for Community Noise" figure;

- 5 dBA Ldn or more where the existing and/or resulting noise levels are “Satisfactory” according to the “Land Use Compatibility Guidelines for Community Noise” figure.

A description of the existing regulatory framework and guidelines is provided below.

5.1 Regulations and Guidelines

5.1.1 Article 29 of the San Francisco Police Code

Article 29 of the San Francisco Police Code contains noise limits that are specific to operational activities in section 2909.

- Section 2909(a) establishes a limit of 5 dBA above the local ambient noise level at residential receiving properties.
- Section 2909(b) establishes a limit of 8 dBA above the local ambient noise level at commercial or industrial receiving properties.
- Section 2909(c) establishes a limit of 10 dBA above the local ambient noise level at a distance of 25 feet or more at public receiving properties.
- Section 2909(d) establishes an interior noise limit for fixed noise sources at the nearest sensitive receptor of 45 dBA at night (10:00 p.m. to 7:00 a.m.) or 55 dBA during the day (7:00 a.m. to 10:00 p.m.) measured from any bedroom or living room.

5.1.2 San Francisco General Plan

The Environmental Protection Element of the San Francisco General Plan contains a “Land Use Compatibility Guidelines for Community Noise” figure for determining the compatibility of various new uses with different noise levels. These guidelines indicate maximum acceptable noise levels for various land uses. Although this figure presents a range of noise levels that are considered compatible or incompatible with new uses, the maximum “satisfactory” noise level is 60 dBA (Ldn) for residential and hotel uses; 65 dBA (Ldn) for school classrooms, libraries, churches, and hospitals; 70 dBA (Ldn) for playgrounds, parks, office uses, retail commercial uses, and noise-sensitive manufacturing/ communications uses; and 77 dBA (Ldn) for other commercial uses such as wholesale, some retail, industrial/manufacturing, transportation, communications, and utilities.

5.2 Methodology for Operational Noise Assessment

The operational noise impact assessment will be based on on-site sound sources that could result in a substantial permanent increase in noise levels at noise-sensitive receivers in the vicinity of the proposed project. The assessment of on-site noise will include heating/ventilation/air conditioning systems. It is anticipated that the proposed project would not intensify noise-generating activities on-site, which consist of bus maintenance activities (i.e. repair and wash), and vehicle movements because there will be no outdoor yard for the proposed project and vehicle movements will mostly occur in an enclosed space, except when the facility doors need to be open for vehicles entering or existing the facility. Specifically, the facility doors at the southwestern portion of the facility would need to remain open for buses exiting the facility from 5 AM to 9 AM and the facility doors at the southeastern portion of the facility need to remain open for buses entering the facility from 4 PM to 8 PM. Therefore, the assessment of on-site noise from bus maintenance activities and bus idling would be discussed qualitatively.

Noise emissions generated by off-site sources that are directly attributable to the proposed project would include project-related traffic traveling on existing roadways in the proposed project vicinity. The assessment of increases in traffic noise will be based on a review of traffic volumes along area roadways under "existing" and "existing+project" scenarios. A traffic noise prediction model (e.g., Federal Highway Administration's Traffic Noise Model Version 2.5 or similar) will be used to estimate traffic noise increase.

6. CUMULATIVE ANALYSIS

Cumulative analyses are proposed for construction noise and vibration, as well as operational noise, specifically due to increases in traffic along area roadways. Reasonably foreseeable projects in the vicinity of the proposed project will be identified through coordination with the City, including approved and pending projects. Details regarding construction activities and schedules for reasonably foreseeable projects are anticipated to be either readily available through the City's online publications, or may be requested directly. The cumulative assessment of construction noise and vibration will be completed for nearby sensitive receptors.

Cumulative assessment of operational traffic noise will be based on data provided within the project's traffic study for the following scenarios: existing, existing+project, cumulative (consistent with the project's traffic analysis horizon year), and cumulative+project.

7. CONTROL MEASURES

Baseline will evaluate the project's construction and operational noise and vibration impacts and recommend control measures required to meet applicable limits, if feasible. Control measures may include, but not limited to:

- Maintain buffer distances or erect noise barriers.
- Limit the use of certain types of construction equipment.
- Notify nearby sensitive receptors prior to the implementation of certain construction activities.
- Prepare a construction noise control plan.

8. DELIVERABLES AND COORDINATION

Baseline will not prepare a stand-alone noise technical background study. Instead, Baseline will work with SWCA Environmental Consultants to document the results of the noise and vibration assessment in the draft Environmental Impact Report (EIR) for the proposed project, with technical documentation included as part of the EIR appendix. The noise technical appendix will provide details that are not required within the EIR section, such as hourly sound level measurement data and charts, details of traffic noise modeling including sound level output data and traffic volumes, and calculation details for construction and operational impact analyses. Baseline will respond to two rounds of comments following two separate rounds of review by the San Francisco Planning Department's Environmental Planning Division.

APPENDIX A

PRELIMINARY PROJECT-SPECIFIC CONSTRUCTION INFORMATION

Preliminary Project-Specific Construction Information

	Demolition			Site Preparation, Grading, and Piling			Foundation			Building Construction			Paving			Architectural Coating		
Total Work Days	42			110			42			546			20			20		
Total Workers per Day[1]	30			50			100			450			25			30		
Total Vendor Truck Trips[2]	840			550			1050			13650			60			100		
Total Soil Haul Truck Trips[3]	5000			20044			200			100			20					
Total Concrete Truck Trips[4]	20			270			3300			2500			50					
Equipment	**# of Equipment**	**Hours/Day**	**Fuel Type**	**# of Equipment**	**Hours/Day**	**Fuel Type**	**# of Equipment**	**Hours/Day**	**Fuel Type**	**# of Equipment**	**Hours/Day**	**Fuel Type**	**# of Equipment**	**Hours/Day**	**Fuel Type**	**# of Equipment**	**Hours/Day**	**Fuel Type**
Aerial Lifts																		
Air Compressors	2	8	Diesel	1	8	Diesel	1	8	Diesel	1	2	Diesel	1	4	Diesel			
Air Compressors	2	8	Electric	2	8	Electric	2	8	Electric	10	8	Electric				1	8	Electric
Bore/Drill Rigs	1	8	Electric															
Cement and Mortar Mixers							1	8	Diesel	1	6	Diesel	1	10	Diesel			
Concrete/Industrial Saws	1	8	Diesel				1	1	Diesel									
Cranes	2	8	Diesel	2	8	Diesel	1	4	Diesel	1	1	Diesel	1	2	Diesel			
Crawler Tractors																		
Crushing/Proc. Equipment																		
Dumpers/Tenders																		
Excavators[5]	2	8	Diesel	6	8	Diesel	2	8	Diesel	2	2.64	Diesel						
Forklifts	1	4	Propane	1	4	Propane	2	8	Propane	3	4	Propane				1	8	Propane
Generator Sets	1	4	Diesel	4	8	Diesel	4	8	Diesel	1	2.34	Diesel						
Graders				2	6	Diesel	1	4	Diesel									
Off-Highway Tractors																		
Off-Highway Trucks																		
Other Construction Equipment	1	1	Electric	15	8	Electric	15	8	Electric	30	8	Electric						
Other General Industrial Equipment							1	8	Diesel									
Other Material Handling Equipment				1	8	Electric	1	8	Electric	2	8	Electric	1	4	Electric			
Pavers													1	8	Diesel			
Paving Equipment													2	8	Diesel			
Plate Compactors				2	8	Propane	2	8	Propane	1	2.64	Propane	4	8	Propane			
Pressure Washers										1	1	Electric				1	1	Electric
Pumps	54	8	Electric	54	8	Electric	54	8	Electric	54	4	Electric	2	8	Electric	2	8	Electric
Rollers				1	8	Diesel	1	6	Diesel				2	6	Diesel			
Rough Terrain Forklifts	1	6	Diesel	2	4	Diesel	2	8	Diesel	2	4							
Rubber Tired Dozers	2	8	Diesel	2	8	Diesel	1	4	Diesel	1	2.64	Diesel	1	8	Diesel			
Rubber Tired Loaders	1	8	Diesel	2	8	Diesel	1	2	Diesel									
Scrapers													1	8	Diesel			
Signal Boards	4	8	Electric	4	8	Electric	4	8	Electric									
Skid Steer Loaders	1	8	Propane	1	2	Propane												
Surfacing Equipment																		
Sweepers/Scrubbers																		
Tractors/Loaders/Backhoes	3	8	Diesel	5	8	Diesel	3	8	Diesel	3	4	Diesel	1	8	Diesel			
Trenchers				1	4	Diesel												
Welders				2	4	Electric	2	8	Electric	33	5	Electric						
Slant Pile Drill				1	8	Diesel												
Soil Mix Drill Rig				1	8	Diesel												
Grout Plant				1	8	Diesel												
Soldier Pile Rig[6]				1	8	Diesel												
Tie Back Drill				1	8	Diesel												
Air Compressor for Tie Back Rig				1	8	Diesel												
Concrete Truck	1	2	Diesel	2	6	Diesel	7	12	Diesel	2	8	Diesel	1	4	Diesel			
Concrete Boom Pump	1	2	Diesel	1	4	Diesel	4	4	Diesel	3	3	Diesel	1	4	Diesel			
Scissor Lift							5	10	Electric	50	5	Electric	2	8	Electric	4	8	Electric
Tower Crane				1	8	Electric	2	10	Electric	4	12	Electric	4	2	Electric	4	2	Electric
Hoist (Construction Elevator)				1	4	Electric	1	8	Electric	2	12	Electric	2	12	Electric	2	12	Electric
Light Plant	4	6	Propane	4	6	Propane	4	6	Propane				2	8	Propane			
Recycling Plant	1	8		1	2													

Notes:

[1] In accordance with CalEEMod, assume single vehicle occupancy, a round trip distance of 21.6 miles, and a fleet mix of 50 percent light-duty auto, 25 percent light-duty truck type 1, and 25 percent light-duty truck type 2.

[2] In accordance with CalEEMod, assume a round trip distance of 14.6 miles and a fleet mix of 100 percent heavy heavy-duty trucks.

[3] In accordance with CalEEMod, assume a fleet mix of 100 percent heavy heavy-duty trucks. Conservatively assume a round trip distance of 110 miles to the Altamont Landfill in Livermore, which is near the border of the San Francisco Bay Area Air Basin.

[4] In accordance with CalEEMod, assume a round trip distance of 40 miles and a fleet mix of 100 percent heavy heavy-duty trucks.

[5] For the noise and vibration analysis, it will be conservatively assumed that excavators will be equipped with a hydraulic breaker (also known as a hoe ram) during bedrock removal.

[6] For the noise and vibration analysis, it will be conservatively assumed that impact pile driver methods will be used for pile installations.

FIGURE

Noise Measurement Locations

Figure 1

Base: Google Aerial Map, 2020.

Legend

Project Site

ST-1 Short-term noise measurement locations

LT-1 Long-term noise measurement locations

0 200 Feet N

Potrero Yard Modernization Project
San Francisco

BASELINE ENVIRONMENTAL CONSULTING

18202-00.02709 Figure 1 04/27/20

Appendix F-2

Sound Level Measurement Data

Overview: Technical memorandum includes ambient noise measurement data collected for the 2000-2070 Bryant Street Project. Due to changes in traffic patterns and reductions in transit use in response to COVID-19 and the subsequent issuance of Mayor's Executive Directive requiring Shelter at Home protocols and ensuing business opening efforts, ambient noise measurements during this period were not conducted for the Potrero Yard modernization Project. Instead, ambient noise measurements collected for the 2000-2070 Bryant Street Project were used to characterize the existing ambient noise environment in the vicinity of the project site for the Potrero Yard modernization Project.

Memorandum

Date:	March 26, 2015
To:	Chris Thomas San Francisco Planning Department, Environmental Planning 1650 Mission Street, Suite 400 San Francisco, CA 94103
From:	Dave Buehler and Cory Matsui, ICF International
Subject:	**2000-2070 Bryant Street Project – Final Noise Study Case No. 2013.0677E**

Introduction

This memorandum has been prepared to document a noise analysis conducted for the 2000-2070 Bryant Street Project (proposed project). The proposed project involves the demolition of seven existing buildings and construction of a six-story, 68-foot-tall, approximately 286,369 gross square-foot (gsf) mixed-use residential and commercial building with a ground-level garage. The mixed-use building would provide approximately 274 dwelling units and 5,415 gsf of commercial retail space.

The project site is located within the Eastern Neighborhoods Area Plan in the Mission District neighborhood at 2000 through 2070 Bryant Street, 2815 18th Street, and 611 Florida Street. The Eastern Neighborhoods Area Plan was adopted in December 2008, in part to support residential mixed-use development in some areas previously zoned for industrial uses, and also to preserve adequate space for existing and future PDR employment and businesses.

The Eastern Neighborhoods Area Plan Program Environmental Impact Report (PEIR) identifies several mitigation measures related to noise. This memo has been prepared to demonstrate compliance with Mitigation Measure F-4, Siting of Noise-Sensitive Uses, which applies to the proposed project because it would introduce noise-sensitive uses (i.e., residential) to the project site. This mitigation measure states that an analysis will be prepared that demonstrates "with reasonable certainty that Title 24 standards, where applicable, can be met, and that there are no particular circumstances about the proposed project site that appear to warrant heightened concern about noise levels in the vicinity."

Compliance with Mitigation Measure F-6 from the PEIR, which applies to open space areas of new land use development, is demonstrated in this memo as well. Mitigation Measure F-6 states that open space is required to be protected from existing ambient noise levels that could prove annoying or disruptive to users of the open space, to the maximum feasible extent.

Noise Terminology

Terminology relevant to the noise survey results and analysis are included in **Table 1**.

Table 1. Definition of Sound Measurements

Sound Measurements	Definition
Decibel (dB)	A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
Maximum Sound Level (L_{max})	The maximum sound level measured during the measurement period.
Minimum Sound Level (L_{min})	The minimum sound level measured during the measurement period.
Equivalent Sound Level (L_{eq})	The equivalent steady state sound level that in a stated period of time would contain the same acoustical energy.
Percentile-Exceeded Sound Level (L_{xx})	The sound level exceeded *xx* % of a specific time period. L_{10} is the sound level exceeded 10% of the time. L_{90} is the sound level exceeded 90% of the time. L_{90} is often considered to be representative of the background noise level in a given area.
Day-Night Level (L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
Community Noise Equivalent Level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
Frequency: Hertz (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.
Sound Transmission Class (STC)	A rating of how well a building partition attenuates airborne sound. STC is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations.
Outdoor-Indoor Transmission Class (OITC)	A rating of how well a building partition attenuates airborne sound between outdoor and indoor spaces in a structure.

Sound Transmission Class and Outdoor-Indoor Transmission Class Ratings

An Outdoor-Indoor Transmission Class (OITC) rating specifies how well a building partition attenuates airborne sound between outdoor and indoor spaces in a structure, such as noise from cars or airplanes. A Sound Transmission Class (STC) rating specifies how well an interior building partition attenuates airborne sound, such as noise from office equipment or human voices (PPG 2015). STC ratings are more widely used than OITC ratings to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations. OITC and STC ratings represent the decibel reduction in noise that is achieved by a partition; thus, a higher rating is more desirable (PPG 2015).

Tests of various wood stud walls indicate OITC ratings from a low of 25 to a high of 44, which corresponds to a sound level reduction in the range of 25 to 44 dBA. Increasing the stud spacing, adding resilient channels, or using a staggered stud configuration all significantly increased the rating of the wall. Combining one of these improvements with additional surface layers to increase their mass produces further improvements in the overall sound insulation (Bradley and Birta 2000). Use of metal studs typically adds 2 dB to STC values, further attenuating interior noise levels (Hoover and Keith 2000). Windows typically have OITC ratings in the range of about 29 to 33 depending on the configuration (PPG 2015). **Table 2** summarizes typical STC and OITC ratings.

Table 2. Typical STC and OITC Ratings

Product Type	**STC**	**OITC**	**Reference Source**
Monolithic Glass			
¼" monolithic glass	31	29	1
½" monolithic glass	36	33	1
Sealed Insulating Glass Units			
¼" glass + ½" air + ¼" glass	35	28	1
¼" glass + 1" air + ¼" glass	37	30	1
Laminated Glass with 0.030 Resin Interlayer			
1/8" glass / resin / 1/8" glass	35	31	1
¼" glass / resin / ¼" glass	38	34	1
Sealed Insulating Glass with 0.030 Resin Interlayer			
1/8" glass / resin / 1/8" glass + ½" air + ¼" glass	39	31	1
1/8" glass / resin / ¼"glass + ½" air + ¼" glass	40	31	1
Wall Assemblies			
½" gypsum board (both sides) screwed to 3-5/8" metal studs	36	-	1
6" lightweight concrete block, two coats of paint each side	46	-	1
4" hollow lightweight masonry block, plastered on both sides	48	-	1
8" dense concrete block wall, two coats of paint each side	52	-	1
Double layer of gypsum wall board, both sides, 3-5/8" metal studs, 3" insulation	54	-	1
½-inch wood board/6-inch wood stud/½-inch gypsum board with glass fiber insulation	-	25	2
½-inch wood board/6-inch wood stud/½-inch gypsum board with glass fiber insulation add expanded polystyrene and stucco on one side	-	27	2
½-inch wood board/6-inch wood stud/½-inch gypsum board with glass fiber insulation add cement stucco on one side	-	29	2

Product Type	STC	OITC	Reference Source
½-inch wood board/6- inch wood stud/½-inch gypsum board with glass fiber insulation add brick on one side	-	40	[2]
4-inch thick concrete	45	41	[3]
6-inch thick hollow-core dense concrete block or masonry	43	39	[3]
Sources: [1]PPG 2015, [2]Bradley and Birta 2000, [3]Hoover and Keith 2000.			

Noise Survey Methodology

Ambient noise levels in the project area were measured at three long-term (48 hours) sites and four short-term (15 minute) sites. Long-term measurements were conducted with three Piccolo Type 2 integrating sound level meters. Short-term measurements were conducted with a Larson Davis Type 1 integrating sound level meter.

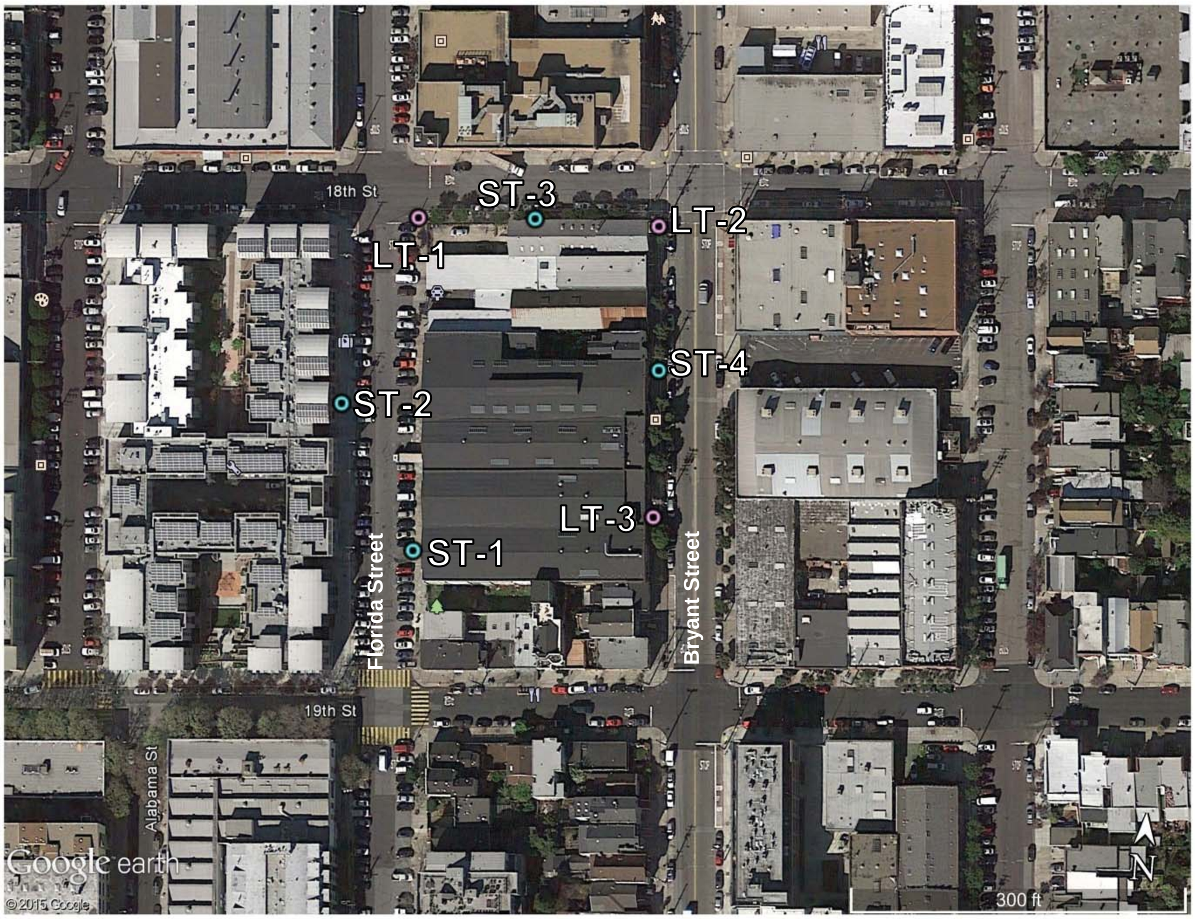
Long-Term Measurements

Long-term measurements were conducted by affixing the sound meters to utility poles in the project area at heights of approximately 10-12 feet above the street level. The meters continuously measured sound levels over a 48-hour period from Monday, December 8, 2014 to Wednesday, December 10, 2014. All relevant noise data metrics were recorded. The locations of the long-term measurement sites are described in **Table 3** and shown in **Figure 1**.

Short-Term Measurements

Short-term measurements were completed on Wednesday, December 10, 2014 at four locations in the vicinity of the project area at street level. Measurements were conducted for 15-minute intervals at each measurement location, with the relevant noise data metrics being recorded. **Table 4** below describes the locations of the 4 short-term measurement sites, and **Figure 1** shows the locations of the short-term sites.

Figure 1. Long-Term and Short-Term Noise Monitoring Sites



Noise Survey Results

Table 3 and **Table 4** present the results of the long-term and short-term noise measurement surveys, respectively.

As shown in **Table 3** below, L_{dn} values for the long-term measurement sites are between approximately 69 dBA and 72 dBA. The site with the highest L_{dn}, LT-2, is located at the intersection of Bryant Street and 18th Street, which is a busy intersection. LT-3 has an L_{dn} value that is less than LT-2 (approximately 70 dBA), as it is located adjacent to only one street and experiences less vehicle acceleration noise from vehicles than the intersection of Bryant Street and 18th Street. LT-1 has the smallest L_{dn} value due to its location at the less active intersection of 18th Street and Florida Street.

Table 3. Long-Term Noise Measurements Results – Monday, 12/8/2014 to Wednesday 12/10/2014

Site #	Location	L_{dn}
LT-1	Florida St & 18th Street, Southeast Corner of Intersection	69
LT-2	Bryant St & 18th Street, Southwest Corner of Intersection	72
LT-3	West Side of Bryant Street. 163 feet north of Bryant St &19th St Intersection	70
Notes: Measurements began between 10:30 – 11:00 AM on 12/8/2014 and ended at approximately 11:00 AM on 12/10/2014. All values are in units of dBA		

As shown in **Table 4**, L_{eq} values from the short-term noise measurements range from 57 dBA to 65 dBA. The noisiest measurement sites are located on Bryant Street and on 18th Street, while the measurement sites on Florida Street resulted in lower noise levels. Noise sources during the short-term measurements included cars and medium-duty trucks, idling delivery vehicles, car-security system noises, parking garage alert sirens, and human voices.

Table 4. Short-Term Noise Measurements Results – Wednesday, 12/10/2014

Site #	Location	L_{eq}	L_{max}	L_{min}	L_{10}	L_{33}	L_{50}	L_{90}
ST-1	681 Florida Street	56.7	57.6	49.9	59.6	55.9	54.4	51.7
ST-2	650-D Florida Street	57.8	76.1	50.4	60.3	55.3	53.8	51.6
ST-3	Opposite side of the street from 2828 18th Street	62.4	81.5	52.1	63.2	59.4	57.8	54.6
ST-4	West side of Bryant Street, 115 feet south of 18th Street and Bryant Street intersection	64.9	78.0	55.3	68.0	64.0	61.6	57.1
Notes: Measurements were conducted between 11:45 AM and 1:30 PM on 12/10/2014. All values are in units of dBA								

Title 24 of the California Code of Regulations

Section 1207.4 of Title 24 of the California Code of Regulations states the following:

Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric shall be either the day-night average sound level (L_{dn}) or the community noise equivalent level (CNEL).

Proposed Wall Assemblies

The project sponsor has provided that following information concerning the exterior wall assemblies:

Assembly 1: Non-load bearing exterior walls

- Wood Siding (1-hr & 2-hr assembly)
- Brick (1-hr & 2-hr assembly)
- Tilt-up Walls w/ Siding at Southwest Property Line (1-hr & 2-hr assembly)
- Storefront
- Board Form Concrete (1-hr assembly only)

Assembly 2: Brick Building

- ½" thin brick exterior over two coat cement plaster (scratch and brown) over 1/2" plywood, 2x6 studs at 16" O.C. with acoustical insulation and one (1) layer 5/8" type X interior gypsum board.
- At exterior load bearing wall conditions (2-Hour Rated), (1) additional layer of 5/8" dens glass is required at the exterior and one (1) additional layer of 5/8" Type X interior gypsum board in addition to the above.

Assembly 3: Wood Building

- Cement Fiber Siding over 5/8" fiberglass sheathing, 2x6 studs at 16" O.C. with acoustical insulation and one (1) layer 5/8" Type X interior gypsum board.
- At exterior load bearing wall conditions (2-hour rated), an additional layer of 5/8" fiberglass sheathing and an additional layer of 5/8" gypsum board is required at the exterior in addition to the above.

Assembly 4: Blind Walls

- ½” plywood sheathing (or similar blind wall siding) 5/8" fiberglass sheathing, 2x6 studs at 16” O.C. with acoustical insulation and two (2) layers 5/8" Type X interior gypsum board.
- At exterior load bearing wall conditions an additional layer of 5/8” fiberglass sheathing is required at the exterior in addition to the above.

Summary: Comparison to Title 24 Requirements

The highest L_{dn} value measured during the long term noise measurements was 72 dBA L_{dn}. This means a rating of at least 27 OITC is needed for the window and wall assemblies to achieve an interior sound level of 45 dBA L_{dn}.

The types of window assemblies to be used are not known at this time. However, all of the window types shown in **Table 2** would provide a rating of at least OITC 27, so it is reasonable to assume the window assemblies for the proposed project will provide a rating of at least OITC 27, assuming windows are closed. As such, the design for the building shell and mechanical design must specify a ventilation or air conditioning system to provide adequate ventilation.

Wall Assembly 1 is based on a concrete tilt up wall, which is expected to perform at least as well as 4-inch thick concrete indicated in **Table 2** (OITC 41). Wall Assemblies 2, 3, and 4 are expected to provide a rating of at least 27 OITC based on the similar assemblies indicated in **Table 2**.

This analysis indicates that the proposed window and wall assemblies as currently proposed have reasonable certainty of meeting the Title 24 interior sound level standard of 45 dBA L_{dn}. The attenuation from window and wall assemblies rated at OITC 27 or higher (see **Table 2**) would ensure that the highest measured noise level of 72 dBA L_{dn} is attenuated by at least 27 dBA to meet the 45 dBA L_{dn} standard. The performance of the final wall and window assembly designs must be confirmed in the formal Title 24 report.

With regard to the open space areas proposed as part of the project, noise levels in these areas would not be considered to be annoying or disruptive. The U.S. Department of Housing and Urban Development considers noise at residential land uses to be acceptable at levels of 65 dBA L_{dn} or less. Thus, demonstrating that noise levels at the 2nd-level outdoor courtyard and rooftop terrace at the project site would be 65 dBA L_{dn} or less would ensure compliance with Mitigation Measure F-6 of the PEIR.

At the noisiest area of the project site, the intersection of Bryant Street and 18th Street, the noise level was measured at 72 dBA L_{dn}. The eastern 2nd level courtyard would be adjacent to this intersection, but the courtyard would be shielded from noise by the project buildings. While some noise would be loud enough to propagate over the buildings and into the courtyard, the shielding effect provided by the project building would be more than sufficient to reduce noise by 7 dBA, from 72 dBA L_{dn} to 65 dBA L_{dn} or less.

The proposed rooftop terrace would be located at the northwest corner of the project site and near measurement site LT-1, where L_{dn} noise was measured to be 69 dBA. Consequently, a reduction in noise of at least 4 dBA would be needed between the street level and rooftop terrace in order for noise to be considered acceptable. The rooftop terrace would be located on the top of the sixth story of the project building, 68 feet above the street level. A distance of 68 feet between the noise on the street level and the rooftop terrace, along with the shielding provided by the top edge of the safety barrier, there would be sufficient noise attenuation to reduce noise levels by at least 4 dBA, from 69 dBA L_{dn}, to 65 dBA L_{dn} or less. Thus, noise at both the 2nd level courtyard and rooftop terrace would not be considered annoying or disruptive, which would ensure that the project is in compliance with Mitigation Measure F-6 from the PEIR.

References:

Bradley and Birta 2000. *Laboratory measurements of the sound insulation of building façade elements*. IRC Internal Report, IRC IR-818.

Hoover and Keith 2000. *Noise control for buildings and manufacturing plants*. Houston, TX.

PPG Technologies. Website accessed January 15, 2015.
http://educationcenter.ppg.com/glasstopics/determining_the_right_glass.aspx

Appendix F-3

Operational and Cumulative Traffic Data

Overview: Data provided by Fehr and Peers for the Potrero Yard Modernization Project, which includes traffic volumes along 22 roadway segments during the PM peak hour.

Potrero Yard Modernization Project
Operational and Cumulative Traffic Data and Model Outputs

Roadway	Location	Direction	Existing Volume - No Project		Existing Volume - Plus Project		Cumulative Volume - Plus Project	
			PM Peak Hour Volume	Approximate Daily Volume	PM Peak Hour Volume	Approximate Daily Volume	PM Peak Hour Volume	Approximate Daily Volume
16th St	East of Bryant St	EB	570	5,700	570	5,700	660	6,600
		WB	1,030	10,300	1,033	10,330	1,110	11,100
	West of Bryant St	EB	490	4,900	501	5,010	580	5,800
		WB	949	9,490	955	9,550	1,040	10,400
	East of Potrero Ave	EB	579	5,790	437	4,370	710	7,100
		WB	779	7,790	797	7,970	820	8,200
	West of Potrero Ave	EB	570	5,700	570	5,700	660	6,600
		WB	1,030	10,300	1,033	10,330	1,110	11,100
17th St	East of Bryant St	EB	274	2,740	291	2,910	340	3,400
		WB	372	3,720	376	3,760	500	5,000
	West of Bryant St	EB	272	2,720	287	2,870	330	3,300
		WB	274	2,740	282	2,820	380	3,800
	East of Hampshire St	EB	287	2,870	290	2,900	350	3,500
		WB	386	3,860	386	3,860	520	5,200
	West of Hampshire St	EB	274	2,740	291	2,910	340	3,400
		WB	372	3,720	376	3,760	500	5,000
Mariposa St	East of Bryant St	EB	114	1,140	158	1,580	210	2,100
		WB	185	1,850	214	2,140	370	3,700
	West of Bryant St	EB	113	1,130	128	1,280	190	1,900
		WB	125	1,250	133	1,330	230	2,300
	East of Hampshire St	EB	111	1,110	163	1,630	220	2,200
		WB	163	1,630	217	2,170	370	3,700
	West of Hampshire St	EB	189	1,890	247	2,470	320	3,200
		WB	163	1,630	234	2,340	360	3,600
	East of York St	EB	189	1,890	247	2,470	320	3,200
		WB	163	1,630	234	2,340	360	3,600
	West of York St	EB	114	1,140	158	1,580	210	2,100
		WB	185	1,850	214	2,140	370	3,700
Bryant St	North of 16th St	NB	489	4,890	504	5,040	560	5,600
		SB	329	3,290	349	3,490	410	4,100
	South of 16th St	NB	420	4,200	438	4,380	520	5,200
		SB	280	2,800	311	3,110	360	3,600
	North of 17th St	NB	420	4,200	438	4,380	520	5,200
		SB	280	2,800	311	3,110	360	3,600
	South of 17th St	NB	317	3,170	338	3,380	420	4,200
		SB	304	3,040	334	3,340	410	4,100
	North of Mariposa St	NB	317	3,170	338	3,380	420	4,200
		SB	304	3,040	334	3,340	410	4,100
	South of Mariposa St	NB	287	2,870	287	2,870	330	3,300
		SB	328	3,280	328	3,280	440	4,400
Potrero Ave	North of 16th St	NB	553	5,530	565	5,650	620	6,200
		SB	1,089	10,890	1,101	11,010	1,400	14,000
	South of 16th St	NB	716	7,160	752	7,520	820	8,200
		SB	961	9,610	991	9,910	1,230	12,300
Hampshire St	North of 17th St	NB	5	50	5	50	20	200
		SB	18	180	18	180	30	300
	South of 17th St	NB	39	390	45	450	80	800
		SB	59	590	76	760	110	1,100
	North of Mariposa St	NB	39	390	45	450	80	800
		SB	59	590	76	760	110	1,100
	South of Mariposa St	NB	49	490	49	490	70	700
		SB	81	810	81	810	130	1,300
York St	North of Mariposa St	NB	5	50	129	1,290	140	1,400
		SB	-	-	94	940	100	1,000
	South of Mariposa St	NB	39	390	48	480	70	700
		SB	36	360	43	430	70	700

Potrero Yard Modernization Project
Operational and Cumulative Traffic Data and Model Outputs

		Heavy Vehicle %				Bus %				Non-Bus Heavy Vehicle %			
	Intersection	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
1	16th St/ Bryant St	3%	3%	8%	4%	1%	1%	1%	1%	2%	2%	7%	3%
2	17th St/ Bryant St	3%	4%	3%	1%	2%	3%	2%	1%	1%	1%	1%	0%
3	Mariposa St/ Bryant St	3%	4%	3%	2%	1%	3%	1%	1%	2%	1%	2%	1%
4	Mariposa St/ York St	3%	--	4%	2%	1%		3%	1%	2%		1%	1%
5	17th St/ Hampshire St	0%	0%	4%	1%			2%		0%	0%	2%	1%
6	Mariposa St/ Hampshire St	4%	0%	3%	2%	1%		3%	1%	3%	0%	0%	1%
7	16th St/ Potrero Ave	4%	4%	9%	5%	2%	2%	2%	2%	2%	2%	7%	3%

* Based on PM Peak hour existing counts

Project Trips:	Daily
% Non-Bus HV	1%
% Bus	3%

Appendix F-4

Operational and Cumulative Traffic Noise Model
Outputs

Overview: Traffic noise levels for the Potrero Yard Modernization Project were determined using the Federal Highway Administration Traffic Noise Model (TNM) Lookup tool, version 2.5.

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Mariposa Street East of Hampshire St E

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	266.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	8.0
Average heavy truck speed (mph):	30.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 58.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Mariposa Street East of Hampshire St E+P

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	369.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	11.0
Average heavy truck speed (mph):	30.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	60.0

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Mariposa Street East of Hampshire St C

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	469.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	15.0
Average heavy truck speed (mph):	30.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	61.2

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Mariposa Street East of Hampshire St C+P

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	572.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	18.0
Average heavy truck speed (mph):	30.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 62.0

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Hampshire Street north of 17th St E

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	23.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	45.6

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Hampshire Street north of 17th St C

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	50.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft):	50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA):	49.0

* * * * CASE INFORMATION * * * *

* * * * Results calculated with TNM Version 2.5 * * * *

Hampshire Street north of 17th St C+P

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	50.0
Average automobile speed (mph):	30.0
Medium truck volume (v/h):	0.0
Average medium truck speed (mph):	0.0
Heavy truck volume (v/h):	0.0
Average heavy truck speed (mph):	0.0
Bus volume (v/h):	0.0
Average bus speed (mph):	0.0
Motorcycle volume (v/h):	0.0
Average Motorcycle speed (mph):	0.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: hard

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

person

Distance from center of 12-ft wide, single lane roadway (ft): 50.0
A-weighted Hourly Equivalent Sound Level without Barrier (dBA): 49.0