WILSON IHRIG
ACOUSTICS, NOISE & VIBRATION

CALIFORNIA
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CONSTRUCTION NOISE AND VIBRATION REDUCTION PLAN

Berkeley Unified School District Workforce Housing Project

Berkeley, CA

January 6, 2025

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WI Project 22-181

Contents

1 Purpose and Scope

The Berkeley Unified School District Workforce Housing Project is a publicly funded multi-family development located at 1701 San Pablo Ave. The building includes 110 residential units in a 5-story building.

Wilson, Ihrig & Associates, Inc. has been retained to prepare a Construction Noise and Vibration Reduction Plan for the Construction work which will be initiated in 2025. The purpose of this plan is to report on how construction noise will be controlled and document whether construction vibration could potentially damage any adjacent buildings to the project. This plan summarizes the applicable Project noise limits, provides a summary of expected noise levels from construction, and other significant noise generators, and outlines feasible site-specific noise attenuation measures.

2 Definitions

The following definitions are referenced herein.

- Noise Level: Unless otherwise noted refers to the A-weighted sound pressure level in terms of dBA re 20 micro-Pascal.
- Leq: Equivalent sound level which represents the average energy for the duration of the noise measurement specified.
- L_{max}: Maximum measured sound level.
- Noise Sensitive Locations: Residences, hotels, institutions, hospitals, commercial use spaces, and other locations identified herein.

3 Project Work Area and Surrounding Areas

Refer to the site plan in Figure 1 which indicates the approximate boundaries of the work area and the closest surrounding sensitive receptors. The site is surrounded by 1and 2-story residences (R-2) and commercial (C-W) land uses.

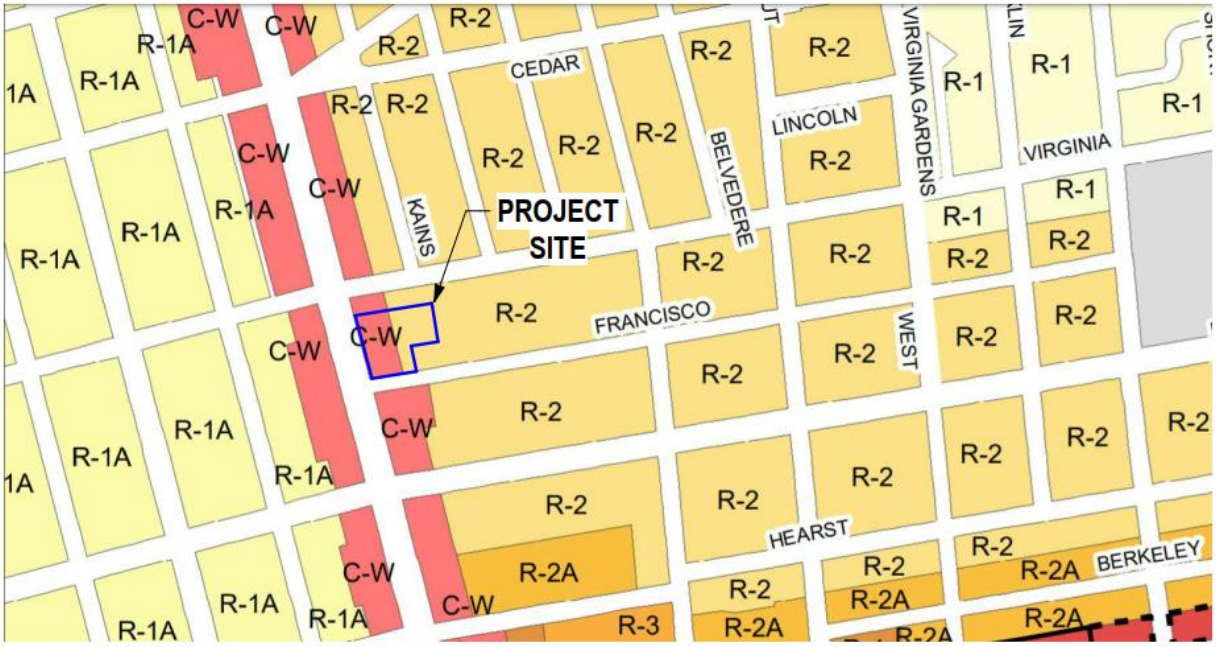

Figure 1 Project Work Area and Surrounding Sensitive Receptors (source: Sheet G2.00 of the 6/17/2024 Permit Set)

4 Project Noise Criteria

4.1 Basic Requirements

The City of Berkeley's standards for construction noise are summarized in Table 1 and briefly discussed below. These are contained in the Berkeley Municipal Code, section 13.40.070.

7. Construction/Demolition.

(a) Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work before 7:00 a.m. on a weekday (or before 9:00 a.m. on a weekend or holiday) or after 7:00 p.m. on a weekday (or after 8:00 p.m. on a weekend or holiday) such that the sound therefrom across a residential or commercial real property line violates Section 13.40.050 or 13.40.060, except for emergency work of public service utilities or by variance issued by the EHD. (This section shall not apply to the use of domestic power tools as specified in subsection B.11 of this section.)

(b) Noise Restrictions at Affected Properties. Where technically and economically feasible, construction activities shall be conducted in such a manner that the maximum sound levels at affected properties will not exceed those listed in the following schedule:

AT RESIDENTIAL PROPERTIES: Mobile Equipment. Maximum sound levels for nonscheduled, intermittent, short-term operation (less than 10 days) of mobile equipment:

Table 13.40-3.

	R-1, R-2 Residential	R-3 and above Multi-Family Residential	Commercial/Industrial
Weekdays 7:00 a.m. to 7:00 p.m.	75 dBA	80 dBA	85 dBA
Weekends 9:00 a.m. to 8:00 p.m. and legal holidays	60	65	70

Stationary Equipment. Maximum sound levels for repetitively scheduled and relatively long term operation (period of 10 days or more) of stationary equipment:

Table 13.40-4.

	R-1, R-2 Residential	R-3 and above Multi-Family Residential	Commercial/Industrial
Weekdays 7:00 a.m. to 7:00 p.m.	60 dBA	65 dBA	70 dBA
Weekends 9:00 a.m. to 8:00 p.m. and legal holidays	50	55	60

8. Vibration. Operating or permitting the operation of any device that creates a vibration, which annoys or disturbs at least two or more reasonable persons of normal sensitiveness who reside in separate residences (including apartments and condominiums) at or beyond the property boundary of the source, if on private property, or at least 150 feet (46 meters) from the source, if on a public space or public right-of-way.

The existing ambient noise conditions were previously documented by Wilson Ihrig along San Pablo Avenue, Francisco Street, and Virginia Street. It was shown that the existing site is typically exposed to hourly equivalent noise levels on the order of 54 to 70 dBA during the weekdays (see Figures A1 through A4 in Appendix A). Average ambient sound levels were determined from data taken during the weekdays of the measurement period and averaging out intermittent high maximums. If noise monitoring is conducted during construction, the site-specific noise limits would be determined from a combination of the construction noise limit and the existing ambient conditions. Based on the ambient noise environment measured, the site-specific noise limits are outlined in Figures 2 through 9 below.

These site-specific criteria are based on the May 2023 measurement locations, and they are subject to revision if different measuring locations are selected for construction monitoring, since the ambient conditions at construction monitoring locations could be different from those previously measured.

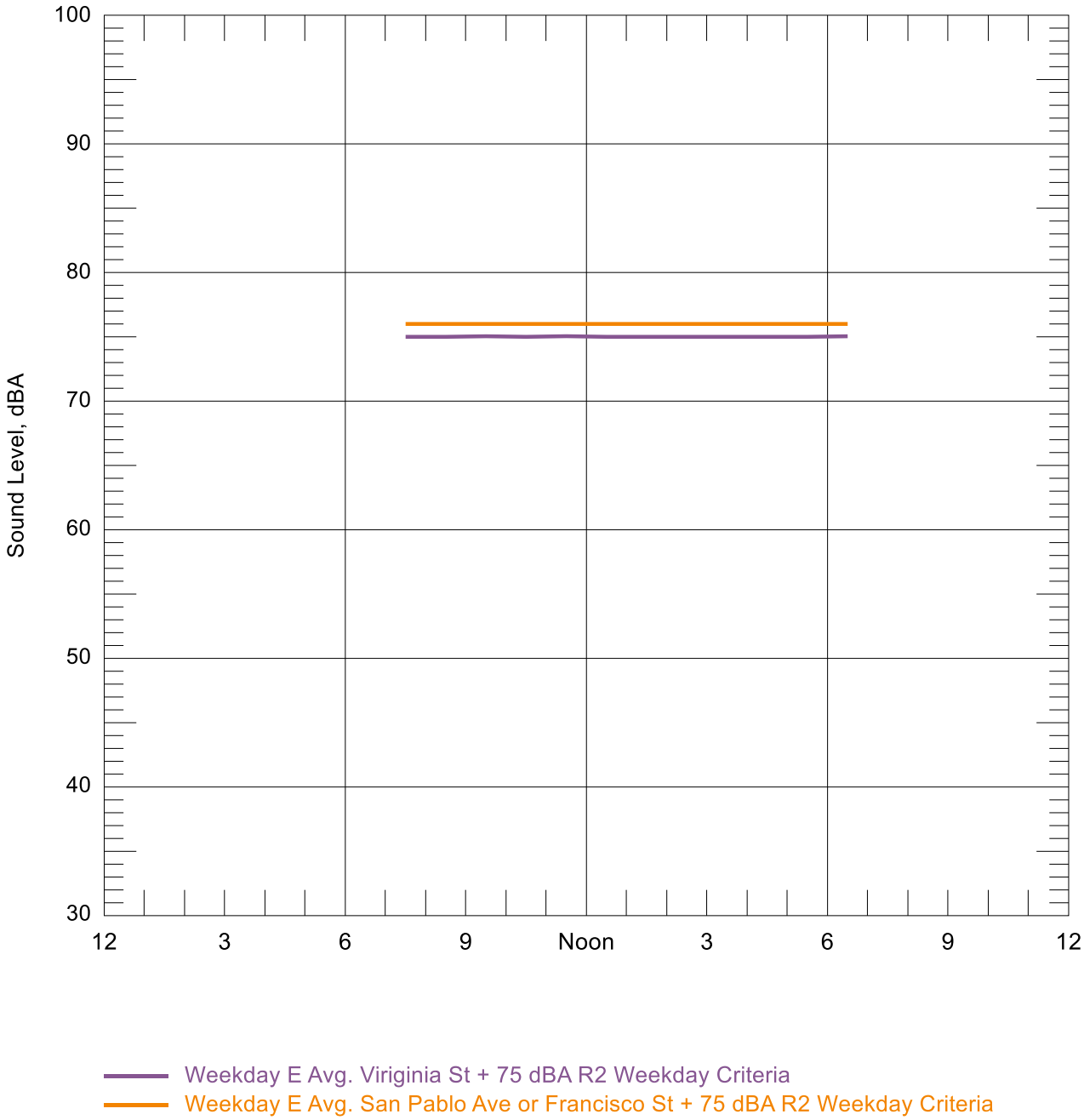

Figure 2: R-2 Weekday Mobile Equipment Noise Criteria

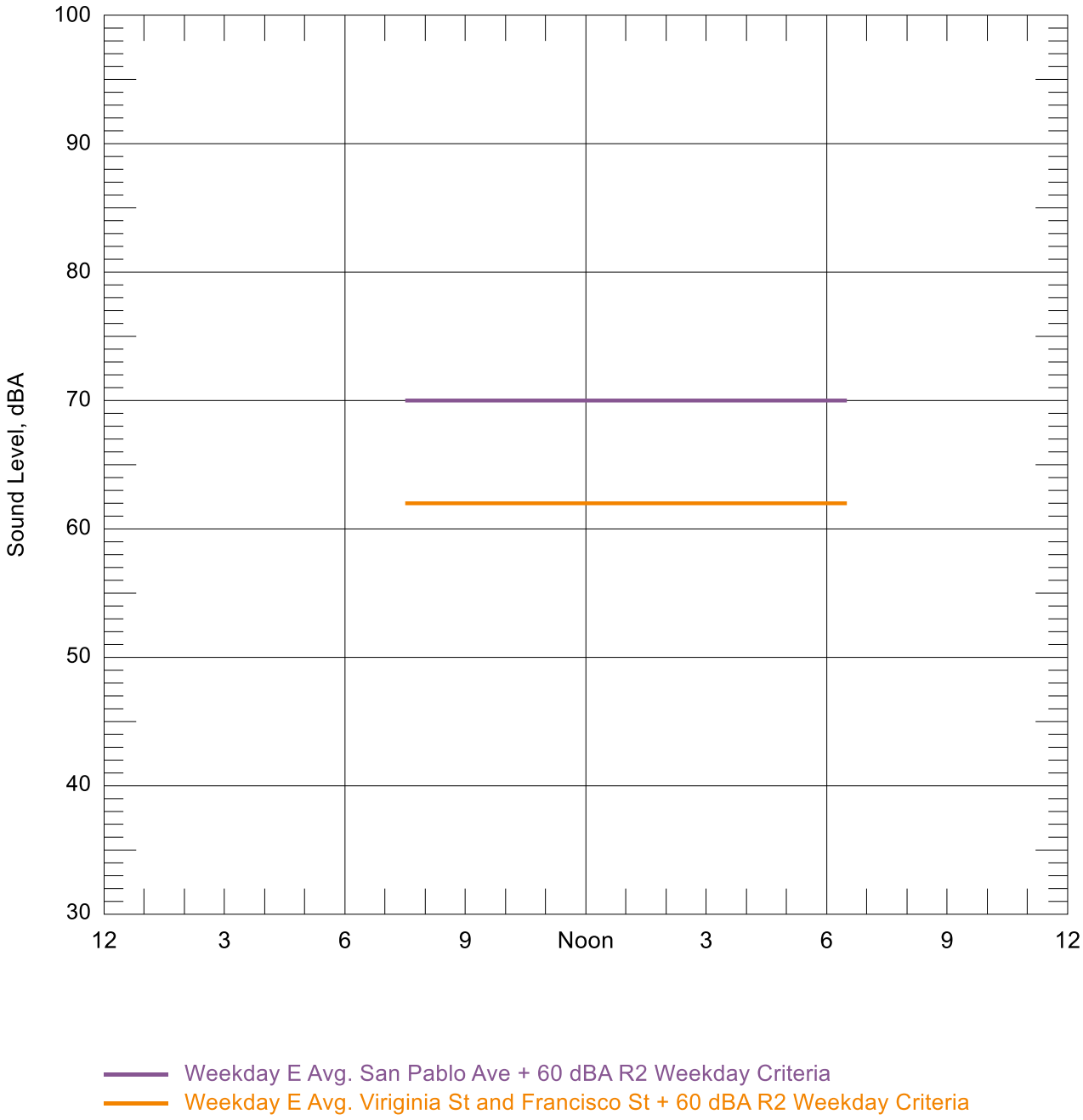

Figure 3: R-2 Weekday Stationary Equipment Noise Criteria

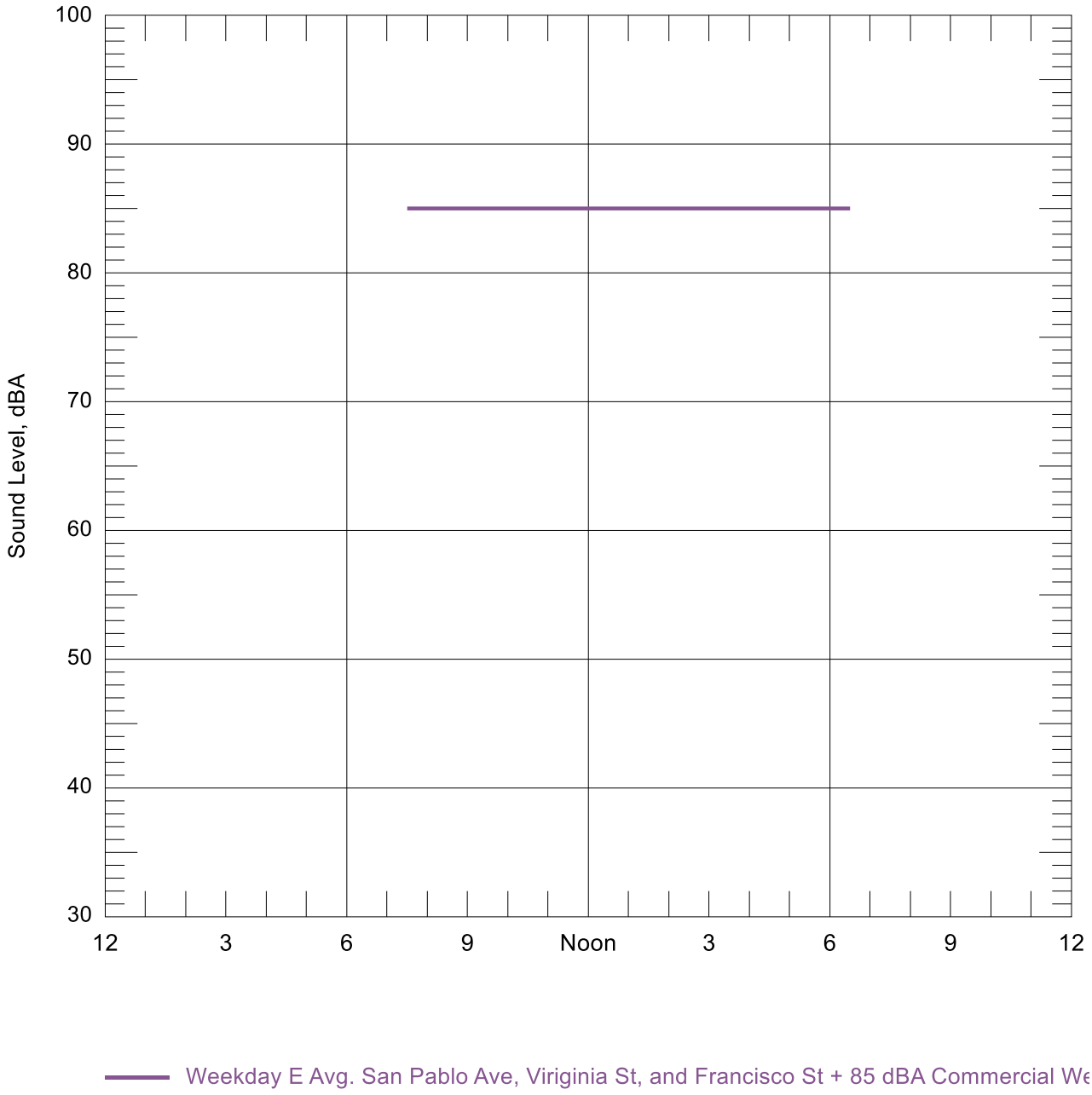

Figure 4: Commercial Weekday Mobile Equipment Noise Criteria

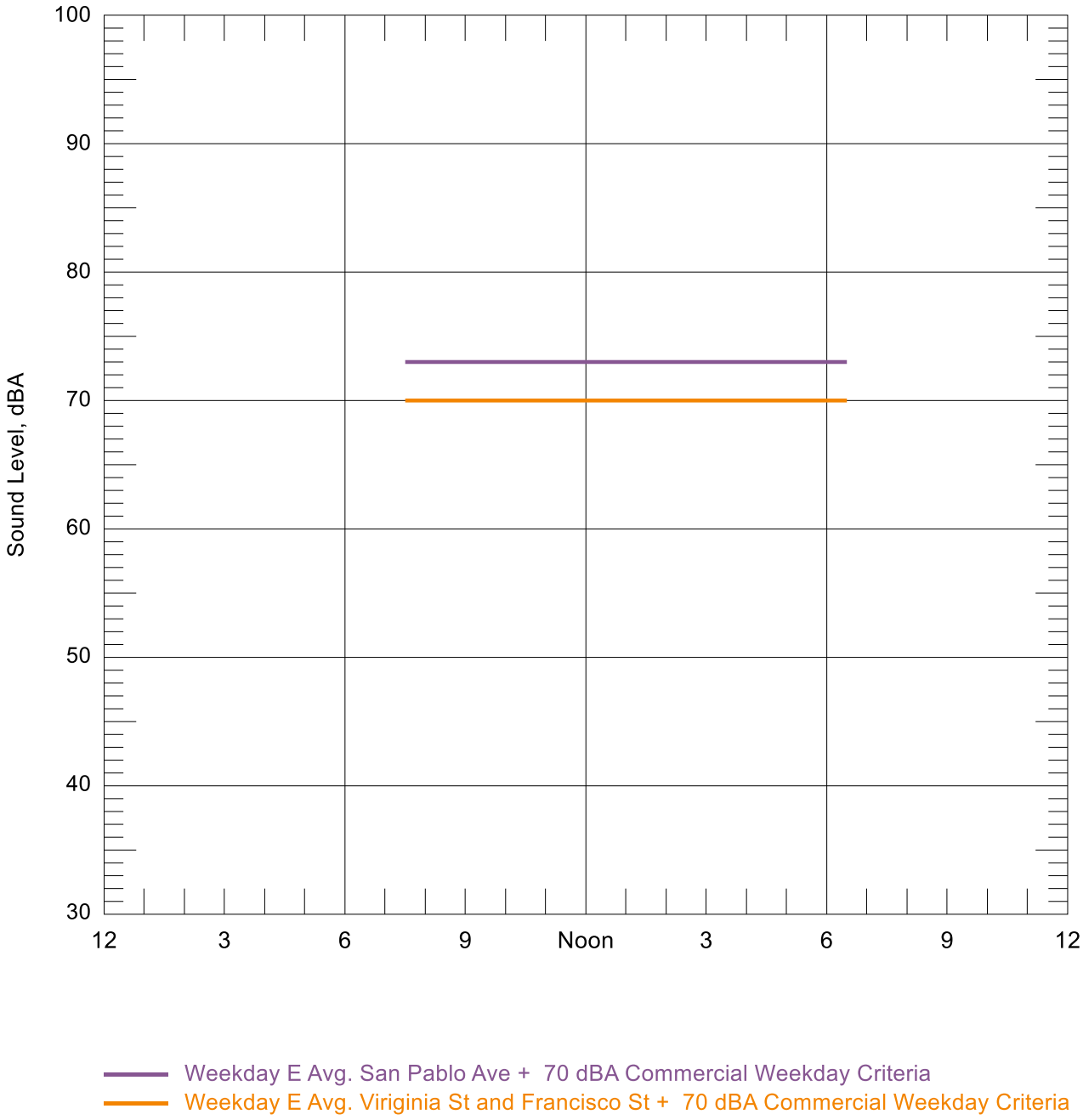

Figure 5: Commercial Weekday Stationary Equipment Noise Criteria

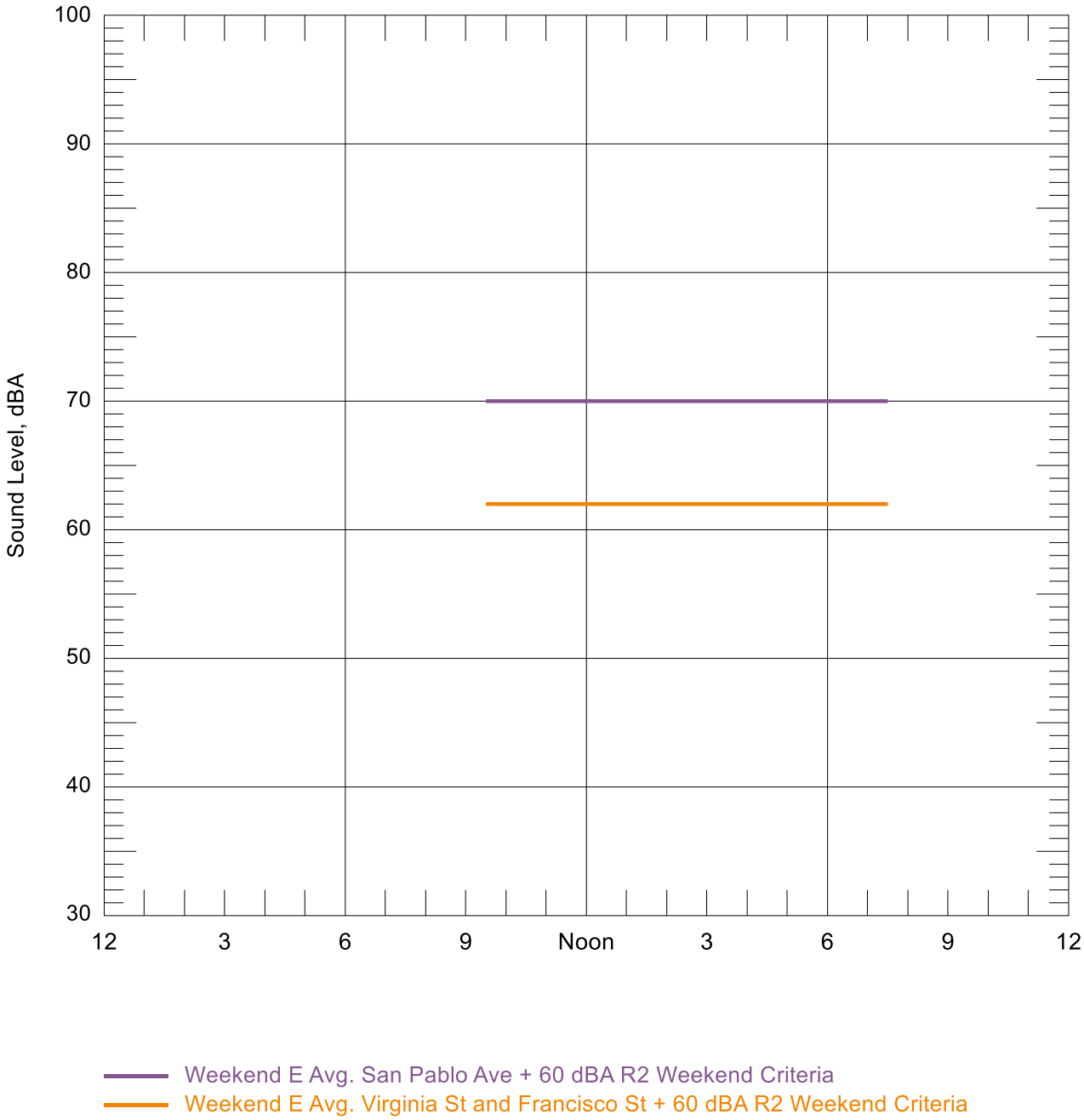

Figure 6: R-2 Weekend Mobile Equipment Noise Criteria

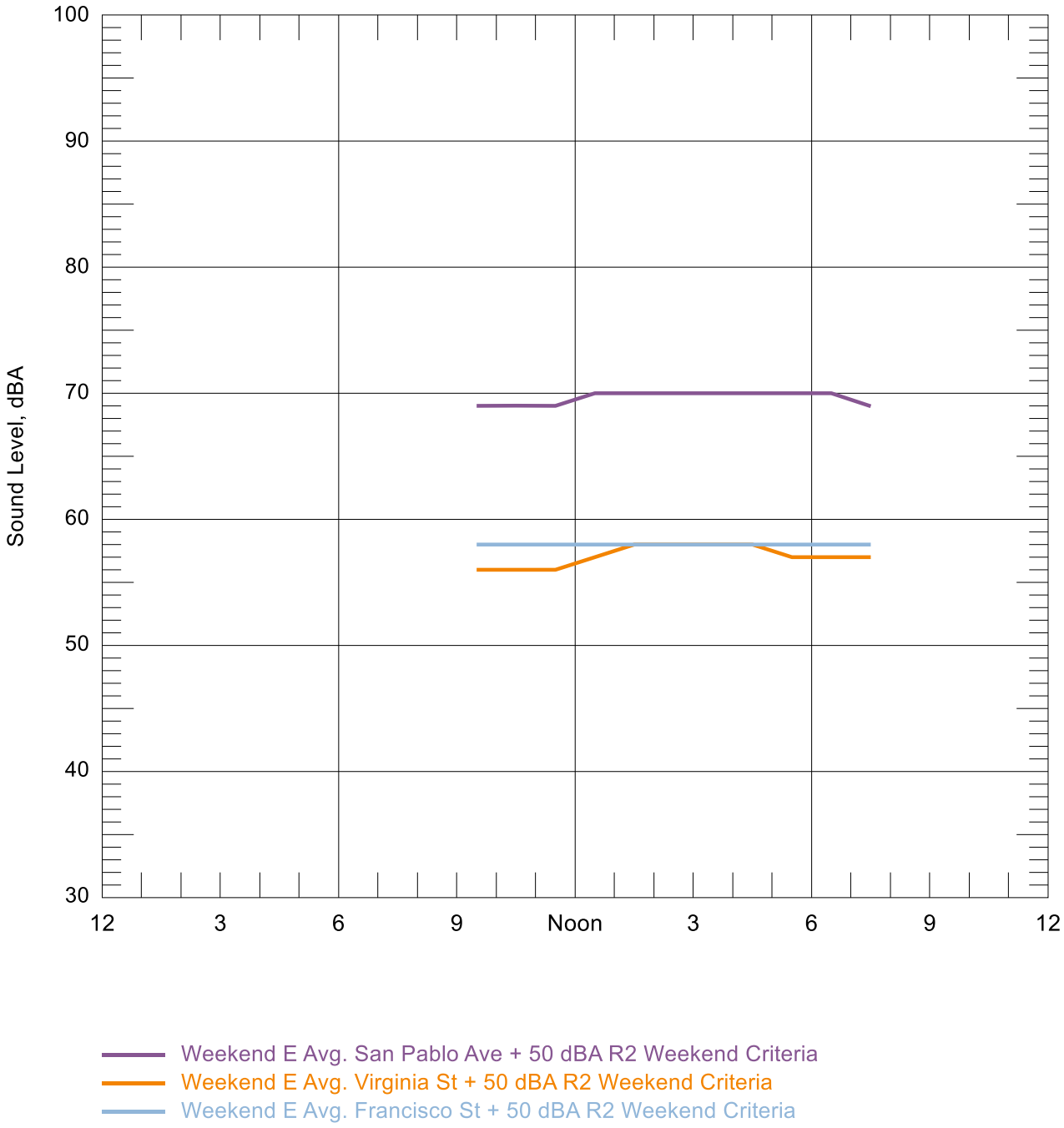

Figure 7: R-2 Weekend Stationary Equipment Noise Criteria

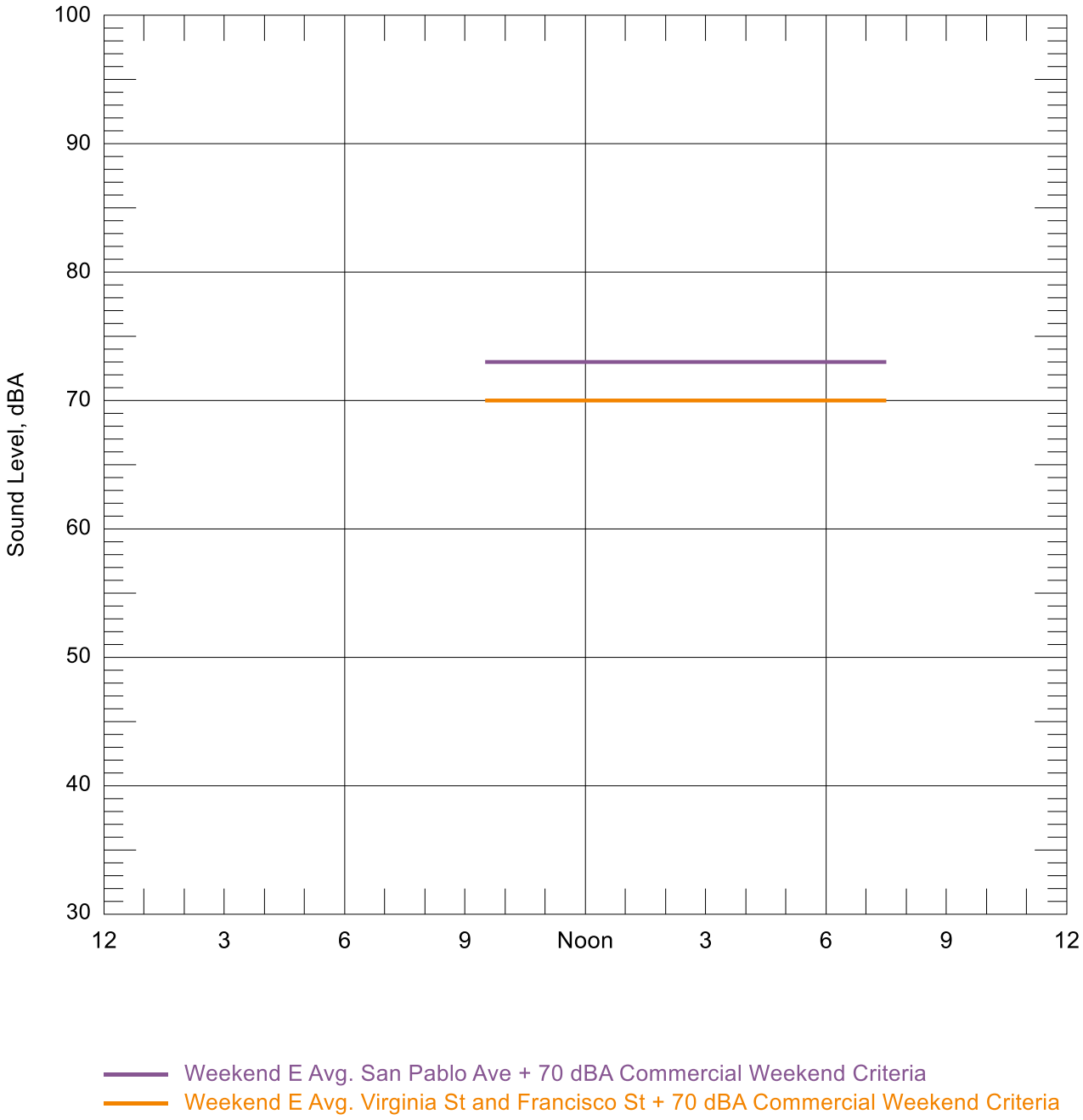

Figure 8: Commercial Weekend Mobile Equipment Noise Criteria

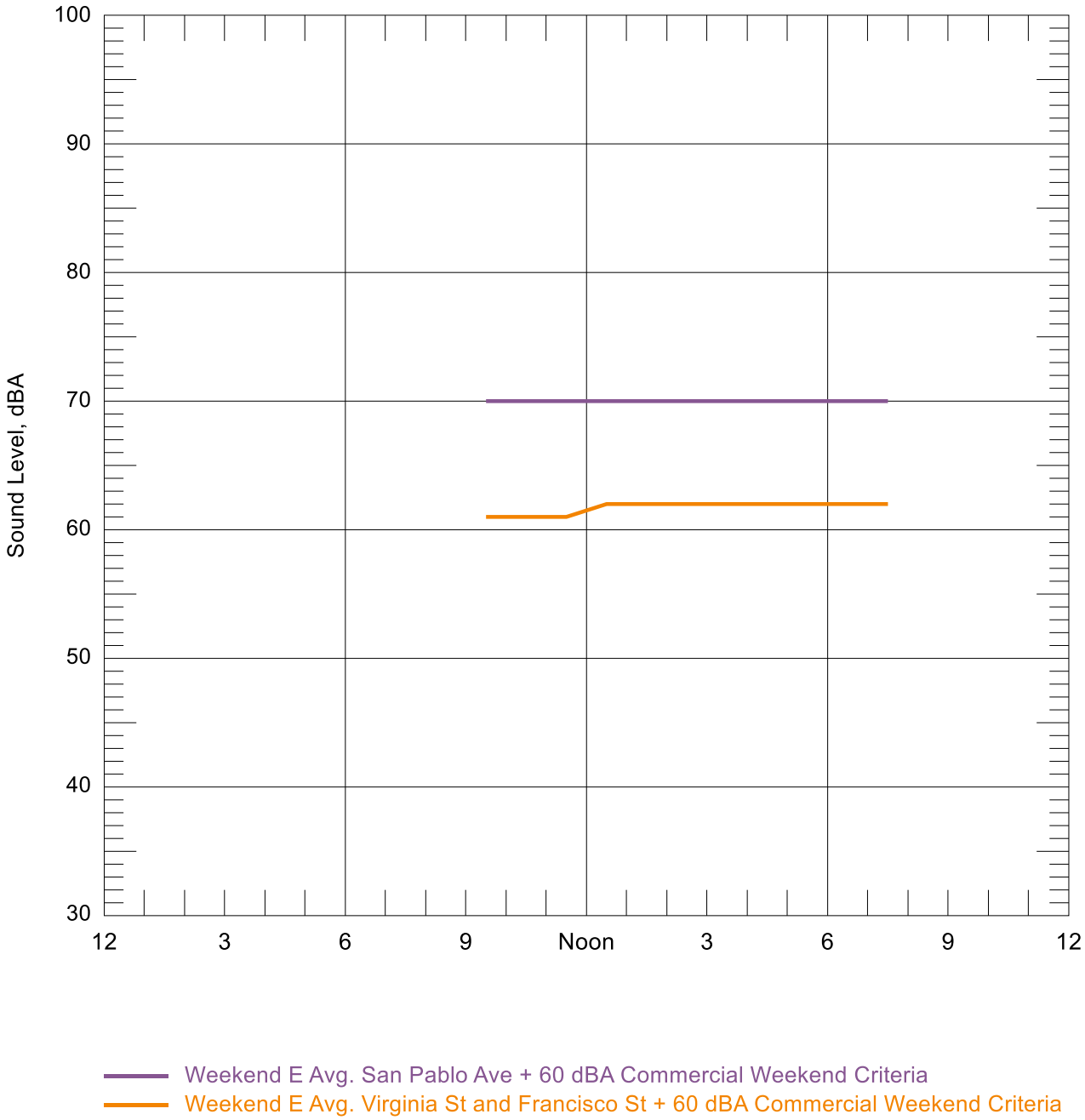

Figure 9: Commercial Weekend Stationary Equipment Noise Criteria

5 COA Requirements

The City of Berkeley has provided a set of Conditions of Approval (COA) requirements for this project. These requirements are listed in the 100 % Permit set dated 6/17/2024 on sheet G3.00. These conditions are standard for projects which could create adverse environmental impacts to neighboring receptors. The portions of the COA applicable to the control of noise at the project site are reproduced below.

Project Conditions of Approval (COA)

16. Construction Noise Reduction Program. The applicant shall develop a site specific noise reduction program prepared by a qualified acoustical consultant to reduce construction noise impacts to the maximum extent feasible, subject to review and approval of the Zoning Officer. The noise reduction program shall include the time limits for construction listed above, as measures needed to ensure that construction complies with BMC Section 13.40.070. The noise reduction program should include, but shall not be limited to, the following available controls to reduce construction noise levels as low as practical:

A. Construction equipment should be well maintained and used judiciously to be as quiet as practical.
B. Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.
C. Utilize "quiet" models of air compressors and other stationary noise sources where technology exists. Select hydraulically or electrically powered equipment and avoid pneumatically powered equipment where feasible.
D. Locate stationary noise-generating equipment as far as possible from sensitive receptors when adjoining construction sites. Construct temporary noise barriers or partial enclosures to acoustically shield such equipment where feasible.
E. Prohibit unnecessary idling of internal combustion engines.
F. If impact pile driving is required, pre-drill foundation pile holes to minimize the number of impacts required to seat the pile.
G. Construct solid plywood fences around construction sites adjacent to operational business, residences or other noise-sensitive land uses where the noise control plan analysis determines that a barrier would be effective at reducing noise.
H. Erect temporary noise control blanket barriers, if necessary, along building facades facing construction sites. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling. Noise control blanket barriers can be rented and quickly erected.
I. Route construction related traffic along major roadways and away from sensitive receptors where feasible.

17. Damage Due to Construction Vibration. The project applicant shall submit screening level analysis prior to, or concurrent with demolition building permit. If a screening level analysis shows that the project has the potential to result in damage to structures, a structural engineer or other appropriate professional shall be retained to prepare a vibration impact assessment (assessment). The assessment shall take into account project specific information such as the composition of the structures, location of the various types of equipment used during each phase of the project, as well as the soil characteristics in the project area, in order to determine whether project construction may cause damage to any of the structures identified as potentially impacted in the screening level analysis. If the assessment finds that the project may cause damage to nearby structures, the structural engineer or other appropriate professional shall recommend design means and methods of construction that to avoid the potential damage, if feasible. The assessment and its recommendations shall be reviewed and approved by the Building and Safety Division and the Zoning Officer. If there are no feasible design means or methods to eliminate the potential for damage, the structural engineer or other appropriate professional shall

undertake an existing conditions study (study) of any structures (or, in case of large buildings, of the portions of the structures) that may experience damage. This study shall

- establish the baseline condition of these structures, including, but not limited to, the location and extent of any visible cracks or spalls; and
- include written descriptions and photographs.

The study shall be reviewed and approved by the Building and Safety Division and the Zoning Officer prior to issuance of a grading permit. Upon completion of the project, the structures (or, in case of large buildings, of the portions of the structures) previously inspected will be resurveyed, and any new cracks or other changes shall be compared to pre-construction conditions and a determination shall be made as to whether the proposed project caused the damage. The findings shall be submitted to the Building and Safety Division and the Zoning Officer for review. If it is determined that project construction has resulted in damage to the structure, the damage shall be repaired to the pre-existing condition by the project sponsor, provided that the property owner approves of the repair.

Prior to Issuance of Any Building & Safety Permit (Demolition or Construction)

18. Construction Noise Management - Public Notice Required. At least two weeks prior to initiating any construction activities at the site, the applicant shall provide notice to businesses and residents within **500 feet** of the project site. This notice shall at a minimum provide the following: (1) project description, (2) description of construction activities during extended work hours and reason for extended hours, (3) daily construction schedule (i.e., time of day) and expected duration (number of months), (4) the name and phone number of the Project Liaison for the project that is responsible for responding to any local complaints, and (5) that construction work is about to commence. The liaison would determine the cause of all construction-related complaints (e.g., starting too early, bad muffler, worker parking, etc.) and institute reasonable measures to correct the problem. A copy of such notice and methodology for distributing the notice shall be provided in advance to the City for review and approval.

6 Site-Specific Noise Reduction Plan

It is anticipated that the noisiest phases of the construction work will be caused by the following noisy operations. Berkeley Municipal Code, section 13.40.070 effectively limits weekday construction

to the hours of 7 AM to 7 PM and weekend construction to 9 AM to 8 PM. Any work outside of these hours will constitute even lower criteria than already presented within this report. If necessary, these criteria can be developed. However, at the time of this report these criteria were left out to streamline the calculations and, as a result, this report. Additionally, as almost all noise sources listed are mobile, the calculations were compared to the mobile equipment criteria, and not the stationary criteria.

Specific noise control measures are recommended to reduce activities below applicable standards where feasible. The anticipated noise sources for each phase of construction are outlined below:

Phase 1: (February – April 2025) Demolition/ Rough Grading

- Linkbelt 350 Excavator
- Bobcat 80 excavator
- Bobcat Skid Steer
- Cat D-6 Dozer
- Case Skip loader
- Track Bobcat

Phase 2: (May – July 2025): Shoring / Earthwork / Underground / Foundations

- Watson EDT-5 Drill Rig on CAT 326 chassis
- Tadano Mantis 30 ton Telescopic Boom Crawler Crane
- Concrete trucks
- Linkbelt 350 Excavator
- Bobcat 80 excavator
- Bobcat Skid Steer
- Cat D-6 Dozer
- Case Skip loader
- Track Bobcat

Phase 3: (July – August 2025): Concrete Structure

- Sidewinder pump for shotcrete
- 58 meter pump for placing concrete
- Concrete trucks
- Gradall
- Small forklifts

- Scissor lifts
- Saws
- Mobile cranes
- Pneumatic tools

Phase 4 (August 2025 – June 2026): Framing / ExteriorsConcrete trucks

- Tower Crane
- Manlift
- Gradall
- Gradall Extreme
- Small forklifts
- Scissor lifts
- Saws
- Mobile cranes
- Pneumatic tools

Phase 5 (April – September 2026): Interior

- Manlift
- Gradall
- Small forklifts
- Scissor lifts
- Saws
- Pneumatic tools

Phase 6 (September 2025 – August 2026): SiteworkPlaster pumps

- Gradall
- Small forklifts
- Saws
- Mini Excavator
- Concrete Trucks
- Concrete pump

- Pneumatic tools

Individual equipment construction noise levels are presented in Appendix B, indicating the maximum noise level and the expected L_{eq}. These distances represent a minimum distance at which the equipment should be staged away from the nearby residential units to meet the site-specific Criteria.

Review of these preliminary calculations indicates that some of the work could exceed the L_{eq} noise standard at the nearest residential noise receptors during worst case conditions, when the work is closest to noise sensitive receptors. According to these calculations, these exceedances could be mitigated by staging equipment farther than 60 feet from the closest residences (buffer distances) or erecting noise barriers. See more information below.

6.1 Recommended Buffer Distances

The buffer distances to achieve Berkeley Construction Noise Standards for all major equipment listed above are listed in Table 2 and Table 3 below to discuss zones R-2 and C-W properties. Equipment should be located further than the listed distance to ensure the Noise Standards are met.

Table 1 Recommended Buffer Distances to Achieve 60 dBA L_{eq} (weekend) and 75 dBA L_{eq} (weekday) Criteria for R-2 zoned receptors

Phase	Loudest 3 Pieces of Equipment	Minimum Distance to mitigate hourly L_{eq} noise below 65 dBA (weekend R-2 criterion)	Minimum Distance to mitigate hourly L_{eq} noise below 75dBA (weekday R-2 criterion)
Phase 1: (February – April 2025) Demolition/ Rough Grading	Dozer, Dump/ Haul Truck, Excavator	55 ft.	20 ft.
Phase 2 (May – July 2025): Shoring / Earthwork / Underground / Foundations	Dozer, Dump/ Haul Truck, Excavator	55 ft.	20 ft.
Phase 3 (July – August 2025): Concrete Structure	Pneumatic Tools, Crane, Man Lift	60 ft.	20 ft.
Phase 4 (August 2025 – June 2026): Framing / Exteriors	Pneumatic Tools, Crane, Man Lift	60 ft.	20 ft.
Phase 5 (April – September 2026): Interior	Pneumatic Tools, Dump/ Haul Truck, Man Lift	60 ft.	20 ft.
Phase 6 (September 2025 – August 2026): Sitework	Excavator, Pumps, and Pneumatic Tools	25 ft.	20 ft.

The only receptors within these distances which fall within the R-2 Criteria are properties which are adjacent to the project site – 1701 San Pablo Avenue (east of the project site), and 1109-1115 Francisco Street (east and south of the project site). All properties which are separated from the job site by Francisco Street or Virginia Street are farther than 60 ft from the project property line. All receptors across San Pablo Avenue are zoned C-W commercial properties and are subject to a higher criteria.

Table 2 Recommended Buffer Distances to Achieve 70 dBA L_{eq} (weekend) and 85 dBA L_{eq} (weekday) Criteria for C-W zoned receptors

Phase	Loudest 3 Pieces of Equipment	Minimum Distance to mitigate hourly L_{eq} noise below 70 dBA (weekend commercial criterion)	Minimum Distance to mitigate hourly L_{eq} noise below 85 dBA (weekday commercial criterion)
Phase 1: (February – April 2025) Demolition/ Rough Grading	Dozer, Dump/ Haul Truck, Excavator	20 ft.	10 ft.
Phase 2 (May – July 2025): Shoring / Earthwork / Underground / Foundations	Dozer, Dump/ Haul Truck, Excavator	20 ft.	10 ft.
Phase 3 (July – August 2025): Concrete Structure	Pneumatic Tools, Crane, Man Lift	30 ft.	10 ft.
Phase 4 (August 2025 – June 2026): Framing / Exteriors	Pneumatic Tools, Crane, Man Lift	30 ft.	10 ft.
Phase 5 (April – September 2026): Interior	Pneumatic Tools, Dump/ Haul Truck, Man Lift	30 ft.	10 ft.
Phase 6 (September 2025 – August 2026): Sitework	Excavator, Pumps, and Pneumatic Tools	30 ft.	10 ft.

All commercial receptors are farther than 30 feet from the project site. Thus, no mitigation measures are recommended between the project site and any of the commercial receptors along San Pablo Avenue which fall within the C-W zone.

6.2 Notifications

According to project COA #18, "At least two weeks prior to initiating any construction activities at the site, the applicant shall provide notice to businesses and residents within 500 feet of the project

site. This notice shall at least provide the following: (1) project description, (2) description of construction activities during extended work hours and reason for extended hours, (3) daily construction schedule, (i.e. time of day) and expected duration (number of months), (4) the name and phone number of the project Liaison for the project that is responsible for responding to any local complaints, and (5) that construction-related complaints (e.g. starting too early, bad muffler, worker parking, etc.) and institute reasonable measures to correct the problem. A copy of such notice and methodology for distributing the notice shall be provided in advance to the City for review and approval." Numerous commercial and residential properties are within 300 feet of this project.

6.3 Noise Control Measures

COA #16 denotes the following noise control measures

A. Construction equipment should be well maintained and used judiciously to be as quiet as practical.
B. Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.
C. Utilize "quiet" models of air compressors and other stationary noise sources where technology exists. Select hydraulically or electrically powered equipment and avoid pneumatically powered equipment where feasible.
D. Locate stationary noise-generating equipment as far as possible from sensitive receptors when adjoining construction sites. Construct temporary noise barriers or partial enclosures to acoustically shield such equipment where feasible.
E. Prohibit unnecessary idling of internal combustion engines.
F. If impact pile driving is required, pre-drill foundation pile holes to minimize the number of impacts required to seat the pile.
G. Construct solid plywood fences around construction sites adjacent to operational business, residences or other noise-sensitive land uses where the noise control plan analysis determines that a barrier would be effective at reducing noise.
H. Erect temporary noise control blanket barriers, if necessary, along building facades facing construction sites. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling. Noise control blanket barriers can be rented and quickly erected.
I. Route construction related traffic along major roadways and away from sensitive receptors where feasible.

As it will be nearly impossible to always stage equipment farther than 60 feet from the project east property line during weekend construction and 20 feet from the project during weekday construction, it is recommended that the project erect a temporary noise screen along the project eastern property line (between it and the R-2 zone receptors) to mitigate construction noise. According to our calculations, this noise barrier must be a minimum of 8 feet in height. See Figure 10 below. Alternatively, construction within 60 feet of 1109-1115 Francisco Street could be scheduled to be completed during weekdays only so long as construction does not come within 20 feet of the property line.

The basic noise screen/fence properties are recommended for two common options as follows:

a) wood option: constructed of minimum ¾" plywood or OSB and appropriate supports and footing to provide a minimum 3 lb./sq. ft. surface density or a minimum STC 25 rating,

b) acoustic blanket option: constructed of material with a minimum 1 lb./sq. ft. surface density with a minimum STC 25 rating, supported by suitable frame and footings.

The noise screen shall have no vertical or horizontal openings; openings for drainage must be reviewed by an acoustical consultant prior to approval. A barrier 8 feet in height or taller will block the line of sight between the listed construction equipment and the ground floor of the residential receptors which consist of two stories. Thus, the barrier will mitigate the construction noise by approximately 5 dBA at the ground floor.

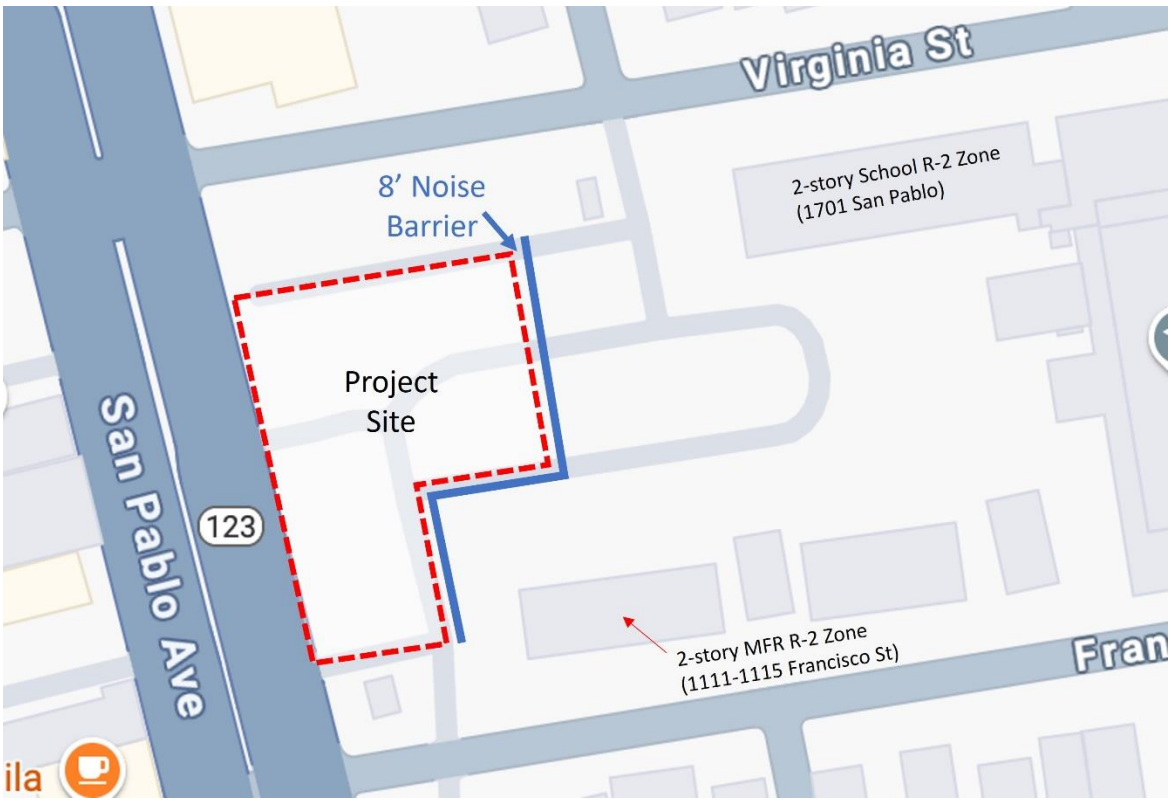

Figure 10: Project Work Area and Surrounding Sensitive Receptors with proposed noise barrier (source: Google Maps)

In addition to the typical COA requirements, use the following where feasible to reduce construction noise:

- Use smaller or quieter equipment.
- Use electric equipment in lieu of gasoline powered equipment where feasible.
- Turn off all idling equipment when not in use especially during evening and early morning hours.
- Minimize drop height when loading excavated material onto trucks.
- Stage large equipment beyond 60 ft of any nearby residential units when work is not being done near those properties

- Schedule any work that could temporarily exceed the construction noise threshold to a time that reduces the impact of noise (e.g., 8 AM to 4 PM).

7 Construction Vibration Control Plan

Project COA #17 has the following to say about vibration due to construction activities:

17. Damage Due to Construction Vibration. The project applicant shall submit screening level analysis prior to, or concurrent with demolition building permit. If a screening level analysis shows that the project has the potential to result in damage to structures, a structural engineer or other appropriate professional shall be retained to prepare a vibration impact assessment (assessment). The assessment shall take into account project specific information such as the composition of the structures, location of the various types of equipment used during each phase of the project, as well as the soil characteristics in the project area, in order to determine whether project construction may cause damage to any of the structures identified as potentially impacted in the screening level analysis. If the assessment finds that the project may cause damage to nearby structures, the structural engineer or other appropriate professional shall recommend design means and methods of construction that to avoid the potential damage, if feasible. The assessment and its recommendations shall be reviewed and approved by the Building and Safety Division and the Zoning Officer. If there are no feasible design means or methods to eliminate the potential for damage, the structural engineer or other appropriate professional shall

undertake an existing conditions study (study) of any structures (or, in case of large buildings, of the portions of the structures) that may experience damage. This study shall

- establish the baseline condition of these structures, including, but not limited to, the location and extent of any visible cracks or spalls; and
- include written descriptions and photographs.

The study shall be reviewed and approved by the Building and Safety Division and the Zoning Officer prior to issuance of a grading permit. Upon completion of the project, the structures (or, in case of large buildings, of the portions of the structures) previously inspected will be resurveyed, and any new cracks or other changes shall be compared to pre-construction conditions and a determination shall be made as to whether the proposed project caused the damage. The findings shall be submitted to the Building and Safety Division and the Zoning Officer for review. If it is determined that project construction has resulted in damage to the structure, the damage shall be repaired to the pre-existing condition by the project sponsor, provided that the property owner approves of the repair.

As neither this project's Conditions of Approval, nor the Berkeley Municipal Code set a limit for vibration activities caused by construction, the Project criteria was selected by Wilson Ihrig from the Federal Transportation Authority (FTA) "TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT MANUAL" construction vibration damage criteria table 7-5, as reproduced below.

Table 7-5 Construction Vibration Damage Criteria

Building/ Structural Category	PPV, in/sec	Approximate L_v*
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

*RMS velocity in decibels, VdB re 1 micro-in/sec

Wilson Ihrig is unaware of any nearby buildings that could be deemed "extremely susceptible to vibration damage." Thus, criteria III was chosen to be conservative, in case one of the two closest buildings still has plaster walls.

It is anticipated that the equipment that will generate the most vibration will be loaded trucks, a large bulldozer and a small bulldozer. Typical maximum vibration amplitudes for these pieces of equipment at the closest receptors to the project site are listed in Table 3. As shown, vibration is not anticipated to exceed the recommended threshold limits for buildings of normal conventional construction (0.2 in/sec PPV) if loaded trucks and large bulldozers are staged farther than 15 feet of 1109-1115 Francisco Street.

Table 3: Construction Vibration

Construction Vibration Source	Reference Vibration at 25 ft. (in/sec PPV)	Vibration Level at Receptors During Nearest Construction Activities					
		1109-1115 Francisco Street		1701 San Pablo Ave		-	
		Dist (ft)	PPV (in/sec)	Dist (ft)	PPV (in/sec)	-	-
Loaded Trucks	0.076	15	0.133	66	0.026	-	-
Large bulldozer	0.089	15	0.156	66	0.031	-	-
Small bulldozer	0.003	15	0.005	66	0.001	-	-
Source: Caltrans							

7.1 Vibration Control Measures

Wilson Ihrig is not aware of any buildings near the project that would be categorized as extremely susceptible to vibration damage. Avoid staging any loaded truck or large bulldozer within 15 feet of 1109-1115 Francisco Street.

We recommend conducting pre-construction and post-construction crack photo surveys at 1109-1115 Francisco Street (this is also spelled out in COA #17). Any preexisting cracks should be assessed

regularly during the initial period of work. If minor cracks do appear or if existing cracks are found to propagate, a more restrictive vibration limit should be imposed.

The following are best management practice measures that will be implemented to control vibration:

- Use smaller equipment when possible.
- During material handling and sorting, minimize material drop height to the extent possible to avoid unnecessary vibration from materials impacting with the ground.

8 Conclusions

The use of available and feasible to install noise control measures such as perimeter site barriers, sound blankets, buffer distances, construction hour restrictions and the City's Conditions of Approval generally are adequate to reduce construction noise. Predicted vibration levels due to construction activities are not anticipated to cause damage to any nearby buildings. However, we do recommend conducting pre-construction and post-construction crack photo surveys at 1109-1115 Francisco Street (this is also spelled out in COA #17).

The project contractors will implement noise control measures to the extent feasible which are in accordance with the Standard Conditions of Approval and site-specific noise control measures given the proximity of sensitive receptors.

Appendix A Previous Noise Survey Results

9 Environmental Noise Survey Methodology

The Environmental Noise Survey consisted of long-term noise measurements at three locations, one along San Pablo Avenue, another along Francisco Street, and the last along Virginia Street. Table A1 summarizes the noise measurement locations and the types of measurements performed at each. Figure A1 shows the relative position of measurement locations for this noise study on a site plan of the project parcel.

9.1 Long-Term Measurements

Long-term, statistical noise levels were measured at the site by means of three precision, calibrated, Type I logging sound level meters left unattended for over four days. Long-term meters (LT-1, LT-2, & LT-3) were placed at the locations indicated in Table A1 and Figure A1. These meters were secured to trees and a utility pole at a height of approximately 12 ft above grade and monitored noise levels continuously for several 24-hour periods, providing information on hourly-averaged and statistical noise levels throughout the survey duration. Hourly equivalent noise data (L_{eq}) were subsequently used to calculate the daily and typical Day-Night Levels (L_{dn}) at this location, as required by the CCR Title 24, and to establish the hourly noise exposure for the CalGreen assessment.

Label	Measurement Type*	Location Description
LT-1	Long-Term – 12 ft microphone height	Francisco Street, on utility pole ~20' from Francisco Street centerline
LT-2	Long-Term – 12 ft microphone height	San Pablo Ave, on tree ~40' from San Pablo Avenue centerline
LT-3	Long-Term – 12 ft microphone height	Virginia St, on tree ~20' from Virginia Street centerline
***See descriptions of measurement types above**		

Table 4: Environmental Noise Survey Measurement Locations

10 Environmental Noise Survey Results

Existing noise levels were determined by analyzing the long-term data obtained at the site; future noise levels were extrapolated from existing noise levels based on proposed building configurations and assumed future increases or changes in street traffic. Exterior-to-interior noise isolation requirements were determined by evaluating the existing and projected future noise levels at the project site.

10.1 Measured Existing Noise Levels

The results of the environmental noise survey reveal that existing noise levels at the San Pablo Ave. street-facing project facade is approximately 71 L_{dn}. Figure A2 through Figure A4 present the long-term data in terms of hourly L_{eq} sound levels for each full 24-hour period measured. The calculated L_{dn} value for each complete 24-hour period is also included.

Figure A1: Project area map with long-term meters (LT-1, LT-2, & LT-3) measurement locations

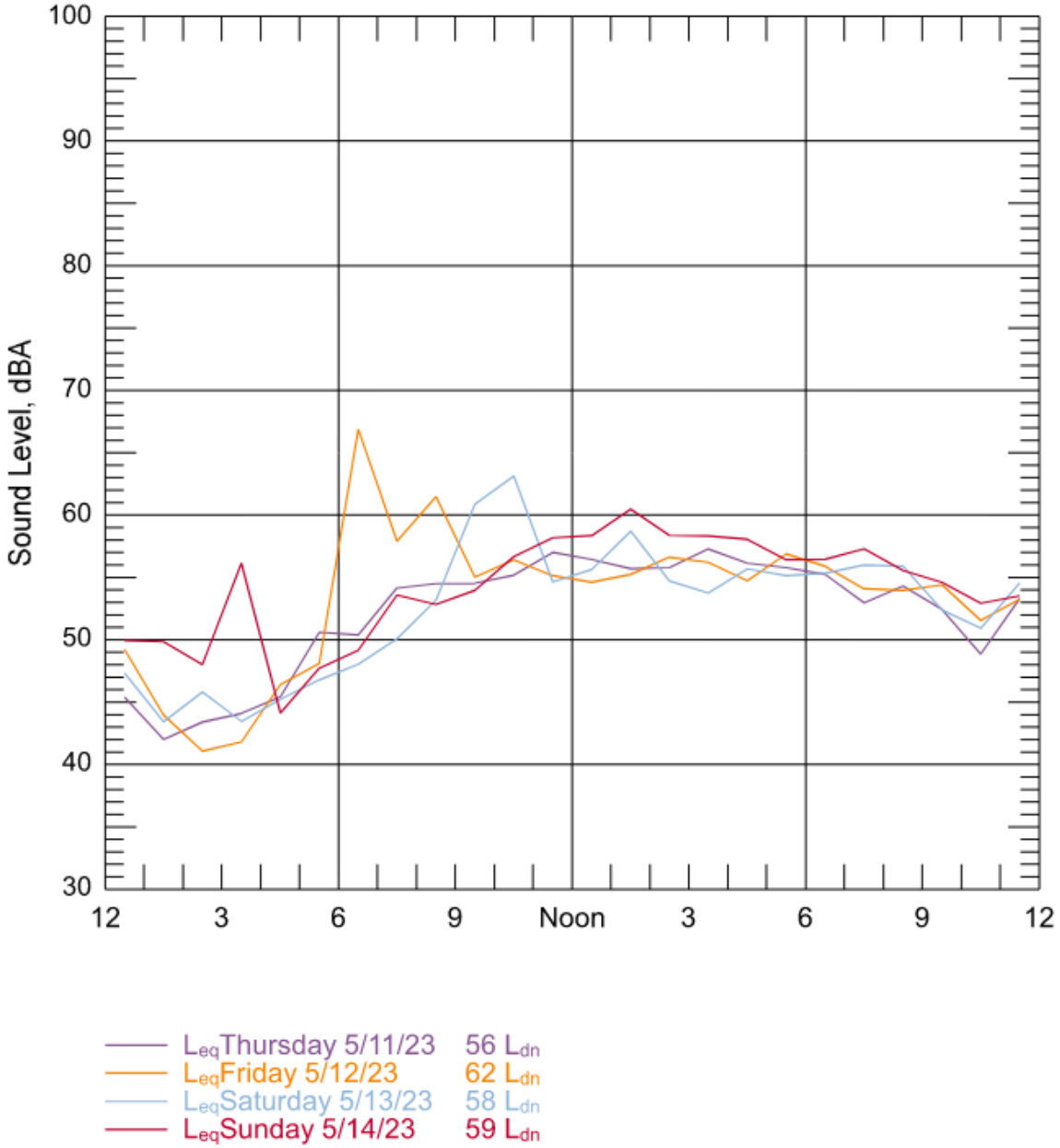

Figure A2: Hourly equivalent noise levels (L_{eq}) and corresponding day-night levels measured at Location LT-1, along Francisco Street.

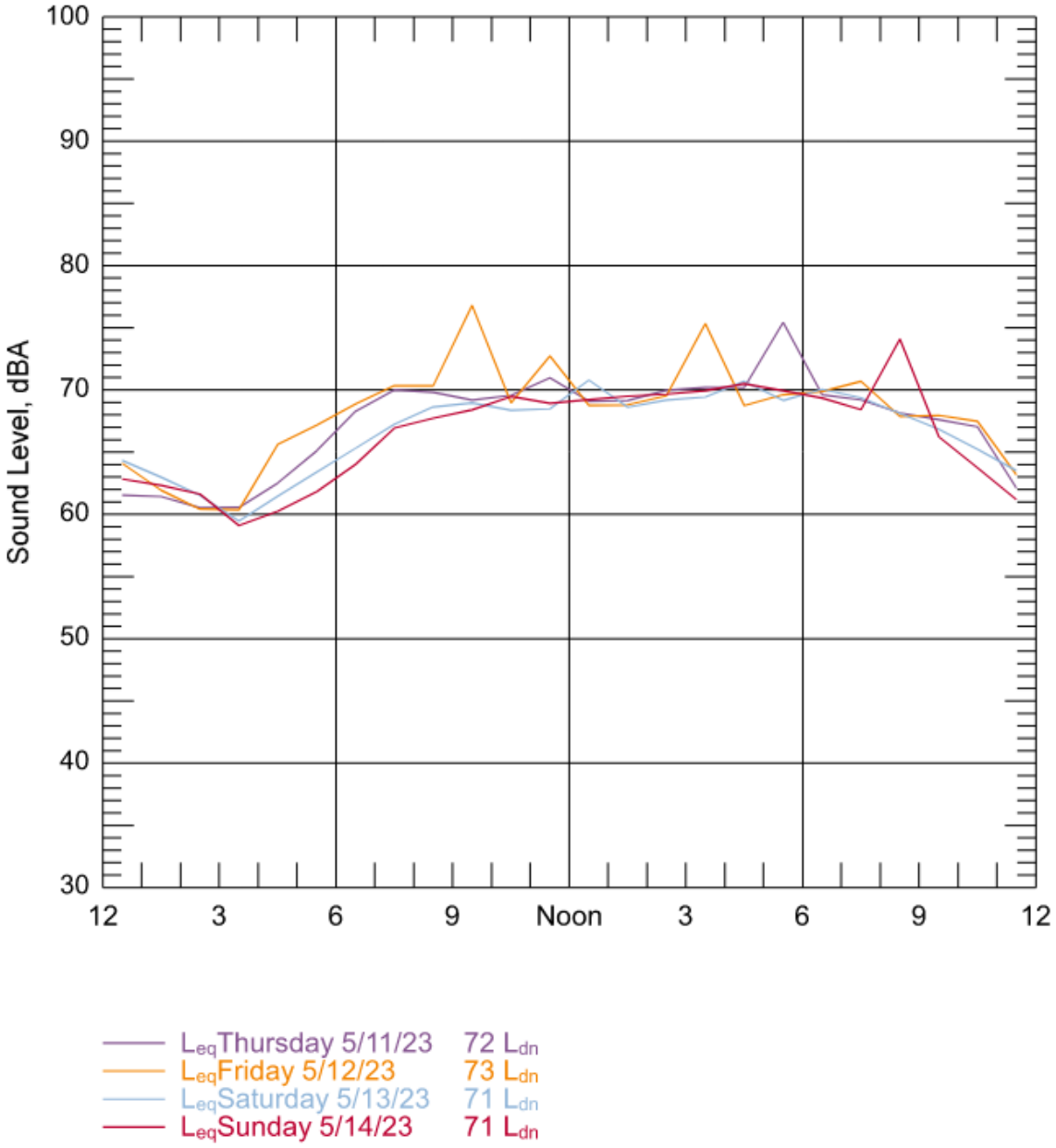

Figure A3: Hourly equivalent noise levels (L_{eq}) and corresponding day-night levels measured at Location LT-2, along San Pablo Avenue.

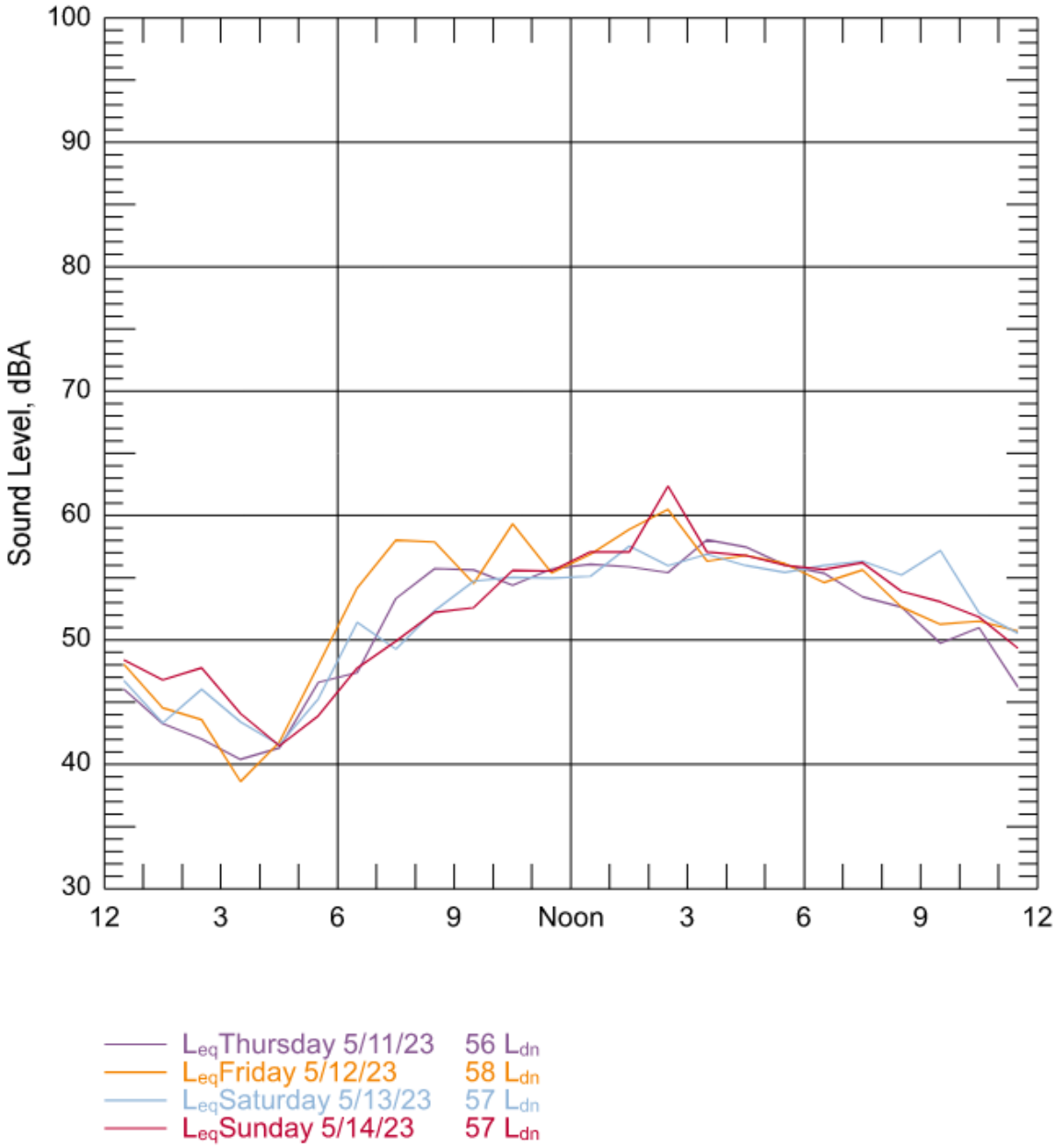

Figure A4: Hourly equivalent noise levels (L_{eq}) and corresponding day-night levels measured at Location LT-2, at Virginia Street.

Appendix B Calculated Construction Equipment Noise

Long-term noise projections for construction equipment have been made using the following formula:

$$L_{eq}(hour) = E.L. + 10 \log (U.F.) - 20 \log(D/50) - 10G \log(D/50) - A_{shielding}$$

where:

E.L. = reference equipment noise emission level (based on L_{max} at 50 ft)

U.F. = equipment usage factor (percentage in use per typical hour as a fraction of 100%)

D = distance between source and receiver (ft)

G = ground effects constant (zero for acoustically hard ground surface conditions)

$A_{shielding}$ = attenuation provided by intervening buildings, barriers, etc.

A summary of calculations for the anticipated types of equipment operations is provided below in Table B1 through Table B6. The calculations assume general noise reference levels based on the Federal Highway Administration (FHWA) Roadway Construction Noise Model[1]. Usage factors are based on assumptions from FHWA. No acoustical shielding is assumed in these preliminary projections.

[1] Federal Highway Administration – *FHWA Roadway Construction Noise Model. Final Report* January 2006.

Table B1 Construction Equipment Noise Calculations for Nearest R-2 Receptors

Equipment	Qty	Usage Factor %	Ref. Level, dBA	Ref. Distance, ft	Horizontal Distance, ft	Estimated Level Without Noise Control		Estimated Level With Noise Controls[1]	
						Leq dBA		Leq dBA	
Phase 1 (February – April 2025): Demolition / Rough Grading									
Dozer	1	0.4	40	50	10 to 250	47 to **75**	-	47 to **70**	-
Dump/Haul Truck	1	0.4	40	50		47 to **75**	-	47 to **70**	-
Loader	1	0.4	40	50		42 to **70**	-	42 to **65**	-
Excavator	1	0.16	16	50		43 to **71**	-	43 to **66**	-
Phase 2 (May – July 2025): Shoring / Earthwork / Underground / Foundations									
Dozer	1	0.4	40	85	10 to 250	47 to **75**	-	47 to **70**	-
Dump/Haul Truck	1	0.4	40	85		47 to **75**	-	47 to **70**	-
Excavator	1	0.16	16	85		43 to **71**	-	43 to **66**	-
Loaders, Rubber-Tired	1	0.4	40	80		42 to **70**	-	42 to **65**	-
Concrete Mixer	1	0.1	10	85		41 to **69**	-	41 to **64**	-
Pumps	1	0.5	50	80		43 to **71**	-	43 to **66**	-
Phase 3 (July – August 2025): Concrete Structure									
Concrete Mixer	1	0.1	10	85	10 to 250	41 to **69**	-	41 to **64**	-
Pumps	1	0.5	50	80		43 to **71**	-	43 to **66**	-
Pneumatic	1	0.5	50	85		48 to **76**	-	48 to **71**	-
Crane	1	0.2	20	85		44 to **72**	-	44 to **67**	-
Man Lift	1	0.2	20	85		44 to **72**	-	44 to **67**	-
Phase 4 (August 2025 – June 2026): Framing / Exteriors									
Crane	1	0.2	20	85	10 to 250	44 to **72**	-	44 to **67**	-
Man Lift	1	0.2	20	85		44 to **72**	-	44 to **67**	-
Pneumatic	1	0.5	50	85		48 to **76**	-	48 to **71**	-
Crane	1	0.2	20	85		44 to **72**	-	44 to **67**	-
Phase 5 (April – September 2026): Interior									
Pneumatic Tools	1	0.5	50	85	10 to 250	48 to **76**	-	48 to **71**	-
Man Lift	1	0.2	20	85		44 to **72**	-	44 to **67**	-
Dump/Haul	1	0.4	40	85		47 to **75**	-	47 to **70**	-

Equipment	Qty	Usage Factor %	Ref. Level, dBA	Ref. Distance, ft	Horizontal Distance, ft	Estimated Level Without Noise Control		Estimated Level With Noise Controls[1]	
						Leq dBA		Leq dBA	
Phase 6 (September 2025 – August 2026): Sitework									
Excavator	1	0.16	16	85	10 to 250	43 to **71**	-	43 to **66**	-
Concrete Mixer	1	0.1	10	85		41 to **69**	-	41 to **64**	-
Pumps	1	0.5	50	80		43 to **71**	-	43 to **66**	-
Pneumatic	1	0.5	50	85		48 to **76**	-	48 to **71**	-

Bolded values indicate potential exceedance over Berkeley Construction Noise Standards if doing work on weekends between 9 AM to 8 PM. Values less than 75 will be within the Berkeley Construction Noise Standard if doing work on weekdays between 7 AM to 7 PM.

Notes:
[1] Noise levels with controls include the effect of the recommended sound barriers. These are only recommended for the project east property line as calculations indicate that other surrounding properties will not be exposed to noise levels which exceed the Berkeley Noise Ordinance and project-specific COA standards.

Table B2 Construction Equipment Noise Calculations for Nearest Commercial Receptors(C-W)

Equipment	Qty	Usage Factor %	Ref. Level, dBA	Ref. Distance, ft	Horizontal Distance, ft	Estimated Level Without Noise Control		Estimated Level With Noise Controls[1]	
						Leq dBA		Leq dBA	
Phase 1 (February – April 2025): Demolition / Rough Grading									
Dozer	1	0.4	40	50	66 to 230	48 to 59	-	-	-
Dump/Haul Truck	1	0.4	40	50		48 to 59	-	-	-
Loader	1	0.4	40	50		43 to 54	-	-	-
Excavator	1	0.16	16	50		44 to 55	-	-	-
Phase 2 (May – July 2025): Shoring / Earthwork / Underground / Foundations									
Dozer	1	0.4	40	85	66 to 230	48 to 59	-	-	-
Dump/Haul Truck	1	0.4	40	85		48 to 59	-	-	-
Excavator	1	0.16	16	85		44 to 55	-	-	-
Loaders, Rubber-Tired	1	0.4	40	80		43 to 54	-	-	-
Concrete Mixer	1	0.1	10	85		42 to 53	-	-	-
Pumps	1	0.5	50	80		44 to 55	-	-	-
Phase 3 (July – August 2025): Concrete Structure									
Concrete Mixer	1	0.1	10	85	66 to 230	42 to 53	-	-	-
Pumps	1	0.5	50	80		44 to 55	-	-	-
Pneumatic	1	0.5	50	85		49 to 60	-	-	-
Crane	1	0.2	20	85		45 to 56	-	-	-
Man Lift	1	0.2	20	85		45 to 56	-	-	-
Phase 4 (August 2025 – June 2026): Framing / Exteriors									
Crane	1	0.2	20	85	66 to 230	45 to 56	-	-	-
Man Lift	1	0.2	20	85		45 to 56	-	-	-
Pneumatic	1	0.5	50	85		49 to 60	-	-	-
Crane	1	0.2	20	85		45 to 56	-	-	-
Phase 5 (April – September 2026): Interior									
Pneumatic Tools	1	0.5	50	85	66 to 230	49 to 60	-	-	-
Man Lift	1	0.2	20	85		45 to 56	-	-	-
Dump/Haul	1	0.4	40	85		48 to 59	-	-	-

Equipment	Qty	Usage Factor %	Ref. Level, dBA	Ref. Distance, ft	Horizontal Distance, ft	Estimated Level Without Noise Control		Estimated Level With Noise Controls[1]	
						Leq dBA		Leq dBA	
Phase 6 (September 2025 – August 2026): Sitework									
Excavator	1	0.16	16	85	66 to 230	44 to 55	-	-	-
Concrete Mixer	1	0.1	10	85		42 to 53	-	-	-
Pumps	1	0.5	50	80		44 to 55	-	-	-
Pneumatic	1	0.5	50	85		49 to 60	-	-	-

Bolded values indicate potential exceedance over Berkeley Construction Noise Standards.

Notes:
[1] Noise levels with controls include the effect of the recommended sound barriers. These are not recommended for any commercial properties as calculations indicate that all zone C-W surrounding properties will not be exposed to noise levels which exceed the Berkeley Noise Ordinance and project-specific COA standards.