Appendix F
Noise

Appendix F.1

Veneklasen Associates, 3rd and Fairfax, Los Angeles, CA, Construction Noise and Vibration Technical Report, VA Project No. 4824-019, October 9, 2020

Appendix F.2

Operational Noise Calculation Worksheets, Parker Environmental Consultants, October 2020

Appendix F.1
Noise

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Veneklasen Associates, 3rd and Fairfax, Los Angeles, CA, Construction Noise and Vibration Technical Report, VA Project No. 4824-019, October 9, 2020

Veneklasen Associates
Consultants in Acoustics | Noise | Vibration | AV | IT

October 9, 2020

Holland Construction, Inc.
5000 East Spring Street, Suite 500
Long Beach, CA 92694

Attention: Shaun Evans

Subject: **3rd and Fairfax**
Los Angeles, CA
Construction Noise and Vibration Technical Report
VA Project No. 4824-019

Dear Shaun:

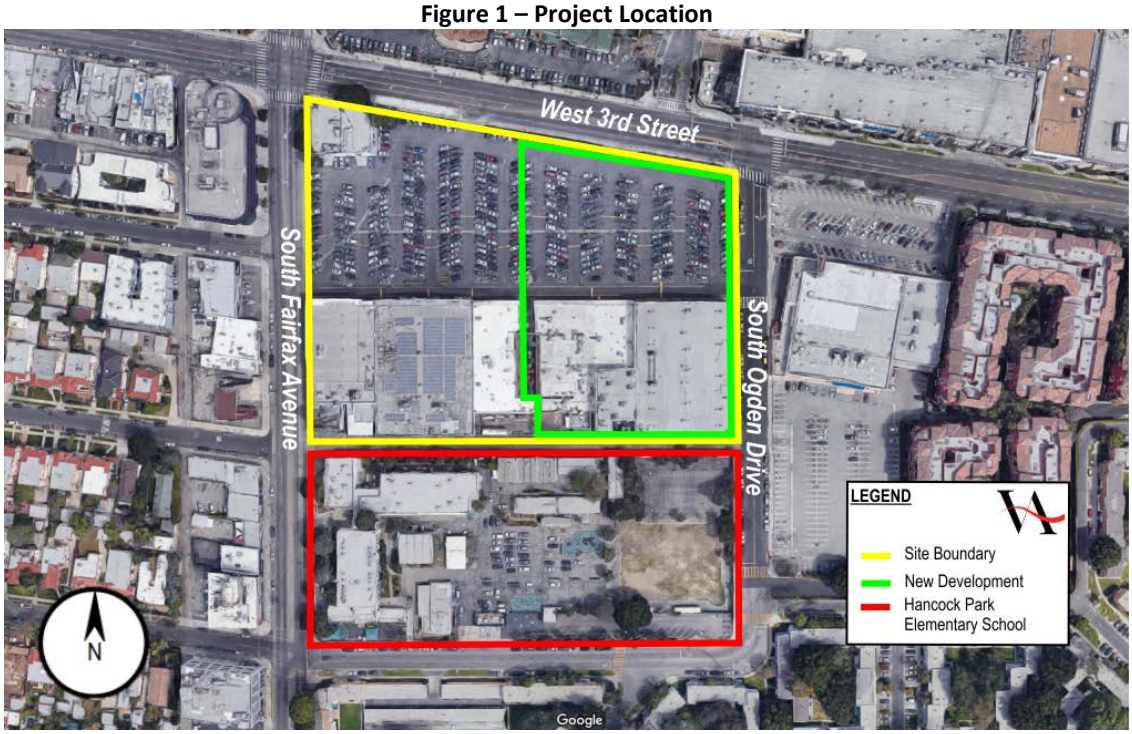
This technical report analyzes the potential noise and vibration impacts during construction of the proposed 3rd and Fairfax project located in Los Angeles, CA. This report provides noise impact analysis for potential sensitive receptor locations around the project site. This report focuses on construction noise and vibration. Other technical analysis, provided in connection with the Draft Environmental Impact Report (Draft EIR) prepared for the project, analyzes the operational noise associated with the project. In addition, the Draft EIR provides supplemental construction noise and vibration analysis to ensure that all applicable thresholds of significance have been analyzed. The developer for the project requested that Veneklasen Associates (VA) obtain noise measurements at surrounding sensitive receptor sites. Specifically, due to the sensitivity of the adjacent Hancock Park Elementary School, Veneklasen monitored ambient noise levels at several locations on the school property. Noise measurements were obtained for exterior and interior (i.e., inside of classrooms and school buildings) to ensure that this noise report discloses the pre- and post-project noise conditions on receptors in those locations. Noise measurements were done at other receptor sites in the vicinity that were not on the school property. In addition, Veneklasen performed construction vibration analysis for the surrounding sensitive receptor sites. The information in this technical report will be used, in conjunction with other construction and operational noise data, to analyze potential noise impacts of the project.

1.0 PROJECT DESCRIPTION

The project would involve the construction and operation of a new mixed-use development ("Proposed Project) on an approximately 327,121 square-foot site ("Project Site") that is currently developed with retail and commercial space. The Proposed Project includes the demolition of certain existing retail uses on the eastern portion of the Project Site and the construction of a mid-rise, eight-story mixed-use structure and two levels of subterranean parking, for a maximum height of approximately 100 feet. The residential component of the Proposed Project will include 331 multi-family dwelling units and 83,994 square feet of new commercial space. The existing 63,688 square feet of commercial space on the western portion of the Project Site would be retained and is not considered part of the Proposed Project.

Construction for the Proposed Project has been separated into 2 phases, for purposes of this impact analysis: (1) Phase 1 Demolition and Excavation Activities and (2) Phase 2 Tower Structure, Exterior Enclosure, Roof, and Interiors Construction. Phase 2 activities have been combined as they will occur simultaneously.

Figure 1 – Project Location



It is estimated that the demolition work will start in the beginning of 2021. Construction work is estimated to begin in June 2021 and be complete in December 2023. The construction schedule is presented in Table 1.

Table 1 – 3rd and Fairfax Project Schedule

Project Phase	Start Date	Complete Date
Phase 1: Demolition and Excavation Activities	January 2021	June 2021
Phase 2: Tower Structure, Exterior Enclosure, Roof and Interior Construction	June 2021	December 2023

2.0 CONSTRUCTION NOISE AND VIBRATION CRITERIA

2.1 Noise Criteria

City of Los Angeles Municipal Code (LAMC)

Section 112.05 of the LAMC provides that: Between the hours of 7:00 a.m. and 10:00 p.m., in any residential zone of the City or within 500 feet thereof, no person shall operate or cause to be operated any powered equipment or powered hand tool that produces a maximum noise level exceeding the following noise limits at a distance of 50 feet therefrom:

a) 75dB(A) for construction, industrial, and agricultural machinery including crawler-tractors, dozers, rotary drills and augers, loaders, power shovels, cranes, derricks, motor graders, paving machines, off-highway trucks, ditchers, trenchers, compactors, scrapers, wagons, pavement breakers, compressors and pneumatic or other powered equipment;
b) 75dB(A) for powered equipment of 20 HP or less intended for infrequent use in residential areas, including chain saws, log chippers and powered hand tools;
c) 65dB(A) for powered equipment intended for repetitive use in residential areas, including lawn mowers, backpack blowers, small lawn and garden tools and riding tractors;

The noise limitations above shall not apply where compliance therewith is technically infeasible. The burden

of proving that compliance is technically infeasible shall be upon the person or persons charged with a violation of this section. Technical infeasibility shall mean that said noise limitations cannot be complied with despite the use of mufflers, shields, sound barriers and/or other noise reduction device or techniques during the operation of the equipment.

In addition, Section 41.40 of the LAMC provides in part that:

> No person shall, between the hours of 9:00 P.M. and 7:00 A.M. of the following day, perform any construction or repair work of any kind upon, or any excavating for, any building or structure, where any of the foregoing entails the use of any power driven drill, riveting machine excavator or any other machine, tool, device or equipment which makes loud noises to the disturbance of persons occupying sleeping quarters in any dwelling hotel or apartment or other place of residence. In addition, the operation, repair or servicing of construction equipment and the job-site delivering of construction materials in such areas shall be prohibited during the hours herein specified.

Appendix G of the State CEQA Guidelines

In accordance with Appendix G of the State CEQA Guidelines, the Proposed Project would have a significant impact on noise if it would result in:

- Threshold (a): Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies; or

- Threshold (b): Generation of excessive groundborne vibration or groundborne noise levels.

L.A. CEQA Thresholds Guide

This technical report analyzes potential construction noise impacts according to the qualitative thresholds set forth by the State CEQA Guidelines. To provide quantitative factors that measure potential noise impacts, the analysis herein utilizes the numeric criteria set for in the L.A. CEQA Thresholds Guide (Thresholds Guide) below:

- Construction activities lasting more than one day would exceed existing ambient exterior noise levels by 10 dBA (hourly Leq) or more at a noise sensitive use;

- Construction activities lasting more than ten days in a three-month period would exceed existing ambient exterior noise levels by 5 dBA (hourly Leq) or more at a noise sensitive use; or

- Construction activities would exceed the ambient noise level by 5 dBA (hourly Leq) at a noise sensitive use between the hours of 9:00 P.M. and 7:00 A.M. Monday through Friday, before 8:00 A.M. or after 6:00 P.M. on Saturday, or anytime on Sunday.

Demolition and construction activities for the Proposed Project will last longer than a 10-day period. Accordingly, per the LA CEQA Thresholds Guide, the threshold that applies is whether construction noise would exceed the existing ambient exterior noise levels by 5 dBA (hourly Leq) or more at a noise sensitive use.

2.2 Vibration Criteria

The LAMC does not provide vibration thresholds for the City. However, the Federal Transit Administration (FTA) provides quantitative criteria used to measure impacts related to architectural damage (PPV in/s) and human annoyance (VdB). The corresponding vibration levels are shown in Table 2.

Table 2 – Construction Vibration

Criteria Description	Vibration Criteria PPV (in/s)	Maximum Vibration Velocity Level (VdB re: 1µin/s)
Offsite studio (recording/broadcast) uses	--	65
Offsite sensitive uses, including residential and theater uses	--	72
Institutional land (offsite school) uses with primarily daytime use (frequent events)	--	75
Institutional land uses with primarily daytime use (occasional events)	--	78
Institutional land uses with primarily daytime use (infrequent events)	--	83
Buildings extremely susceptible to vibration damage, such as historic buildings	0.12	90
Non-engineered timber and masonry buildings	0.2	94
Engineered concrete and masonry (no plaster)	0.3	98
Reinforced-concrete, steel or timber (no plaster)	0.5	102

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

Based on the existing conditions at sensitive receptors in the vicinity of the Project Site, character-defining features of the buildings associated with the receptors, and the land use at the receptors the following vibration criteria apply to the following receptors for impact analysis purposes:

- the maximum vibration level of 0.2 inches per second PPV for building damage at receptors NVSR-1 (except Main Building), NVSR-2, and NVSR-3;
- the maximum vibration level of 75 VdB for human annoyance within Hancock Elementary School in receptor locations NVSR-1;
- the maximum vibration level of 0.12 inches per second PPV within the Hancock Elementary School Main Building (historic building) at receptor NVSR-1; and
- the maximum vibration level of 72 VdB for human annoyance within residential receptors at receptors NVSR-2 and NVSR-3.

3.0 NOISE/VIBRATION SENSITIVE RECEPTORS

The LA CEQA Guide states that residences, schools, transient lodging, libraries, churches, hospitals, nursing homes, auditoriums, concert halls, amphitheaters, playgrounds, and parks can be considered sensitive receptors for noise analysis. Similarly, the Noise Element of the General Plan defines noise sensitive land uses as: single-family and multi-family dwellings, long-term care facilities, dormitories, motels, hotels, transient lodging, and other residential uses, houses of worship, hospitals, libraries, schools, auditoriums, concert halls, outdoor theaters, nature and wildlife preserves, and parks.

The Project Site and the noise/vibration-sensitive receptors (NVSR) to the north, south, east, and west of the site are shown in Table 3 and Figure 2.

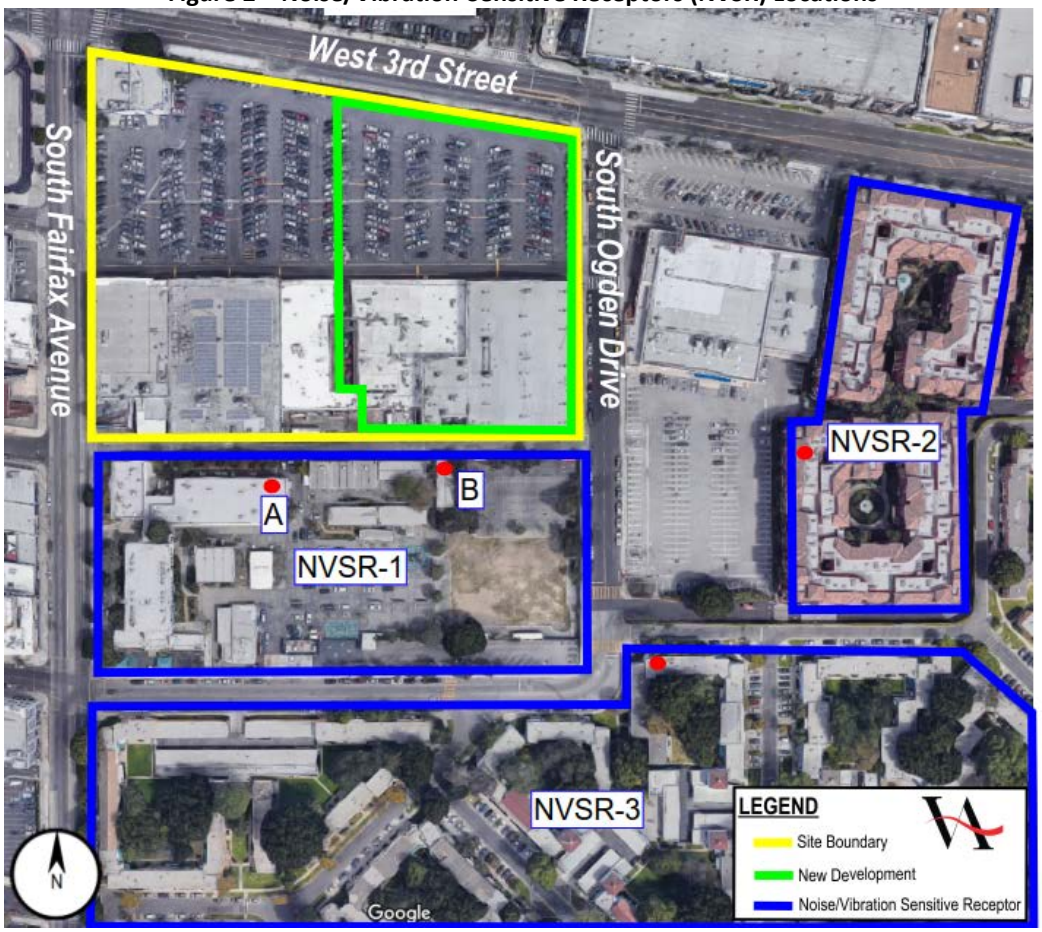
Table 3 – Noise/Vibration Sensitive Receptors (NVSR)

Receptor Group for Analysis	Address	Cardinal Direction from Project Site	Type of Receptor
NVSR-1	408 S. Fairfax Ave. (Hancock School)	South	Educational
NVSR-2	6200 W. 3rd St. (Park La Brea Apartments)	East	Residential
NVSR-3	6186 Colgate Ave. (Alandele Park Apartments)	Southeast	Residential

For NVSR-1, the distance from the Project Site is zero feet because the Hancock Park Elementary School and the Project Site have adjacent property lines. This is an extremely conservative method to analyze potential noise impacts on the school property since actual receptors, such as students in the classroom, or buildings subject to vibration, are in most instances not located exactly on the property line.

For each sensitive receptor, the most conservative location on the sensitive receptor site is indicated as a red dot in Figure 2 below. These locations are the ones closest to the construction site for that sensitive receptor. For the school, there are two locations (A and B) that have been used in the analyses that are closest to the construction site. Construction noise and vibration analyses results for these locations are shown in Table 8 through Table 11 below.

Figure 2 – Noise/Vibration-Sensitive Receptors (NVSR) Locations



4.0 EXISTING CONDITIONS

4.1 Ambient Noise Measurements

VA performed short-duration (15-minute) spot measurements in the surrounding community. Per LAMC Section 111.01 (a) "Ambient Noise", ambient noise must be measured for a minimum period of 15 minutes. These measurements were completed on May 21, 2019 between 11am and 1pm, which represents the typical time period when ambient noise sources and project construction activities are ongoing. Table 4 and Figure 3 summarizes these measurements. Based on long term measurements, sound levels between 7am and 4pm are within 1dBA of the measured short-term levels. For acoustical definitions, reference Appendix I.

Table 4 – Measured Short-Term Levels

Measurement Location	VA Measured Levels (dBA)		
	LAeq	LASmax	LASmin
S1	71.2	85.1	54.4
S2	72.1	87.5	58.7
S3	67.7	86.5	54.6
S4	60.9	75.4	52.2

4.2 School Measurements

VA also visited the Hancock Park Elementary School site on Monday, May 20, 2019 and placed meters in classroom 21 (interior measurement) and on its roof (L1) and in classroom 28 (interior measurement) and on its roof (L2) to capture the hourly sound levels for up to 9 days total (6 weekdays, 2 weekend days and Memorial Day) during the hours of 8:00 a.m. to 3:00 p.m. while school was in session. These measurements captured the ambient noise levels when the classrooms were occupied and unoccupied. The ambient noise levels below represent the occupied classroom noise levels because that is the time when the students (i.e., the receptors) could be exposed to changes in noise levels.

Figure 3 – Measurement Locations

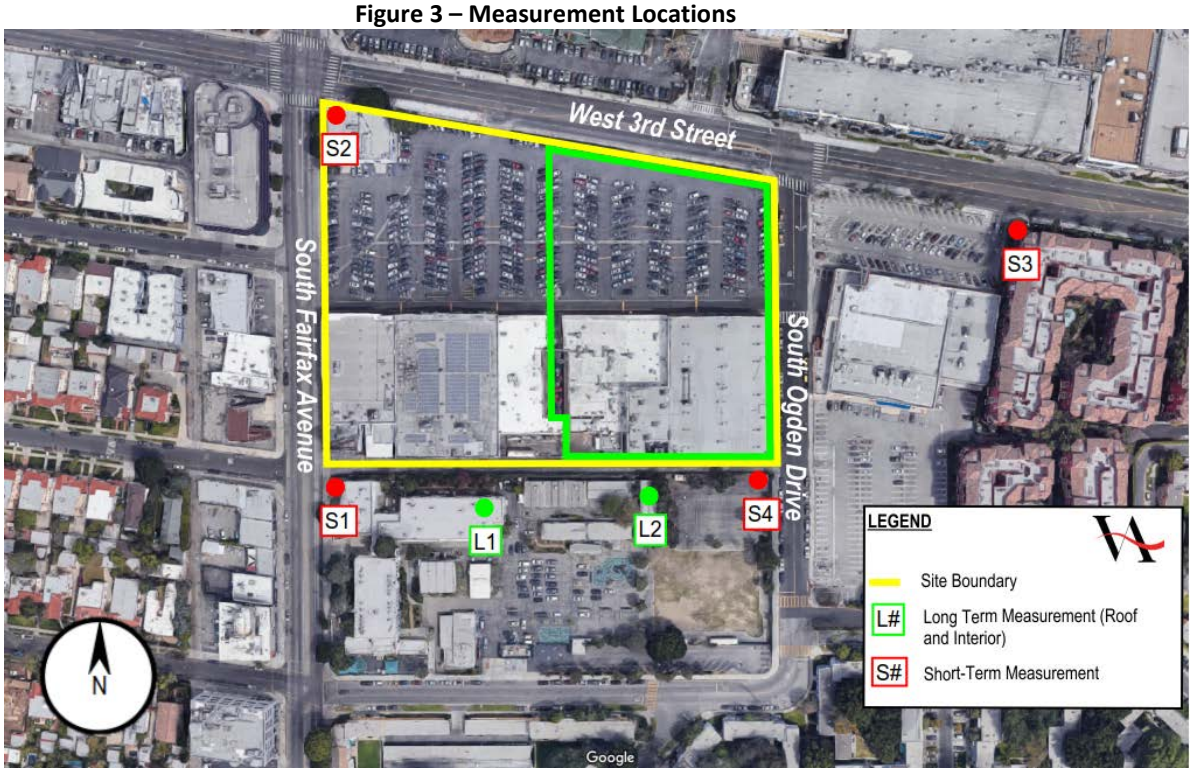


Table 5 below shows the summary of long-term measurements between 8am-3pm weekdays while school was in session:

Table 5 – Measured Long-Term Levels

Measurement Location	LAeq (dBA)
Classroom 21 (L1)	63.5
Roof Classroom 21 (L1)	61.6
Classroom 28 (L2)	63.9
Roof Classroom 28 (L2)	61.8

5.0 CONSTRUCTION EQUIPMENT NOISE AND VIBRATION LEVELS

VA obtained the list of equipment types anticipated to be used to construct the Proposed Project, construction phase information, and usage factors from the developer consistent with the assumption sets used to model environmental impacts. This list was compared to, and determined consistent with, industry standard reference databases including the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) for equipment typical to projects of this scale.

Table 6 and Table 7 below show the loudest equipment anticipated for use on the Proposed Project along with associated noise and vibration levels at reference distances and anticipated equipment usage factors. The listed noise levels do not include the effects of any noise mitigation measures. VA was informed that construction of the Proposed Project would not require pile driving on the Project Site.

The construction phases for the Proposed Project are as follows:

- Demolition & Site Clearance
- Grading & Excavation
- Building Construction
- Architectural Coating / Finishing

Table 6 – Noise Data for Selected Construction Equipment at 3rd and Fairfax

Construction Equipment	Phase of Construction	Estimated Usage Factor %	Actual Measured Noise Level at 50 Feet (dBA L_{MAX})*
Excavator	Demolition & Site Clearance/Grading & Excavation	73	81
Front End Loader	Grading & Excavation/Building Construction	73	79
Grader	Grading & Excavation	73	85
Dozer	Demolition & Site Clearance/Grading & Excavation	73	82
Dump/Haul Truck	Grading & Excavation	73	76
Concrete/Industrial Saw	Demolition & Site Clearance	73	90
Concrete Pump Truck		20	81
Concrete Pump Truck	Building Construction	73	81
Concrete Mixer truck	Building Construction	73	79
Fork Lift	Building Construction	73	75
Crane	Building Construction	64	81
Air Compressor	Architectural Coating/ Finishing	55	78
Welder	Building Construction	73	74
Generator	Building Construction	73	81
Backhoe	Grading & Excavation/Building Construction	73	78
Drill Rig	Grading & Excavation	73	84
Aerial Lift	Architectural Coating/ Finishing	73	75
Tractor	Grading & Excavation/Building Construction	73	84

*Source: FHWA Highway Construction Noise Handbook Final Report dated August 2006, Table 9.1 (see Appendix III)

In a similar manner, Table 7 below lists the heaviest equipment anticipated for use on the Proposed Project along with associated vibration levels at reference distances. Note that only vibration intensive equipment types are included on this list. Any equipment omitted from this list produce insignificant vibration levels.

Table 7 – Vibration Data for Selected Construction Equipment at 3rd and Fairfax

Construction Equipment	Phase of Construction	PPV Level at Reference Distance (in/s at 25-feet)	VdB Level at Reference Distance (1 µin/s at 25-feet)
Excavator	Demolition & Site Clearance/Grading & Excavation	0.089	87
Front End Loader	Grading & Excavation/Building Construction	0.003	58
Dozer	Demolition & Site Clearance/Grading & Excavation	0.089	87

Dump/Haul Truck	Grading & Excavation	0.076	86
Concrete Pump Truck	Building Construction	0.076	86
Concrete mixer truck	Building Construction	0.076	86
Backhoe	Grading & Excavation/Building Construction	0.003	58
Crane	Building Construction	0.089	87
Drill Rig	Grading & Excavation	0.089	87
Tractor	Grading & Excavation/Building Construction	0.076	86

Source: FTA Transit Noise and Vibration Impact Assessment Guidance Manual dated September 2018, Table 7-4 (see Appendix III)

6.0 PREDICTION AND MODELING

The list of construction equipment, sound levels attributable to that equipment, and assumed utilization factors are shown in Table 6 in Section 5.0 of this report. Sound levels of the construction equipment were based upon the FTA Noise Guidance Manual and the FHWA Construction Noise Handbook. Utilization factors were calculated based on the information provided by the developer. The noise modeling (including assumptions for the location of construction equipment and distance to receptors) was performed according to the methodology and standards contained in the FTA Noise Guidance Manual and the FHWA Construction Noise Handbook.

Appendix II contains the quantitative noise modeling results explained in this report. Calculations were performed for each piece of equipment to determine the noise and vibration level for each phase of construction. Calculations were then completed separately at each receptor location (NVSR1~NVSR3) for vibration.

6.1 Construction Noise Calculations

For purposes of calculating potential noise impacts, all noise sources were assumed to be moving throughout the Project Site, which is consistent and typical of construction processes, and consistent with the industry standards for modeling noise impacts per the FTA Noise Guidance Manual and the FHWA Construction Noise Handbook. A long-term average of noise emissions from the Project Site incident upon the noise-sensitive receptors was modeled using the distances in Table 3.

In addition, the predicted continuous noise levels attributable to construction activity, with and without a temporary noise barrier in certain locations around the construction activities, were modeled and are discussed in Section 7.0.

All noise sources were based upon daytime operation only with construction activity occurring between the hours of 7:00 a.m. to 6:00 p.m., Monday through Saturday.

The basis for the calculations is that sound decays with distance (D) due to geometric spreading, according to Equation 1:

(1) Distance Attenuation = 20 x log(D/50)

The L_{MAX} at the receptor is calculated using the $L_{MAX\text{-}REF}$ levels for each piece of equipment (measured at 50 feet) from Table 6.

(2) $L_{MAX} = L_{MAX\text{-}REF}$ – Distance Attenuation – shielding

Shielding is the insertion loss of any barriers or mitigation, in dBA.

In addition, the hourly $L_{EQ}(h)$ can be calculated by applying a usage factor (UF) using methodology from FHWA guidelines Section 3.1, according to Equation 3:

(3) $L_{EQ}(h) = L_{MAX} + 10 \times \log(UF/100)$

The estimated L_{EQ} due to each of the construction equipment at a distance of 50 feet are presented in Appendix II. The L_{EQ} calculations consider the usage factor UF, therefore accounting for the fact that some equipment does not run constantly.

The overall construction noise level at some point is simply the sum (on an energy basis) of the individual contributions of each piece of equipment. Mathematically, the overall construction noise level at some point is expressed as:

(4) $L_{eq}(h) = 10 \times \log {}^{n}\sum_{i=1} 10^{Leq(equipment)/10}$

6.2 Construction Vibration Calculations

Attenuation of vibration levels with distance varies depending on the local soil conditions. The following calculations estimate the vibration levels that will be generated by the construction activities using the propagation formula published in the Caltrans Transportation and Construction-Induced Vibration Guidance Manual dated June 2004. The propagation formula is as follows:

(1) PPV_{equip} Vibration at Receptor (for damage) = PPV_{ref} * (25/D)^n

PPV_{equip} = peak particle velocity of equipment adjusted for distance, in/sec

PPVref = source reference vibration level at 25 ft, in/sec (Table 7)

D = distance from the equipment to receiver, ft

The value n is determined by the soil conditions at the project site. Using Caltrans Transportation and Construction-Induced Vibration Guidance Manual dated June 2004 (See Appendix III) and a conservative assumption, we have modeled vibration using n = 1.1.

(2) $L_{v.distance}$ Vibration at Receptor (for annoyance) = L_{vref} – 30log (D/25)

$L_{v.distance}$ = rms velocity level adjusted for distance, VdB

L_{vref} = source reference vibration level at 25 ft, VdB (Table 7)

D = distance from the equipment to receiver, ft

The estimated vibration due to each of the construction activities at each receptor are presented in Table 10. For each construction activity, typical setback, minimum setback, and vibration information are given. Receptor vibration levels are calculated as a function of the 25-foot reference vibration level (PPV_{ref}) shown in Table 7 and the receptor setback (D). The minimum and typical setbacks were derived from the project work areas indicated on the project drawings, which are illustrated by the new development footprint in Figure 2 and the noise barrier locations identified in Figure 4. A comparison of the calculated vibration levels to the project criteria is shown in Table 10.

Vibration limits for structures are assessed using the peak particle velocity (PPV) metric. This metric refers to the maximum speed of a particular particle as it oscillates about a point of equilibrium that is moved by a passing wave. Vibration limits for human perception and annoyance are assessed using the VdB metric .

7.0 ANALYSIS AND CONCLUSIONS

7.1 Noise

As discussed above, the primary threshold of significance to analyze construction noise impacts is whether the Proposed Project would result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the Project Site in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. Using the applicable quantitative standard, this analysis determines if construction noise from the Proposed Project would exceed existing ambient exterior noise levels by 5 dBA (hourly Leq) or more at a noise sensitive use.

Construction noise is inherently temporary and ends when construction is complete. Thus, the analysis here focuses (in relation to the temporary or permanent prongs of the noise threshold above) on the generation of temporary noise during construction.

The noise modeling results are compared with background levels of noise recorded at the sensitive receptor locations around the Project Site. The noise exposure to the surrounding NVSR's was modeled both with and without noise mitigation measures. The results were then compared to noise thresholds applicable to the Project Site.

Table 8 below shows the modeled noise levels associated with construction of the Project, before applying noise mitigation measures. The noise levels are calculated using the typical (average) setback distance between receptor and construction site (assuming all equipment operational at various locations on site at any given time). The modeled noise levels during each construction phase at each receptor is shown in Appendix II.

Table 8 – Noise Levels to Construct Proposed Project

Receptor Location	Typical Setback Distance from Construction Site to Noise Receptor (ft.)	Existing Ambient Noise Levels (dBA Leq)	Applicable Criteria +5dBA Above Ambient (dBA Leq)	Estimated Maximum Construction Noise Levels (dBA Leq)	Change in Ambient Noise Level (dBA Leq)	Exceed Criteria?
NVSR-1 – Hancock Park Elementary School Property Line	240	61.6	66.6	77.1	15.5	Yes
NVSR-1 – Classroom 28 Exterior (B)	255	61.8	66.8	76.6	14.8	Yes
NVSR-1 – Inside Classroom 28 (B)	255	63.9	68.9	53.7	0	No
NVSR-1 – Classroom 21 Exterior (A)	320	61.6	66.6	74.7	13.1	Yes
NVSR-1 – Inside Classroom 21 (A)	320	63.5	68.5	51.8	0	No
NVSR-2 – Park La Brea Apartments - Palazzo West at the Grove	510	60.9	65.9	70.9	10	Yes
NVSR-3 – Park La Brea Apartments - Alandele Park Apartments	590	60.9	65.9	69.7	8.8	Yes

Based on the above table, the noise levels (without mitigation) from construction of the Proposed Project exceed the applicable threshold at five of the seven the sensitive receptor locations listed above.

The conclusion, when compared to the applicable threshold of significance, is that the Project would have a significant noise impact if mitigation is not included.

Noise Modeling Results with Mitigation

The following analysis explains the noise reduction levels that would occur if noise mitigation is imposed. Recommended noise mitigation would include temporary noise barriers placed between construction activities and certain sensitive receptor locations.

Table 9 below shows the modeled noise levels anticipated from construction equipment assuming there is a 20-foot high noise barrier (along the school property line and a 10-foot high noise barrier along Ogden Drive). The 20-foot barrier would consist of the existing permanent concrete wall that the operator of the existing commercial center constructed plus a temporary noise barrier installed on top of the existing concrete wall that the project applicant would install before construction activities for the Proposed Project commenced. The noise levels in this table are calculated using the typical (average) setback distance between the receptor and construction site with the assumption that construction equipment operates in a variety of locations around the Project Site. The estimated noise levels during each construction phase at each receptor is shown in Appendix II.

Table 9 – Construction Noise Levels to Construct Proposed Project (with Mitigation)

Receptor Location	Typical Setback Distance from Construction Site to Noise Receptor (ft.)	Existing Ambient Noise Levels (dBA Leq)	Applicable Criteria +5dBA Above Ambient (dBA Leq)	Estimated Maximum Construction Noise Levels (dBA Leq)	Change in Ambient Noise Level (dBA Leq)	Exceed Criteria?
NVSR-1 – Hancock Park Elementary School Property Line	240	61.6	66.6	57.1	0	No
NVSR-1 – Classroom 28 Exterior (B)	255	61.8	66.8	56.6	0	No
NVSR-1 - Inside Classroom 28 (B)	255	63.9	68.9	33.7	0	No
NVSR-1 – Classroom 21 Exterior (A)	320	61.6	66.6	54.7	0	No
NVSR-1 - Inside Classroom 21 Exterior (A)	320	63.5	68.5	31.8	0	No
NVSR-2 – Park La Brea Apartments - Palazzo West at the Grove	510	60.9	65.9	63.9	3.0	No
NVSR-3 - Park La Brea Apartments - Alandele Park Apartments	590	60.9	65.9	62.7	1.8	No

Based on the above table, the noise levels from construction of all phases of the Proposed Project would not exceed the applicable noise impact threshold at any of the sensitive receptors. The noise barrier locations along the school property line and Ogden Drive are shown in Figure 4.

Figure 4 – Location Map of Noise Barriers

The location of the noise barriers shown in Figure 4 above identifies where the temporary 10-foot noise barrier would be placed on top of a portion of the concrete wall. The concrete wall currently extends nearly the length of the property line (between the school and commercial center) between South Fairfax Avenue and South Ogden Drive. There is an approximately 10 linear foot area (from South Ogden Drive extending down the service alley) where the concrete wall does not exist to allow for safe vehicular ingress and egress to the service alley. The temporary noise barrier installed in this particular area would be a 20-foot high barrier to ensure a consistent break in line of sight between the Development Site and adjacent property to the south. Another temporary 10-foot barrier would extend north along South Ogden Drive. Note that noise barrier mitigation measures are only required for exterior construction activities or construction activities that may lead outside. Any work contained wholly indoors (either in the existing structures before demolition or inside the future building once its constructed) would not require the use of noise barriers because the building's enclosure would provide adequate noise attenuation.

Individual pieces of construction equipment anticipated to be used during construction of the Proposed Project could produce maximum noise levels (Lmax) of 74 dBA to 90 dBA at a reference distance of 50 feet from the noise source, as shown in Table 6. These maximum noise levels shown in the FHWA Noise Model User's Guide (2006) at 50 feet would occur when equipment is operating under full power conditions (i.e., the equipment engine at maximum speed). However, equipment used on construction sites often operates under less than full power conditions, or part power. Therefore, to more accurately characterize construction-period noise levels, the average (Hourly Leq) noise level associated with each construction phase is calculated based on the quantity, type, and usage factors for each type of equipment that would be used during each construction phase.

7.2 Vibration

Vibration levels were also modeled for construction of the Proposed Project. As discussed above, the applicable thresholds of significance for vibration impacts include the following:

Based on the existing conditions at sensitive receptors in the vicinity of the Project Site, character-defining features of the buildings associated with the receptors, and the land use at the receptors the following criteria apply to the following receptors for impact analysis purposes:

- the maximum vibration level of 0.2 inches per second PPV for building damage at receptors NVSR-1 (except Main Building), NVSR-2, and NVSR-3;
- the maximum vibration level of 75 VdB for human annoyance within Hancock Elementary School in receptor locations NVSR-1;
- the maximum vibration level of 0.12 inches per second PPV within the Hancock Elementary School Main Building (historic building) at receptor NVSR-1; and
- the maximum vibration level of 72 VdB for human annoyance within residential receptors at receptors NVSR-2 and NVSR-3.

Table 10 below shows estimated maximum vibration levels for construction of the Proposed Project. Vibration levels for various equipment were assumed to be equivalent to similar equipment specified in the FTA Transit Noise and Vibration Guidance Manual. The reference levels for each type of equipment assumed to generate appreciable vibration levels are shown in Table 7. Vibration criteria for various human and structural responses are shown in Table 2 of this report.

Table 10 – Construction Vibration Levels

Receptor	Minimum Distance from Construction Site to Vibration Receptor (ft.)	Vibration Level Criteria (Exterior) (PPV [in/s)/VdB)	Predicted Construction Maximum Vibration Level (PPV [in/s)/VdB)	Compliance with Damage Criteria	Compliance with Annoyance Criteria
NVSR-1 - Classroom 28 (B)	15	0.2/75	0.156/94	Yes	No
NVSR-1 – Classroom 21 (A)	100	0.12/75	0.019/69	Yes	Yes
NVSR-2 – Park La Brea Apartments - Palazzo West at the Grove	280	0.2/72	0.006/56	Yes	Yes
NVSR-3 - Park La Brea Apartments - Alandele Park Apartments	330	0.2/72	0.005/53	Yes	Yes

For construction activities, projected maximum PPV levels at each sensitive receptor would not exceed the applicable threshold of significance for building damage criteria.

The projected maximum VdB levels would not exceed the human annoyance threshold at sensitive receptor location NVSR-1 within the Main Building, NVSR-2, and NVSR-3. However, the VdB levels would exceed the human annoyance threshold at sensitive receptor location NVSR-1, which is within the Bungalow Classrooms. These are the vibration levels prior to mitigation.

Vibration Modeling Results with Mitigation

The impacts from vibration are primarily caused by heavy machinery operating in close proximity to the property line of the adjacent school. If there is more separation distance between such activities and the property line, then the vibration levels are reduced. Thus, to mitigate vibration levels, heavy machinery (excavators, dozers, cranes and drill rig) must work at least 70 feet from the Bungalow Buildings while school is in session. Construction activity that must occur within 70 feet of the Bungalow Buildings would need to be

performed with smaller equipment types that do not exceed the vibration applicable thresholds of significance. This criterion is included in the recommendations below to reduce potential vibration impacts.

Table 11 below shows the estimated maximum vibration levels for the construction of the Proposed Project with the use of required setback distance mitigation measures.

Table 11 - Construction Vibration Levels with Mitigation

Receptor	Minimum Distance from Construction Site to Noise Receptor (ft.)	Vibration Level Criteria (Exterior) (PPV [in/s)/VdB)	Predicted Construction Maximum Vibration Level (PPV [in/s)/VdB)	Compliance with Damage Criteria	Compliance with Annoyance Criteria
NVSR-1 - Classroom 28 (B)	70	0.2/75	0.029/74	Yes	Yes
NVSR-1 – Classroom 21 (A)	100	0.12/75	0.019/69	Yes	Yes
NVSR-2 – Park La Brea Apartments - Palazzo West at the Grove	280	0.2/72	0.006/56	Yes	Yes
NVSR-3 - Park La Brea Apartments - Alandele Park Apartments	330	0.2/72	0.005/53	Yes	Yes

7.3 Noise Measure Mitigation

School Property Noise Barrier

Mitigation requires that the temporary noise barrier along the school property line consist of a 10-foot sound barrier, or an equivalent system approved by the acoustical engineer, installed on top of the existing concrete wall. For the gap area between the end of the existing concrete wall and South Ogden Drive, there should be a 20-foot temporary noise barrier. The sound barrier can be any solid material with a density no less than 2.5 lb. per square foot. Materials meeting this requirement include 3/4-inch thick wood, 3/4-inch outdoor plywood, 16-gauge steel sheet, and any masonry unit. Support frames should be constructed in sections which allow overlapping between barrier panels when multiples are attached. Gaps between barrier units and between the bottom edge of barrier panels where they meet the top of the existing concrete wall shall be covered or sealed with material of no less than 2 pcf density. These barriers should be capable of achieving a minimal Sound Transmission Class (STC) rating of 32[1]. Use of equivalent noise barrier systems shall be reviewed and approved by the acoustical engineer. Barrier design and construction shall be approved by a structural engineer. The design details and materials for the movable noise barriers and supports will be prepared for approval and stamped by a Professional Engineer licensed in the state of California and submitted to the Department of Building and Safety prior to issuance of the first demolition or building permit.

Ogden Drive Noise Barrier

Mitigation requires that the temporary noise barrier along Ogden Drive should consist of a 10-foot high sound blanket, or a system approved by the acoustical engineer. The sound blanket can be any solid material with a density no less than 2 lb. per square foot. Materials meeting this requirement include 3/4-inch thick wood, 3/4-inch outdoor plywood, 16-gauge steel sheet, and any masonry unit. Support frames should be constructed in sections which allow overlapping between barrier panels when multiples are attached. Gaps between barrier units and between the bottom edge of barrier panels and the ground shall be covered or sealed with material no less than 2 pcf density. These barriers shall be capable of achieving a minimal Sound

[1] An STC 32 rating results in at least 5dB of attenuation at low frequency.

Transmission Class (STC) rating of 32. Use of equivalent noise barrier systems shall be reviewed and approved by the acoustical engineer. Barrier design and construction shall be approved by a structural engineer. The design details and materials for the movable noise barriers and supports will be prepared for approval and stamped by a Professional Engineer licensed in the state of California and submitted to the Department of Building and Safety prior to issuance of the first demolition or building permit.

Mufflers/Shielding

Electrically powered or gas/diesel-driven construction equipment must utilize sound mufflers at the exhaust and/or acoustical skirts, screens to shield the engine. These attenuating devices may be acquired at the time of leasing, rental, or purchase of equipment from the rental agency and/or manufacturer.

7.4 Vibration Mitigation

Setback Distance

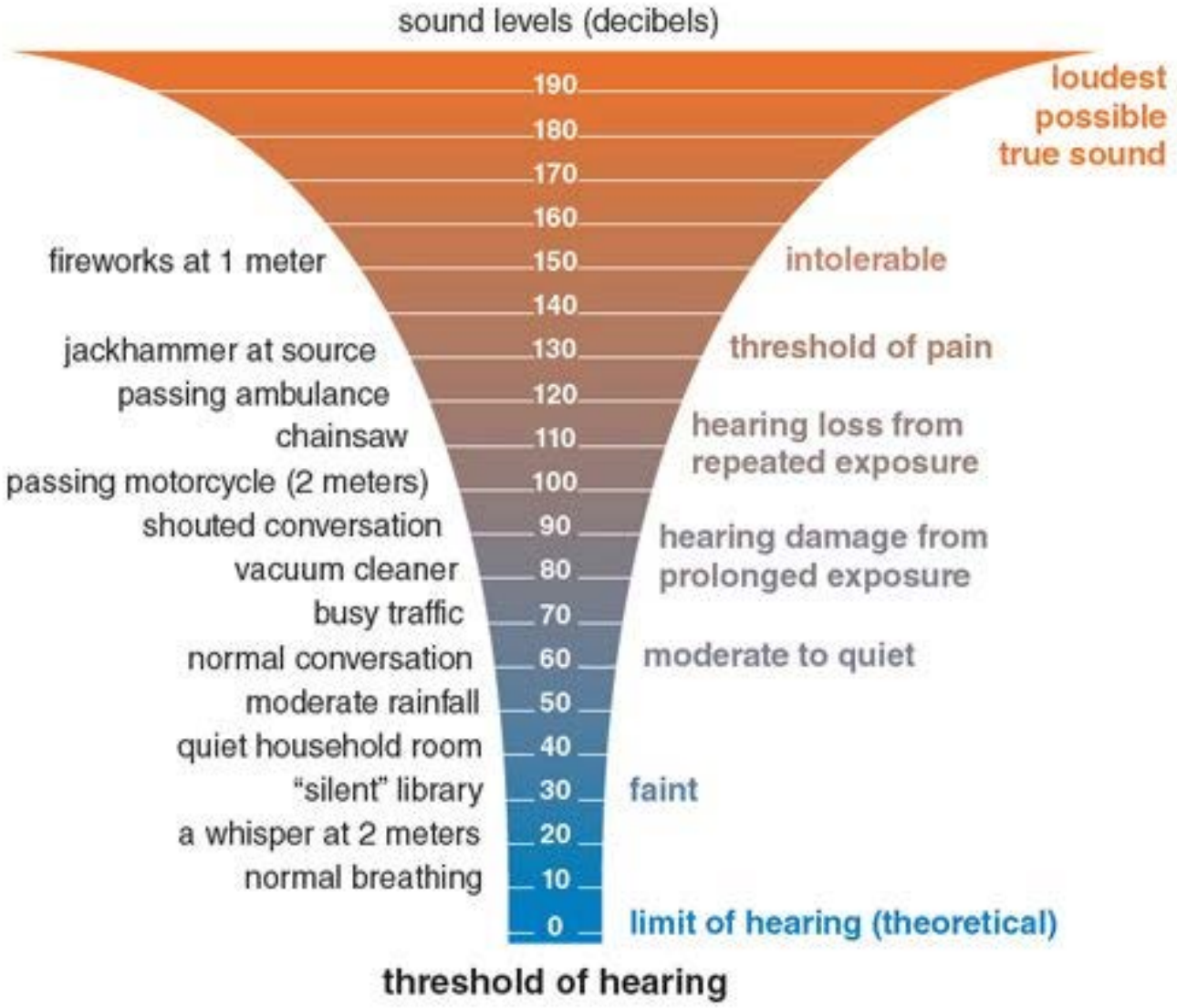
Heavy machinery (excavators, dozers, cranes and drill rig) must work at least 70 feet from the School Bungalow Buildings while school is in session.

APPENDIX I – GLOSSARY OF ACOUSTICAL TERMS

Definitions of Acoustical and Other Related Terms

Term	Definition
Construction Site	For the purpose of noise and vibration control requirements, the construction site includes property lines, construction easement boundaries, and contractor staging areas outside the defined boundary lines, used expressly for construction.
Daytime	Local – Pacific Standard Time Zone between 07:00 and 19:00.
Decibel (dB)	A unit describing the amplitude of sound in a logarithmic ratio to a reference value.
A-weighted Decibels (dBA)	A filter applied to sound pressure levels in decibel to simulate the response of the human ear at the threshold of hearing. A-weighting de-emphasizes the low frequency components of a sound similar to the human ear at these levels. This metric has been closely tied to subjective reactions of annoyance to noise, and is used as a noise metric in this and in many other environmental acoustics reports. In this report, all dBA levels reported refer to the sound pressure level, referenced to 20µPa
Sound Pressure Level (L_p)	The amplitude of sound compared to the reference value of 20µPa. Sound Pressure Level is what we perceive as audible sound. Sound Pressure Level decreases as distance from the source to the receiver increases. All sound values discussed in this report refer to Sound Pressure Levels.
Equivalent Sound Level (L_{eq})	The time-weighted average sound or vibration level for a given period of time. Use of this metric allows the observation of the overall sound level for the measurement period.
Maximum Sound Level (L_{max})	The instantaneous maximum sound or vibration level of an event. The L_{max} can occur over very short periods of time, and fluctuates much more than the L_{eq} due to the presence of short events in the environment.
Vibration Decibel (VdB)	A measure of vibration amplitude in decibels, referenced to 1µin/sec, most commonly used for assessment and prediction of annoyance due to perceptible vibration and ground-borne noise. The V is added for clarity to easily distinguish between sound and vibration decibels.

Decibel Level Scale



APPENDIX II – CALCULATION RESULTS

Noise Data for Selected Construction Equipment at 3rd and Fairfax

Construction Activity Noise Estimation

Equipment Item	Construction Phases > Reference at 50 feet (dBA) L_{EQ}	Reference at 50 feet (dBA) LMAX	Demolition & Site Clearance Quantity	Demolition & Site Clearance Usage (%)	Grading & Excavation Quantity	Grading & Excavation Usage (%)	Building Construction Quantity	Building Construction Usage (%)	Architectural Coating / Finishing Quantity	Architectural Coating / Finishing Usage (%)
Compressor (air)	75.1	77.7	0	55	0	55	0	55	3	55
Backhoe	76.2	77.6	0	73	1	73	1	73	0	73
Crane	78.7	80.6	0	64	0	64	1	64	0	64
Concrete Mixer Truck	77.4	78.8	0	73	0	73	1	73	0	73
Concrete Pump Truck	80.0	81.4	0	73	0	73	1	73	0	73
Concrete Saw	88.2	89.6	1	73	0	73	0	73	0	73
Dozer	80.3	81.7	2	73	1	73	0	73	0	73
Drill Rig	82.6	84	0	73	1	73	0	73	0	73
Excavator	79.3	80.7	3	73	3	73	0	73	0	73
Fork Lift	73.3	74.7	0	73	0	73	3	73	0	73
Generator	79.2	80.6	0	73	0	73	1	73	0	73
Grader	83.6	85	0	73	1	73	0	73	0	73
Dump Truck	74.6	76	0	73	2	73	0	73	0	73
Lift	73.3	74.7	0	73	0	73	0	73	3	73
Front End Loader	77.7	79.1	0	73	1	73	1	73	0	73
Welder/Torch	72.6	74	0	73	0	73	1	73	0	73
Tractor	82.6	84	0	73	1	73	1	73	0	73
			L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}
	Total at 50 feet (dBA)		**90.6**	**89.6**	**90.5**	**85.0**	**88.3**	**84.0**	**82.1**	**77.7**

Source: FHWA Highway Construction Noise Handbook Final Report dated August 2006, Table 9.1

Noise Estimation at Sensitive Receptors for Selected Construction Equipment without mitigation measures

Construction Noise Estimation at Sensitive Receptor Locations (No mitigation)

#	Sensitive Receiver	Existing Ambient Noise Level (dBA)	Typical Setback Distance (ft)	Criteria LEQ (dBA)	Building NR	Demolition & Site Clearance		Grading & Excavation		Building Construction		Architectural Coating / Finishing	
						L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}
1	Hancock Park Elementary School Property Line	62	240	67		77.1	76.1	77.0	71.8	74.9	71.0	69.3	66.2
2	Classroom 28 Exterior (B)	62	255	67		76.6	75.6	76.5	71.4	74.4	70.5	68.9	65.9
3	Inside Classroom 28 (B)	64	255	69	23	53.7	52.7	53.6	48.7	51.6	47.9	46.4	43.8
4	Classroom 21 Exterior (A)	62	320	67		74.7	73.8	74.6	69.7	72.6	68.9	67.4	64.8
5	Inside Classroom 21 (A)	64	320	69	23	51.8	50.9	51.8	47.1	49.8	46.4	45.1	43.0
6	Park La Brea Apartments - Palazzo West at the Grove	61	510	66		70.9	70.0	70.8	66.3	68.9	65.7	64.5	62.6
7	Park La Brea Apartments - Alandele Park Apartments	61	590	66		69.7	68.9	69.7	65.5	67.9	64.9	63.8	62.3

Fields highlighted in Red in the above table indicate noise levels above threshold

Noise Estimation at Sensitive Receptors for Selected Construction Equipment with 20-foot high noise barrier along School property line

Construction Noise Estimation at Sensitive Receptor Locations (with 20-foot high barrier along School Property Line)

#	Sensitive Receiver	Existing Ambient Noise Level (dBA)	Typical Setback Distance (ft)	Criteria LEQ (dBA)	Building NR	Shielding (Barrier, etc) (dB)	Demolition & Site Clearance		Grading & Excavation		Building Construction		Architectural Coating / Finishing	
							L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}
1	Hancock Park Elementary School Property Line	62	240	67		20	57.1	56.1	57.0	51.8	54.9	51.0	49.3	46.2
2	Classroom 28 Exterior (B)	62	255	67		20	56.6	55.6	56.5	51.4	54.4	50.5	48.9	45.9
3	Inside Classroom 28 (B)	64	255	69	23	20	33.7	32.7	33.6	28.7	31.6	27.9	26.4	23.8
4	Classroom 21 Exterior (A)	62	320	67		20	54.7	53.8	54.6	49.7	52.6	48.9	47.4	44.8
5	Inside Classroom 21 (A)	64	320	69	23	20	31.8	30.9	31.8	27.1	29.8	26.4	25.1	23.0
6	Park La Brea Apartments - Palazzo West at the Grove	61	510	66			70.9	70.0	70.8	66.3	68.9	65.7	64.5	62.6
7	Park La Brea Apartments - Alandele Park Apartments	61	590	66			69.7	68.9	69.7	65.5	67.9	64.9	63.8	62.3

Fields highlighted in Red in the above table indicate noise levels above threshold

Noise Estimation at Sensitive Receptors for Selected Construction Equipment with 20-foot high noise barrier along School property line and 10-foot high barrier along Ogden Drive

Construction Noise Estimation at Sensitive Receptor Locations (with 20-foot high noise barrier along school and 10-foot high barrier along Ogden)

#	Sensitive Receiver	Existing Ambient Noise Level (dBA)	Typical Setback Distance (ft)	Criteria LEQ (dBA)	Building NR	Shielding (Barrier, etc) (dB)	Demolition & Site Clearance		Grading & Excavation		Building Construction		Architectural Coating / Finishing	
							L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}	L_{EQ}	L_{MAX}
1	Hancock Park Elementary School Property Line	62	240	67		20	57.1	56.1	57.0	51.8	54.9	51.0	49.3	46.2
2	Classroom 28 Exterior (B)	62	255	67		20	56.6	55.6	56.5	51.4	54.4	50.5	48.9	45.9
3	Inside Classroom 28 (B)	64	255	69	23	20	33.7	32.7	33.6	28.7	31.6	27.9	26.4	23.8
4	Classroom 21 Exterior (A)	62	320	67		20	54.7	53.8	54.6	49.7	52.6	48.9	47.4	44.8
5	Inside Classroom 21 (A)	64	320	69	23	20	31.8	30.9	31.8	27.1	29.8	26.4	25.1	23.0
6	Park La Brea Apartments - Palazzo West at the Grove	61	510	66		7	63.9	63.0	63.8	59.3	61.9	58.7	57.5	55.6
7	Park La Brea Apartments - Alandele Park Apartments	61	590	66		7	62.7	61.9	62.7	58.5	60.9	57.9	56.8	55.3

Vibration Estimation at Hancock Park Elementary School Classroom 28 in Sensitive Receptor NVSR-1 for Selected Construction Equipment

Veh. #	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)
1	Tractor	0.076	86	15	0.133	92.7
2	Crane	0.089	87	15	0.156	93.7
3	Excavator	0.089	87	15	0.156	93.7
4	Dozer	0.089	87	15	0.156	93.7
5	Drill Rig	0.089	87	15	0.156	93.7
6	Trucks	0.076	86	15	0.133	92.7
7	Backhoe	0.003	58	15	0.005	64.7

Vibration Estimation at Hancock Park Elementary School Classroom 28 in Sensitive Receptor NVSR-1 for Selected Construction Equipment with 70-foot Setback from property line while School is in session

Veh. #	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)
1	Tractor	0.076	86	70	0.024	72.6
2	Crane	0.089	87	70	0.029	73.6
3	Excavator	0.089	87	70	0.029	73.6
4	Dozer	0.089	87	70	0.029	73.6
5	Drill Rig	0.089	87	70	0.029	73.6
6	Trucks	0.076	86	70	0.024	72.6
7	Backhoe	0.003	58	70	0.001	44.6

Vibration Estimation at Hancock Park Elementary School Classroom 21 in Sensitive Receptor NVSR-1 for Selected Construction Equipment

Veh. #	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)
1	Tractor	0.076	86	100	0.017	67.9
2	Crane	0.089	87	100	0.019	68.9
3	Excavator	0.089	87	100	0.019	68.9
4	Dozer	0.089	87	100	0.019	68.9
5	Drill Rig	0.089	87	100	0.019	68.9
6	Trucks	0.076	86	100	0.017	67.9
7	Backhoe	0.003	58	100	0.001	39.9

Vibration Estimation at Park La Brea Apartments - Palazzo West at the Grove in Sensitive Receptor NVSR-2 for Selected Construction Equipment

Veh. #	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)
1	Tractor	0.076	86	280	0.005	54.5
2	Crane	0.089	87	280	0.006	55.5
3	Excavator	0.089	87	280	0.006	55.5
4	Dozer	0.089	87	280	0.006	55.5
5	Drill Rig	0.089	87	280	0.006	55.5
6	Trucks	0.076	86	280	0.005	54.5
7	Backhoe	0.003	58	280	0.000	26.5

Vibration Estimation at Park La Brea Apartments - Alandele Park Apartments in Sensitive Receptor NVSR-3 for Selected Construction Equipment

Veh. #	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)
1	Tractor	0.076	86	330	0.004	52.4
2	Crane	0.089	87	330	0.005	53.4
3	Excavator	0.089	87	330	0.005	53.4
4	Dozer	0.089	87	330	0.005	53.4
5	Drill Rig	0.089	87	330	0.005	53.4
6	Trucks	0.076	86	330	0.004	52.4
7	Backhoe	0.003	58	330	0.000	24.4

APPENDIX III – FHWA, FTA, AND CALTRANS REFERENCES

FHWA Highway Construction Noise Handbook Final Report dated August 2006, Table 9.1

Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors.

Equipment	Impact	Acoustical	Spec. 721.560	Actual Measured L_{max} @	Number of
Description	**Device?**	**Usage Factor (%)**	**L_{max} @ 50 feet (dBA, slow)**	**50 feet (dBA, slow) (Samples Averaged)**	**Actual Data Samples (Count)**
All Other Equipment > 5 HP	No	50	85	N/A	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	N/A	0
Blasting	Yes	N/A	94	N/A	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	N/A	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS Signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	N/A	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydraulic Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	N/A	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarifier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90

Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/Chipping Gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (single nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Sheers (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	N/A	0
Tractor	No	40	84	N/A	0
Vacuum Excavator (Vac-Truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44
Warning Horn	No	5	85	83	12
Welder/Torch	No	40	73	74	5

FTA Transit Noise and Vibration Impact Assessment Guidance Manual dated September 2018, Table 7-4

- **Vibration Source Levels from Construction Equipment** – Table 7-4 presents average source levels in terms of velocity for various types of construction equipment measured under a wide variety of construction activities. The approximate rms vibration velocity levels were calculated from the PPV limits using a crest factor of 4, representing a PPV-rms difference of 12 dB. Note that although the table gives one level for each piece of equipment, there is considerable variation in reported ground vibration levels from construction activities. The data in Table 7-4 provide a reasonable estimate for a wide range of soil conditions.[66][67][68][69]

Table 7-4 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft, in/sec	Approximate Lv* at 25 ft
Pile Driver (impact)	upper range	1.518	112
	typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	typical	0.17	93
Clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.21	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

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

Caltrans Transportation and Construction-Induced Vibration Guidance Manual dated June 2004

Table 17. Measured and Suggested "n" Values Based on Soil Class

Soil Class	Description of Soil Material	Value of "n" measured by Woods and Jedele	Suggested Value of "n"
I	Weak or soft soils: loose soils, dry or partially saturated peat and muck, mud, loose beach sand, and dune sand, recently plowed ground, soft spongy forest or jungle floor, organic soils, top soil. (shovel penetrates easily)	Data not available	1.4
II	Competent soils: most sands, sandy clays, silty clays, gravel, silts, weathered rock. (can dig with shovel)	1.5	1.3
III	Hard soils: dense compacted sand, dry consolidated clay, consolidated glacial till, some exposed rock. (cannot dig with shovel, need pick to break up)	1.1	1.1
IV	Hard, competent rock: bedrock, freshly exposed hard rock. (difficult to break with hammer)	Data not available	1.0

L1 Main Building Classroom 21

Start	Elapsed Time	LAeq	LAFmax	LASmin
5/22/19 19:29	01:00:00	56.63	97.39	33.11
5/22/19 20:29	01:00:00	37.57	56.24	32.24
5/22/19 21:29	01:00:00	36.95	54.64	32.08
5/22/19 22:29	01:00:00	36.49	57.85	32.41
5/22/19 23:29	01:00:00	37.54	56.4	32
5/23/19 0:00	01:00:00	34.93	45.31	31.47
5/23/19 1:00	01:00:00	36.93	54.27	31.61
5/23/19 2:00	01:00:00	36.55	53.99	31.39
5/23/19 3:00	01:00:00	35.17	50.62	31.88
5/23/19 4:00	01:00:00	35.58	58.65	31.64
5/23/19 5:00	01:00:00	36.24	61.29	31.97
5/23/19 6:00	01:00:00	36.38	57.48	32.22
5/23/19 7:00	01:00:00	44.04	77.21	33.06
5/23/19 8:00	01:00:00	64.52	85.48	34.31
5/23/19 9:00	01:00:00	68.7	94.58	42.11
5/23/19 10:00	01:00:00	63.32	83.73	37.7
5/23/19 11:00	01:00:00	66.64	86.69	43.46
5/23/19 12:00	01:00:00	63.23	88.17	38.04
5/23/19 13:00	01:00:00	63.29	88.49	32.66
5/23/19 14:00	01:00:00	36.72	52.56	32.51
5/23/19 15:00	01:00:00	36.46	57.77	31.54
5/23/19 16:00	01:00:00	53.17	90.27	31.79
5/23/19 17:00	01:00:00	36.03	53.51	31.58
5/23/19 18:00	01:00:00	35.74	48.87	31.64
5/23/19 19:00	01:00:00	35.96	55.3	31.68
5/23/19 20:00	01:00:00	36.48	55.33	30.92
5/23/19 21:00	01:00:00	37.35	46.61	31.13
5/23/19 22:00	01:00:00	35.55	52.79	31.11
5/23/19 23:00	01:00:00	36.17	56.95	30.43
5/24/19 0:00	01:00:00	34.46	53.18	29.67
5/24/19 1:00	01:00:00	35.52	54.92	30.36
5/24/19 2:00	01:00:00	35.15	53.6	30.97
5/24/19 3:00	01:00:00	33.61	53.3	29.92
5/24/19 4:00	01:00:00	35.15	56.34	31.3
5/24/19 5:00	01:00:00	36.72	58.75	29.91
5/24/19 6:00	01:00:00	37.11	59.84	31.72
5/24/19 7:00	01:00:00	51.35	78.95	32.31
5/24/19 8:00	01:00:00	60.04	80.96	35.51
5/24/19 9:00	01:00:00	67.54	100.19	41.61
5/24/19 10:00	01:00:00	65.27	87.83	37
5/24/19 11:00	01:00:00	65.38	91.24	44.72
5/24/19 12:00	01:00:00	63.2	91.73	35.91
5/24/19 13:00	01:00:00	63.34	85.28	40.33
5/24/19 14:00	01:00:00	65.54	85.97	34.53
5/24/19 15:00	01:00:00	37.85	52.69	32.41
5/24/19 16:00	01:00:00	37.47	52.62	31.57
5/24/19 17:00	01:00:00	51.93	88.24	33.6

L1 Main Building Classroom 21

5/24/19 18:00	01:00:00	37.62	50.93	33.44
5/24/19 19:00	01:00:00	37.89	66.56	32.83
5/24/19 20:00	01:00:00	36.97	51.13	31.8
5/24/19 21:00	01:00:00	35.77	51.66	31.25
5/24/19 22:00	01:00:00	35.38	53.18	31.26
5/24/19 23:00	01:00:00	35.26	52.9	31.12
5/25/19 0:00	01:00:00	34.97	49.74	30.7
5/25/19 1:00	01:00:00	36.63	53.87	30.99
5/25/19 2:00	01:00:00	34.97	50.01	30.53
5/25/19 3:00	01:00:00	36.48	55.53	31.08
5/25/19 4:00	01:00:00	35.46	56.95	31.11
5/25/19 5:00	01:00:00	37.61	56.73	31.11
5/25/19 6:00	01:00:00	37.05	63.72	31.36
5/25/19 7:00	01:00:00	42.03	73.2	32.57
5/25/19 8:00	01:00:00	62.45	94.25	33.82
5/25/19 9:00	01:00:00	43.94	75.82	33.56
5/25/19 10:00	01:00:00	44.06	75.85	33.92
5/25/19 11:00	01:00:00	38.62	57.08	33.14
5/25/19 12:00	01:00:00	46.14	75.85	32.31
5/25/19 13:00	01:00:00	38.87	65.39	32.5
5/25/19 14:00	01:00:00	62.4	85.28	33.43
5/25/19 15:00	01:00:00	37.54	59.77	32.09
5/25/19 16:00	01:00:00	43.78	76.97	32.86
5/25/19 17:00	01:00:00	49.25	81.52	32.42
5/25/19 18:00	01:00:00	37.21	58.29	32.44
5/25/19 19:00	01:00:00	37.5	57.5	32.57
5/25/19 20:00	01:00:00	36.51	54.81	31.85
5/25/19 21:00	01:00:00	36.56	59.13	31.69
5/25/19 22:00	01:00:00	34.76	46.23	31.12
5/25/19 23:00	01:00:00	35.49	57.33	31.22
5/26/19 0:00	01:00:00	34.79	53.05	30.9
5/26/19 1:00	01:00:00	35.42	56.07	30.94
5/26/19 2:00	01:00:00	34.88	53.47	30.99
5/26/19 3:00	01:00:00	34.73	54.88	31.13
5/26/19 4:00	01:00:00	36.08	59.69	31.19
5/26/19 5:00	01:00:00	36	62.21	31.03
5/26/19 6:00	01:00:00	37.34	58.8	31.25
5/26/19 7:00	01:00:00	48.61	72.41	31.42
5/26/19 8:00	01:00:00	61.29	81.2	35.93
5/26/19 9:00	01:00:00	68.95	90.8	52.88
5/26/19 10:00	01:00:00	49.54	76.75	34.64
5/26/19 11:00	01:00:00	57.95	83.13	34.64
5/26/19 12:00	01:00:00	54.83	80.11	33.42
5/26/19 13:00	01:00:00	58.63	80.85	35.02
5/26/19 14:00	01:00:00	61.34	88.79	35.81
5/26/19 15:00	01:00:00	53.15	81.44	33.47
5/26/19 16:00	01:00:00	37.85	53.88	32.4
5/26/19 17:00	01:00:00	51.66	86.3	32.48

L1 Main Building Classroom 21

5/26/19 18:00	01:00:00	37.27	49.55	32.12
5/26/19 19:00	01:00:00	37.47	57.15	31.84
5/26/19 20:00	01:00:00	36.54	52.36	32.25
5/26/19 21:00	01:00:00	37.07	48.29	32.11
5/26/19 22:00	01:00:00	37.33	58.66	30.77
5/26/19 23:00	01:00:00	36.52	54.23	31.08
5/27/19 0:00	01:00:00	37.16	60.08	30.81
5/27/19 1:00	01:00:00	36.35	46.65	30.58
5/27/19 2:00	01:00:00	36	48.43	30.85
5/27/19 3:00	01:00:00	35.23	45.48	31.15
5/27/19 4:00	01:00:00	34.81	56.38	31.24
5/27/19 5:00	01:00:00	37.03	58.91	31.67
5/27/19 6:00	01:00:00	37.02	58.91	31.54
5/27/19 7:00	01:00:00	36.21	56.01	31.53
5/27/19 8:00	01:00:00	38.38	51.87	32.07
5/27/19 9:00	01:00:00	36.86	53.71	31.45
5/27/19 10:00	01:00:00	36.15	51.23	31.86
5/27/19 11:00	01:00:00	36.09	53.31	31.88
5/27/19 12:00	01:00:00	37.77	61.84	31.72
5/27/19 13:00	01:00:00	36.74	51.1	31.37
5/27/19 14:00	01:00:00	37	48.95	31.53
5/27/19 15:00	01:00:00	37.42	55.91	30.97
5/27/19 16:00	01:00:00	36.99	49.65	31.48
5/27/19 17:00	01:00:00	37.01	54.77	31.86
5/27/19 18:00	01:00:00	36.19	51.52	30.77
5/27/19 19:00	01:00:00	36.51	57.17	32.11
5/27/19 20:00	01:00:00	36.28	52.53	31.68
5/27/19 21:00	01:00:00	36.8	48.32	31.51
5/27/19 22:00	01:00:00	36.61	54.36	31.45
5/27/19 23:00	01:00:00	37.18	60.3	31.35
5/28/19 0:00	01:00:00	36.21	52.01	31.05
5/28/19 1:00	01:00:00	36.2	57.71	30.96
5/28/19 2:00	01:00:00	36.64	53.96	31.22
5/28/19 3:00	01:00:00	36.02	54.26	30.62
5/28/19 4:00	01:00:00	35.63	53.31	30.28
5/28/19 5:00	01:00:00	36.01	46.81	30.52
5/28/19 6:00	01:00:00	36.21	59.59	30.51
5/28/19 7:00	01:00:00	36.14	48.69	30.71
5/28/19 8:00	01:00:00	36.15	45.99	30.55
5/28/19 9:00	01:00:00	37.18	64.73	31.07
5/28/19 10:00	01:00:00	36.18	55.56	30.89
5/28/19 11:00	01:00:00	37.55	60	31.01
5/28/19 12:00	01:00:00	36.51	51.63	30.9
5/28/19 13:00	01:00:00	36.67	54.81	32.08
5/28/19 14:00	01:00:00	36.47	48.23	31.59
5/28/19 15:00	01:00:00	36.77	47.11	31.49
5/28/19 16:00	01:00:00	36.15	50.42	31.43
5/28/19 17:00	01:00:00	36.04	51.92	30.95

L1 Main Building Classroom 21

5/28/19 18:00	01:00:00	36.49	52.32	30.98
5/28/19 19:00	01:00:00	38.06	62.4	30.81
5/28/19 20:00	01:00:00	37.43	52.03	30.94
5/28/19 21:00	01:00:00	35.96	50.27	30.38
5/28/19 22:00	01:00:00	36.04	46.89	30.83
5/28/19 23:00	01:00:00	37.04	60.78	30.7
5/29/19 0:00	01:00:00	34.03	54.59	29.79
5/29/19 1:00	01:00:00	35.35	50.15	29.83
5/29/19 2:00	01:00:00	36.74	53.17	30.06
5/29/19 3:00	01:00:00	36.1	51.28	29.62
5/29/19 4:00	01:00:00	36.66	54.24	29.48
5/29/19 5:00	01:00:00	35.71	60.67	30.37
5/29/19 6:00	01:00:00	36.8	61.34	30.57
5/29/19 7:00	01:00:00	36.83	61.58	31.58
5/29/19 8:00	01:00:00	43.55	75.56	30.59
5/29/19 9:00	01:00:00	42.99	75.34	31.04
5/29/19 10:00	01:00:00	42.42	74.86	32.74
5/29/19 11:00	01:00:00	35.49	51.89	31
5/29/19 12:00	01:00:00	43.03	73.3	30.75
5/29/19 13:00	01:00:00	37.13	49.97	32.64
5/29/19 14:00	01:00:00	41.11	72.21	32.77
5/29/19 15:00	01:00:00	37.34	51.69	32.22
5/29/19 16:00	01:00:00	37.51	52.47	32.72
5/29/19 17:00	01:00:00	36.65	51.73	32.48
5/29/19 18:00	01:00:00	36.36	46.93	32.44
5/29/19 19:00	01:00:00	36.74	60.27	31.7
5/29/19 20:00	01:00:00	37.53	54	31.56
5/29/19 21:00	01:00:00	36.75	58.4	30.93
5/29/19 22:00	01:00:00	37.49	58.52	30.38
5/29/19 23:00	01:00:00	36.64	55.53	31.41
5/30/19 0:00	01:00:00	36.04	49.76	31.14
5/30/19 1:00	01:00:00	35.94	52.41	31.1
5/30/19 2:00	01:00:00	36.54	58.35	30.6
5/30/19 3:00	01:00:00	36.08	46.02	30.69
5/30/19 4:00	01:00:00	36.99	58.06	30.57
5/30/19 5:00	01:00:00	37.19	58.58	30.94
5/30/19 6:00	01:00:00	36.82	57.57	31.4
5/30/19 7:00	01:00:00	52.42	84.15	32.46
5/30/19 8:00	01:00:00	52.94	81.63	33.96
5/30/19 9:00	01:00:00	67.42	85.52	42.3
5/30/19 10:00	01:00:00	68.02	85.79	42.05
5/30/19 11:00	01:00:00	67.04	84.07	42.28
5/30/19 12:00	01:00:00	59.45	84.14	39.89
5/30/19 13:00	01:00:00	65.82	85.4	31.91
5/30/19 14:00	01:00:00	37.33	52.67	32.49
5/30/19 15:00	01:00:00	37.15	53.13	32.01
5/30/19 16:00	01:00:00	37.37	56.8	32.46
5/30/19 17:00	01:00:00	51.82	84.82	32.87

L1 Main Building Classroom 21

5/30/19 18:00	01:00:00	38.03	49.2	31.96
5/30/19 19:00	01:00:00	37.37	49.79	32
5/30/19 20:00	01:00:00	39.31	49.69	32.37
5/30/19 21:00	01:00:00	37.63	57.52	31.9
5/30/19 22:00	01:00:00	37.55	57.36	31.26
5/30/19 23:00	01:00:00	37.47	58.72	31.1

L1 Main Building Roof

Start	Elapsed Time	LAeq	LAFmax	LASmin
5/20/19 19:00	01:00:00	59.63	80.72	56.24
5/20/19 20:00	01:00:00	60.61	85.68	55.27
5/20/19 21:00	01:00:00	58.09	77.51	54.97
5/20/19 22:00	01:00:00	58.61	85.3	54.61
5/20/19 23:00	01:00:00	57.81	81.46	54.53
5/21/19 0:00	01:00:00	56.4	74.29	54.07
5/21/19 1:00	01:00:00	60.55	81.32	53.76
5/21/19 2:00	01:00:00	62.33	87.23	53.82
5/21/19 3:00	01:00:00	57.02	78.85	53.53
5/21/19 4:00	01:00:00	57.67	82.13	53.94
5/21/19 5:00	01:00:00	59.12	91.26	54.61
5/21/19 6:00	01:00:00	59.45	89.07	54.92
5/21/19 7:00	01:00:00	62.7	88.75	56.26
5/21/19 8:00	01:00:00	60.01	88.78	56.05
5/21/19 9:00	01:00:00	61.64	82.89	56.52
5/21/19 10:00	01:00:00	60.23	91.82	56.2
5/21/19 11:00	01:00:00	60.55	83.21	56.29
5/21/19 12:00	01:00:00	61.26	79.55	57.5
5/21/19 13:00	01:00:00	61.58	88.8	57.62
5/21/19 14:00	01:00:00	60.39	71.56	57.9
5/21/19 15:00	01:00:00	60.26	80.96	57.11
5/21/19 16:00	01:00:00	60.18	81.74	56.33
5/21/19 17:00	01:00:00	59.45	74.39	56.44
5/21/19 18:00	01:00:00	59.07	75.08	56.43
5/21/19 19:00	01:00:00	59.34	75.49	56.41
5/21/19 20:00	01:00:00	59.95	83.65	56.2
5/21/19 21:00	01:00:00	60.75	72.72	55.87
5/21/19 22:00	01:00:00	58.23	74.21	54.98
5/21/19 23:00	01:00:00	59.2	87.38	54.98
5/22/19 0:00	01:00:00	57.18	86.42	54.59
5/22/19 1:00	01:00:00	59.42	84.88	54.43
5/22/19 2:00	01:00:00	60.19	84.69	55.32
5/22/19 3:00	01:00:00	58.15	85.38	55.04
5/22/19 4:00	01:00:00	59.18	89.02	55.5
5/22/19 5:00	01:00:00	61.32	88.92	55.23
5/22/19 6:00	01:00:00	61.69	91.09	55.94
5/22/19 7:00	01:00:00	62.7	81.89	56.72
5/22/19 8:00	01:00:00	62.58	85.99	57.53
5/22/19 9:00	01:00:00	62	85.2	57.75
5/22/19 10:00	01:00:00	61.83	85.49	57.44
5/22/19 11:00	01:00:00	62.15	86.28	57.61
5/22/19 12:00	01:00:00	60.87	78.27	57.49
5/22/19 13:00	01:00:00	61.5	77.03	57.86
5/22/19 14:00	01:00:00	61.1	81.72	57.54
5/22/19 15:00	01:00:00	59.69	72.73	56.7
5/22/19 16:00	01:00:00	58.55	73.9	55.58
5/22/19 17:00	01:00:00	59.78	81.08	57.39

L1 Main Building Roof

5/22/19 18:00	01:00:00	59.39	77.48	57.33
5/22/19 19:00	01:00:00	59.94	84.94	56.06
5/22/19 20:00	01:00:00	59.2	79.18	55.37
5/22/19 21:00	01:00:00	57.53	80.56	55.28
5/22/19 22:00	01:00:00	58.2	85.77	55.17
5/22/19 23:00	01:00:00	58.03	84.94	54.99
5/23/19 0:00	01:00:00	56.77	72.2	54.5
5/23/19 1:00	01:00:00	60.71	84.05	54.22
5/23/19 2:00	01:00:00	57.42	79.15	54.42
5/23/19 3:00	01:00:00	61.99	86.96	54.72
5/23/19 4:00	01:00:00	58.65	86.37	54.74
5/23/19 5:00	01:00:00	62.3	87.74	54.67
5/23/19 6:00	01:00:00	61.06	93.07	55.06
5/23/19 7:00	01:00:00	59.81	88.23	56.34
5/23/19 8:00	01:00:00	60	80.3	56.67
5/23/19 9:00	01:00:00	60.49	75.98	56.96
5/23/19 10:00	01:00:00	59.81	80.45	56.74
5/23/19 11:00	01:00:00	61.89	81.3	56.68
5/23/19 12:00	01:00:00	61.47	77.09	57.37
5/23/19 13:00	01:00:00	60.04	78.17	56.59
5/23/19 14:00	01:00:00	60.73	76.4	57.2
5/23/19 15:00	01:00:00	64.4	90.12	57.09
5/23/19 16:00	01:00:00	65.55	76.38	57.42
5/23/19 17:00	01:00:00	60.57	82.97	56.68
5/23/19 18:00	01:00:00	60.38	88.12	56.19
5/23/19 19:00	01:00:00	60.32	79.65	56.53
5/23/19 20:00	01:00:00	59.22	79.65	55.3
5/23/19 21:00	01:00:00	60.58	88.6	55.61
5/23/19 22:00	01:00:00	57.82	75.33	54.9
5/23/19 23:00	01:00:00	58.96	86.41	55.11
5/24/19 0:00	01:00:00	56.9	83.51	54.74
5/24/19 1:00	01:00:00	59.35	84.72	54.5
5/24/19 2:00	01:00:00	58.43	82.73	54.51
5/24/19 3:00	01:00:00	57.95	83.61	54.72
5/24/19 4:00	01:00:00	59.94	83.33	54.76
5/24/19 5:00	01:00:00	61.03	89.83	55.07
5/24/19 6:00	01:00:00	61.94	86.02	54.98
5/24/19 7:00	01:00:00	63.27	95.41	55.24
5/24/19 8:00	01:00:00	66.04	94.26	57.98
5/24/19 9:00	01:00:00	61.77	88.01	56.77
5/24/19 10:00	01:00:00	62.56	90.13	58.06
5/24/19 11:00	01:00:00	63.33	89.51	56.68
5/24/19 12:00	01:00:00	63.14	87	57.84
5/24/19 13:00	01:00:00	61.41	79.94	56.9
5/24/19 14:00	01:00:00	60.65	80.56	57.55
5/24/19 15:00	01:00:00	60.36	76.22	57.15
5/24/19 16:00	01:00:00	59.86	79.9	56.5
5/24/19 17:00	01:00:00	60.19	83.49	56.73

L1 Main Building Roof

5/24/19 18:00	01:00:00	59.66	75.1	56.47
5/24/19 19:00	01:00:00	60.9	84.75	56.21
5/24/19 20:00	01:00:00	58.96	80.67	55.94
5/24/19 21:00	01:00:00	59.29	79.12	55.38
5/24/19 22:00	01:00:00	59.69	87.79	54.67
5/24/19 23:00	01:00:00	57.34	82.99	54.61
5/25/19 0:00	01:00:00	60.09	87.53	54.5
5/25/19 1:00	01:00:00	57.1	73.96	54.17
5/25/19 2:00	01:00:00	56.12	69.23	54.11
5/25/19 3:00	01:00:00	56.81	70.94	54.46
5/25/19 4:00	01:00:00	56.44	75.19	54.28
5/25/19 5:00	01:00:00	60.04	89.11	54.78
5/25/19 6:00	01:00:00	62.27	89.64	54.9
5/25/19 7:00	01:00:00	57.65	85.85	54.81
5/25/19 8:00	01:00:00	60.37	81.39	55.59
5/25/19 9:00	01:00:00	59.06	77.13	55.4
5/25/19 10:00	01:00:00	58.55	75.18	55.66
5/25/19 11:00	01:00:00	58.88	83.65	55.13
5/25/19 12:00	01:00:00	59.82	85.85	55.4
5/25/19 13:00	01:00:00	58.46	71	55.11
5/25/19 14:00	01:00:00	58.61	74.17	55.61
5/25/19 15:00	01:00:00	59.59	79.49	55.15
5/25/19 16:00	01:00:00	59.08	71.18	56.02
5/25/19 17:00	01:00:00	59.86	83.1	56.63
5/25/19 18:00	01:00:00	59.81	80.52	56.07
5/25/19 19:00	01:00:00	59.73	87.25	56.1
5/25/19 20:00	01:00:00	57.65	77.01	55.29
5/25/19 21:00	01:00:00	57.34	74.35	54.87
5/25/19 22:00	01:00:00	57.09	75.02	54.71
5/25/19 23:00	01:00:00	59.95	84.62	54.69
5/26/19 0:00	01:00:00	57.05	84.89	54.22
5/26/19 1:00	01:00:00	56.52	77.97	54.19
5/26/19 2:00	01:00:00	60.18	83.13	54.26
5/26/19 3:00	01:00:00	59.03	82.1	54.06
5/26/19 4:00	01:00:00	57.31	78.43	54.33
5/26/19 5:00	01:00:00	57	78.32	54.32
5/26/19 6:00	01:00:00	59.03	92.63	54.35
5/26/19 7:00	01:00:00	57.34	75.64	54.49
5/26/19 8:00	01:00:00	57.36	73.64	54.94
5/26/19 9:00	01:00:00	61.05	92.54	55.32
5/26/19 10:00	01:00:00	59.94	76.9	56.24
5/26/19 11:00	01:00:00	60.63	84.84	55.37
5/26/19 12:00	01:00:00	58.48	83.1	55.19
5/26/19 13:00	01:00:00	58.38	71.74	55.42
5/26/19 14:00	01:00:00	57.85	69.3	55.69
5/26/19 15:00	01:00:00	58.62	78.39	55.58
5/26/19 16:00	01:00:00	57.99	73.39	55.11
5/26/19 17:00	01:00:00	58.84	78.09	55.48

L1 Main Building Roof

5/26/19 18:00	01:00:00	59.1	73.19	55.73
5/26/19 19:00	01:00:00	58.96	80.95	55.28
5/26/19 20:00	01:00:00	60.89	81.8	55.81
5/26/19 21:00	01:00:00	57.58	70.92	55.35
5/26/19 22:00	01:00:00	58.19	73.62	55.36
5/26/19 23:00	01:00:00	60.26	82.21	55.6
5/27/19 0:00	01:00:00	56.8	80.66	54.85
5/27/19 1:00	01:00:00	56.57	78.02	54.19
5/27/19 2:00	01:00:00	59.42	84.88	54.3
5/27/19 3:00	01:00:00	58.17	79.83	53.1
5/27/19 4:00	01:00:00	59.27	82.91	52.89
5/27/19 5:00	01:00:00	58.28	90.1	53.49
5/27/19 6:00	01:00:00	64.1	91.96	54.61
5/27/19 7:00	01:00:00	59.48	84.55	55.53
5/27/19 8:00	01:00:00	60.39	90.81	54.89
5/27/19 9:00	01:00:00	59.94	87.09	54.93
5/27/19 10:00	01:00:00	59.44	77.4	56.47
5/27/19 11:00	01:00:00	58.74	78.42	55.58
5/27/19 12:00	01:00:00	59.57	77.47	54.93
5/27/19 13:00	01:00:00	58.95	71.23	56.65
5/27/19 14:00	01:00:00	61.29	78.01	57.35
5/27/19 15:00	01:00:00	59.28	77.69	56.54
5/27/19 16:00	01:00:00	59.63	75.62	57.03
5/27/19 17:00	01:00:00	59.39	74.95	56.99
5/27/19 18:00	01:00:00	59.76	71.77	57.24
5/27/19 19:00	01:00:00	59.88	92.8	56.08
5/27/19 20:00	01:00:00	59.7	84.41	55.14
5/27/19 21:00	01:00:00	57.16	77.43	54.61
5/27/19 22:00	01:00:00	59.21	85.95	54.25
5/27/19 23:00	01:00:00	57.04	84.12	54.83
5/28/19 0:00	01:00:00	56.6	84.1	54.3
5/28/19 1:00	01:00:00	59.95	84.94	54.59
5/28/19 2:00	01:00:00	58.23	84.07	54.16
5/28/19 3:00	01:00:00	56.53	69.9	54.64
5/28/19 4:00	01:00:00	59.03	86.99	54.47
5/28/19 5:00	01:00:00	59.06	88.27	55.09
5/28/19 6:00	01:00:00	60.05	88.34	55.13
5/28/19 7:00	01:00:00	60.32	84.13	56.24
5/28/19 8:00	01:00:00	59.92	78.04	56.49
5/28/19 9:00	01:00:00	64.3	85.36	56.81
5/28/19 10:00	01:00:00	60.03	78.82	56.5
5/28/19 11:00	01:00:00	62.56	81.63	56.01
5/28/19 12:00	01:00:00	61.54	84.5	56.89
5/28/19 13:00	01:00:00	59.71	78.03	56.49
5/28/19 14:00	01:00:00	60.17	74.32	57.32
5/28/19 15:00	01:00:00	59.74	76.5	56.87
5/28/19 16:00	01:00:00	60.31	78.32	57.11
5/28/19 17:00	01:00:00	59.97	75.67	56.92

L1 Main Building Roof

5/28/19 18:00	01:00:00	60.74	76.62	57.09
5/28/19 19:00	01:00:00	60.05	76.42	56.87
5/28/19 20:00	01:00:00	61.31	76.56	56
5/28/19 21:00	01:00:00	60.26	81.9	55.65
5/28/19 22:00	01:00:00	58.03	77.88	55.28
5/28/19 23:00	01:00:00	57.94	85.69	54.88
5/29/19 0:00	01:00:00	56.85	86.26	54.48
5/29/19 1:00	01:00:00	58.8	78.56	54.03
5/29/19 2:00	01:00:00	59.55	79.84	54.32
5/29/19 3:00	01:00:00	58.17	76.34	54.57
5/29/19 4:00	01:00:00	58.92	88.97	54.88
5/29/19 5:00	01:00:00	61.45	86.96	55.54
5/29/19 6:00	01:00:00	62.02	88.45	55.46
5/29/19 7:00	01:00:00	62.76	91.57	56.26
5/29/19 8:00	01:00:00	61.58	80.47	57.21
5/29/19 9:00	01:00:00	62.03	80.29	57.54
5/29/19 10:00	01:00:00	62.6	82.75	57.28
5/29/19 11:00	01:00:00	62.06	81.95	56.72
5/29/19 12:00	01:00:00	60.62	77.67	57.21
5/29/19 13:00	01:00:00	61.28	78.1	56.62
5/29/19 14:00	01:00:00	60.73	78.5	57.15
5/29/19 15:00	01:00:00	60.06	80.85	57.12
5/29/19 16:00	01:00:00	61	78.16	56.82
5/29/19 17:00	01:00:00	60.4	79.99	56.53

L2 Bungalow Classroom 28

Start	Elapsed Time	LAeq	LAFmax	LASmin
5/20/19 18:32	01:00:00	52.2	89.75	28.2
5/20/19 19:00	01:00:00	32.42	55.35	27.64
5/20/19 20:00	01:00:00	49.1	74.2	26.13
5/20/19 21:00	01:00:00	30.47	54.28	25.59
5/20/19 22:00	01:00:00	34.97	55.04	25.62
5/20/19 23:00	01:00:00	31.27	59.09	24.65
5/21/19 0:00	01:00:00	28.64	53.85	24.78
5/21/19 1:00	01:00:00	33.71	51.55	24.75
5/21/19 2:00	01:00:00	35.88	60.31	24.66
5/21/19 3:00	01:00:00	30.01	48.96	24.86
5/21/19 4:00	01:00:00	30.78	49.7	25.09
5/21/19 5:00	01:00:00	33.21	56.28	25.27
5/21/19 6:00	01:00:00	37.17	61.26	25.08
5/21/19 7:00	01:00:00	50.25	88.03	28.32
5/21/19 8:00	01:00:00	62.25	81.48	30.63
5/21/19 9:00	01:00:00	63.56	84.56	31.95
5/21/19 10:00	01:00:00	65.18	91.6	46.3
5/21/19 11:00	01:00:00	68.8	96.18	30.15
5/21/19 12:00	01:00:00	60.7	84.3	29.84
5/21/19 13:00	01:00:00	62.69	88.44	31.46
5/21/19 14:00	01:00:00	40.08	76.41	31.13
5/21/19 15:00	01:00:00	34.02	57.5	29.93
5/21/19 16:00	01:00:00	33.63	54.45	28.45
5/21/19 17:00	01:00:00	32.6	49.41	27.71
5/21/19 18:00	01:00:00	31.15	48.25	27.64
5/21/19 19:00	01:00:00	48.15	88.01	26.5
5/21/19 20:00	01:00:00	32.67	53.93	26.13
5/21/19 21:00	01:00:00	35.06	56.4	25.58
5/21/19 22:00	01:00:00	29.56	51.76	24.83
5/21/19 23:00	01:00:00	31.02	61.02	24.29
5/22/19 0:00	01:00:00	28.95	54.6	24.52
5/22/19 1:00	01:00:00	32.22	54.53	24.29
5/22/19 2:00	01:00:00	34.06	56.9	24.58
5/22/19 3:00	01:00:00	30.03	55.23	24.12
5/22/19 4:00	01:00:00	30.55	47.65	25.17
5/22/19 5:00	01:00:00	35.92	60.63	25.09
5/22/19 6:00	01:00:00	38.04	66.68	27.09
5/22/19 7:00	01:00:00	50.51	85.15	27.24
5/22/19 8:00	01:00:00	61.04	83.23	31.04
5/22/19 9:00	01:00:00	63	84.59	27.88
5/22/19 10:00	01:00:00	66.55	88.96	51.46
5/22/19 11:00	01:00:00	62.72	84.33	31.25
5/22/19 12:00	01:00:00	61.65	86.26	30.83
5/22/19 13:00	01:00:00	66.54	87.37	45.39
5/22/19 14:00	01:00:00	63.19	85.58	28.17
5/22/19 15:00	01:00:00	33.1	49.61	27.86
5/22/19 16:00	01:00:00	31.54	47.22	26.69

L2 Bungalow Classroom 28

5/22/19 17:00	01:00:00	32.08	49.19	27.84
5/22/19 18:00	01:00:00	30.27	50.92	27.15
5/22/19 19:00	01:00:00	41.77	76.39	27.2
5/22/19 20:00	01:00:00	34.04	53.15	26.2
5/22/19 21:00	01:00:00	28.45	47.94	26.02
5/22/19 22:00	01:00:00	31.16	52.31	25.24
5/22/19 23:00	01:00:00	29.09	48.34	24.62
5/23/19 0:00	01:00:00	28.17	47.96	24.49
5/23/19 1:00	01:00:00	33.16	52.03	25.15
5/23/19 2:00	01:00:00	28.76	45.93	25.02
5/23/19 3:00	01:00:00	37.38	61.94	25.26
5/23/19 4:00	01:00:00	30.46	54.51	24.79
5/23/19 5:00	01:00:00	35.26	59.86	24.89
5/23/19 6:00	01:00:00	33	56.25	25.21
5/23/19 7:00	01:00:00	44.61	75.53	26.39
5/23/19 8:00	01:00:00	55.4	79.25	28.5
5/23/19 9:00	01:00:00	60.43	86.66	28.59
5/23/19 10:00	01:00:00	66.48	86.76	48.89
5/23/19 11:00	01:00:00	63.3	87.5	36.09
5/23/19 12:00	01:00:00	63.93	87.79	32.99
5/23/19 13:00	01:00:00	66.52	87.2	40.58
5/23/19 14:00	01:00:00	65.83	88.59	28.5
5/23/19 15:00	01:00:00	37.83	53.93	28.29
5/23/19 16:00	01:00:00	38.67	61.7	29.23
5/23/19 17:00	01:00:00	31.85	49.15	27.15
5/23/19 18:00	01:00:00	33.12	53.46	27.31
5/23/19 19:00	01:00:00	34.34	70.6	26.31
5/23/19 20:00	01:00:00	46.75	84.11	25.28
5/23/19 21:00	01:00:00	34.73	53.25	25.6
5/23/19 22:00	01:00:00	30.77	54.01	25.25
5/23/19 23:00	01:00:00	29.48	48.8	24.64
5/24/19 0:00	01:00:00	27.6	46.42	25.15
5/24/19 1:00	01:00:00	32.51	51.72	24.82
5/24/19 2:00	01:00:00	35.95	56.09	25.06
5/24/19 3:00	01:00:00	30.72	57.42	24.97
5/24/19 4:00	01:00:00	33.72	57.36	25.07
5/24/19 5:00	01:00:00	31.53	54.16	25.98
5/24/19 6:00	01:00:00	38.88	75.45	25.65
5/24/19 7:00	01:00:00	39.38	61.28	25.85
5/24/19 8:00	01:00:00	64.2	87.03	36.5
5/24/19 9:00	01:00:00	64.37	87.62	28
5/24/19 10:00	01:00:00	64.69	85.92	37.03
5/24/19 11:00	01:00:00	62.01	81.49	36.75
5/24/19 12:00	01:00:00	60.45	85.07	36.66
5/24/19 13:00	01:00:00	68	89.25	48.71
5/24/19 14:00	01:00:00	61.71	83.73	31.21
5/24/19 15:00	01:00:00	33.83	58.72	29.78
5/24/19 16:00	01:00:00	33.29	57.45	29.44

5/24/19 17:00	01:00:00	32.96	48.01	29.22
5/24/19 18:00	01:00:00	31.88	56.57	28.04
5/24/19 19:00	01:00:00	43.91	79.55	26.82
5/24/19 20:00	01:00:00	32.49	61	26.24
5/24/19 21:00	01:00:00	32.04	49.5	25.67
5/24/19 22:00	01:00:00	29.64	55.42	25.36
5/24/19 23:00	01:00:00	29.94	52.78	25.09
5/25/19 0:00	01:00:00	33.01	51.52	26.51
5/25/19 1:00	01:00:00	30.26	43.91	26.91
5/25/19 2:00	01:00:00	29.47	44.97	27.13
5/25/19 3:00	01:00:00	29.68	50.54	27.01
5/25/19 4:00	01:00:00	29.02	42.2	26.61
5/25/19 5:00	01:00:00	31.93	47.93	27.55
5/25/19 6:00	01:00:00	31.67	54.9	26.28
5/25/19 7:00	01:00:00	29.82	49.86	26.93
5/25/19 8:00	01:00:00	31.97	51.92	26.61
5/25/19 9:00	01:00:00	30.06	45.45	26.14
5/25/19 10:00	01:00:00	30.1	42.76	27.19
5/25/19 11:00	01:00:00	31.93	62.49	26.05
5/25/19 12:00	01:00:00	31.65	51.13	27.54
5/25/19 13:00	01:00:00	31.62	50.54	27.79
5/25/19 14:00	01:00:00	31.3	46.92	27.92
5/25/19 15:00	01:00:00	31.6	53.85	27.36
5/25/19 16:00	01:00:00	31.81	61.33	27.93
5/25/19 17:00	01:00:00	31.61	47.28	27.46
5/25/19 18:00	01:00:00	31.45	59.88	26.46
5/25/19 19:00	01:00:00	30.8	57.51	26.09
5/25/19 20:00	01:00:00	29.82	57.83	25.94
5/25/19 21:00	01:00:00	28.79	50.35	25.68
5/25/19 22:00	01:00:00	28.24	45.82	25.38
5/25/19 23:00	01:00:00	28.79	49.35	24.97
5/26/19 0:00	01:00:00	26.85	39.56	24.23
5/26/19 1:00	01:00:00	27.37	46.25	24.55
5/26/19 2:00	01:00:00	32.62	50.34	24.68
5/26/19 3:00	01:00:00	35.2	51.35	24.42
5/26/19 4:00	01:00:00	27.3	55.06	24.7
5/26/19 5:00	01:00:00	30.9	54.44	24.07
5/26/19 6:00	01:00:00	29.86	45.34	24.36
5/26/19 7:00	01:00:00	29.45	43.12	25.59
5/26/19 8:00	01:00:00	29.44	45.46	25.96
5/26/19 9:00	01:00:00	31.11	51	25.74
5/26/19 10:00	01:00:00	31.74	51.44	26.04
5/26/19 11:00	01:00:00	33.14	52.4	26.85
5/26/19 12:00	01:00:00	30.8	51.53	26.21
5/26/19 13:00	01:00:00	30.24	46.44	26.8
5/26/19 14:00	01:00:00	31.53	51.92	26.94
5/26/19 15:00	01:00:00	31.27	55.63	26.48
5/26/19 16:00	01:00:00	29.32	45.92	26.12

L2 Bungalow Classroom 28

5/26/19 17:00	01:00:00	33.76	48.72	25.52
5/26/19 18:00	01:00:00	35.68	55.78	26
5/26/19 19:00	01:00:00	37.73	73.83	25.77
5/26/19 20:00	01:00:00	33.4	53.08	26.02
5/26/19 21:00	01:00:00	42.01	65.17	25.31
5/26/19 22:00	01:00:00	29.4	42.75	24.99
5/26/19 23:00	01:00:00	33.23	59.77	24.45
5/26/19 0:00	01:00:00	26.85	39.56	24.23
5/26/19 1:00	01:00:00	27.37	46.25	24.55
5/26/19 2:00	01:00:00	32.62	50.34	24.68
5/26/19 3:00	01:00:00	35.2	51.35	24.42
5/26/19 4:00	01:00:00	27.3	55.06	24.7
5/26/19 5:00	01:00:00	30.9	54.44	24.07
5/26/19 6:00	01:00:00	29.86	45.34	24.36
5/26/19 7:00	01:00:00	29.45	43.12	25.59
5/26/19 8:00	01:00:00	29.44	45.46	25.96
5/26/19 9:00	01:00:00	31.11	51	25.74
5/26/19 10:00	01:00:00	31.74	51.44	26.04
5/26/19 11:00	01:00:00	33.14	52.4	26.85
5/26/19 12:00	01:00:00	30.8	51.53	26.21
5/26/19 13:00	01:00:00	30.24	46.44	26.8
5/26/19 14:00	01:00:00	31.53	51.92	26.94
5/26/19 15:00	01:00:00	31.27	55.63	26.48
5/26/19 16:00	01:00:00	29.32	45.92	26.12
5/26/19 17:00	01:00:00	33.76	48.72	25.52
5/26/19 18:00	01:00:00	35.68	55.78	26
5/26/19 19:00	01:00:00	37.73	73.83	25.77
5/26/19 20:00	01:00:00	33.4	53.08	26.02
5/26/19 21:00	01:00:00	42.01	65.17	25.31
5/26/19 22:00	01:00:00	29.4	42.75	24.99
5/26/19 23:00	01:00:00	33.23	59.77	24.45
5/28/19 0:00	01:00:00	28.28	50.92	24.47
5/28/19 1:00	01:00:00	32.35	51.66	24.66
5/28/19 2:00	01:00:00	32.9	51.3	23.98
5/28/19 3:00	01:00:00	27.83	47.57	24.35
5/28/19 4:00	01:00:00	31.13	54.81	24.67
5/28/19 5:00	01:00:00	30.96	57.02	25.28
5/28/19 6:00	01:00:00	38.42	69.18	24.99
5/28/19 7:00	01:00:00	55.86	80.77	26.71
5/28/19 8:00	01:00:00	60.78	83.87	29.31
5/28/19 9:00	01:00:00	63.4	87.99	27.58
5/28/19 10:00	01:00:00	65.35	86.14	49.11
5/28/19 11:00	01:00:00	59.76	84.08	28.16
5/28/19 12:00	01:00:00	63.07	90.04	29.52
5/28/19 13:00	01:00:00	63.87	88.29	30.4
5/28/19 14:00	01:00:00	40.65	72.78	29.21
5/28/19 15:00	01:00:00	34.2	60.21	30.01
5/28/19 16:00	01:00:00	32.35	49.27	29.46

L2 Bungalow Classroom 28

5/28/19 17:00	01:00:00	32.24	50.42	28.68
5/28/19 18:00	01:00:00	30.08	42.47	26.72
5/28/19 19:00	01:00:00	37.26	75.75	26.32
5/28/19 20:00	01:00:00	38.06	70.98	25.78
5/28/19 21:00	01:00:00	37.1	62.06	25.45
5/28/19 22:00	01:00:00	32.33	61.42	25.11
5/28/19 23:00	01:00:00	30.44	62.84	24.73

L2 Bungalow Rooftop

Start	Elapsed Time	LAeq	LAFmax	LASmin
5/20/19 18:18	01:00:00	54.41	77.04	51.34
5/20/19 19:00	01:00:00	56.36	79.6	50.8
5/20/19 20:00	01:00:00	59.44	78.33	49.52
5/20/19 21:00	01:00:00	54.2	75.8	49.29
5/20/19 22:00	01:00:00	57.86	79.36	49.15
5/20/19 23:00	01:00:00	54.3	77.52	48.05
5/21/19 0:00	01:00:00	52.14	76.67	48.3
5/21/19 1:00	01:00:00	57.39	75.74	48.62
5/21/19 2:00	01:00:00	59.73	86.27	48.18
5/21/19 3:00	01:00:00	53.42	75.06	48.06
5/21/19 4:00	01:00:00	54.05	74.22	48.69
5/21/19 5:00	01:00:00	56.97	79.96	48.66
5/21/19 6:00	01:00:00	60.94	87.56	48.12
5/21/19 7:00	01:00:00	65.59	83.43	50.87
5/21/19 8:00	01:00:00	61.89	80.28	51.31
5/21/19 9:00	01:00:00	62.72	81.77	53.79
5/21/19 10:00	01:00:00	60.25	85.44	52.04
5/21/19 11:00	01:00:00	61.8	87.24	53.33
5/21/19 12:00	01:00:00	63.24	82.91	54.77
5/21/19 13:00	01:00:00	60.31	80.37	54.25
5/21/19 14:00	01:00:00	60.3	77.66	55.56
5/21/19 15:00	01:00:00	61.45	81.91	54.96
5/21/19 16:00	01:00:00	59.6	77.54	52.51
5/21/19 17:00	01:00:00	57.57	74.73	51.39
5/21/19 18:00	01:00:00	55.03	73.61	50.74
5/21/19 19:00	01:00:00	54.56	74.37	50.11
5/21/19 20:00	01:00:00	56.16	77.38	49.87
5/21/19 21:00	01:00:00	59.19	78.93	49.26
5/21/19 22:00	01:00:00	53.12	76.85	48.41
5/21/19 23:00	01:00:00	54.35	79.82	47.68
5/22/19 0:00	01:00:00	52.19	78.56	47.8
5/22/19 1:00	01:00:00	54.77	77.15	48.25
5/22/19 2:00	01:00:00	56.98	80.62	48.81
5/22/19 3:00	01:00:00	53.81	77.48	47.98
5/22/19 4:00	01:00:00	53.56	72	49.56
5/22/19 5:00	01:00:00	59.87	86.43	48.81
5/22/19 6:00	01:00:00	62.93	91.69	48.74
5/22/19 7:00	01:00:00	60.34	86.38	50.51
5/22/19 8:00	01:00:00	59.41	79.01	53.38
5/22/19 9:00	01:00:00	59.08	81.47	52.06
5/22/19 10:00	01:00:00	59.95	77.43	52.52
5/22/19 11:00	01:00:00	61.53	82.6	53.34
5/22/19 12:00	01:00:00	62.94	81.92	54.22
5/22/19 13:00	01:00:00	60.13	84.31	53.59
5/22/19 14:00	01:00:00	59.01	80.55	52.39
5/22/19 15:00	01:00:00	57.36	72.31	52.3
5/22/19 16:00	01:00:00	59.48	81.12	50.52

L2 Bungalow Rooftop

5/22/19 17:00	01:00:00	59.08	75.08	51.81
5/22/19 18:00	01:00:00	54.2	70.29	50.07
5/22/19 19:00	01:00:00	54.99	76.72	50.66
5/22/19 20:00	01:00:00	58.02	76.98	49.33
5/22/19 21:00	01:00:00	51.92	71.4	49.38
5/22/19 22:00	01:00:00	55.04	74.67	48.76
5/22/19 23:00	01:00:00	53.16	73.49	47.91
5/23/19 0:00	01:00:00	51.41	64.8	47.96
5/23/19 1:00	01:00:00	56.13	76.45	48.78
5/23/19 2:00	01:00:00	53.05	73.18	48.24
5/23/19 3:00	01:00:00	61	88.58	48.39
5/23/19 4:00	01:00:00	53.99	78.5	48.39
5/23/19 5:00	01:00:00	58.82	87.54	48.3
5/23/19 6:00	01:00:00	57.14	77.45	48.06
5/23/19 7:00	01:00:00	55.65	78.92	49.9
5/23/19 8:00	01:00:00	59.86	79.72	52.25
5/23/19 9:00	01:00:00	62.01	81.34	52.12
5/23/19 10:00	01:00:00	56.57	81.31	50.17
5/23/19 11:00	01:00:00	62.09	88.98	51.78
5/23/19 12:00	01:00:00	62.79	82.72	53.03
5/23/19 13:00	01:00:00	60.18	78.95	52.69
5/23/19 14:00	01:00:00	62.53	80.99	53.85
5/23/19 15:00	01:00:00	65.08	79.5	54.17
5/23/19 16:00	01:00:00	65.5	81.65	53.5
5/23/19 17:00	01:00:00	58.69	78.53	51.53
5/23/19 18:00	01:00:00	57.63	78.66	51.21
5/23/19 19:00	01:00:00	56.1	78.15	50.32
5/23/19 20:00	01:00:00	59.01	86.48	49.2
5/23/19 21:00	01:00:00	59.46	76.61	49.39
5/23/19 22:00	01:00:00	55.06	77.07	48.84
5/23/19 23:00	01:00:00	53.32	74.71	48.85
5/24/19 0:00	01:00:00	51.29	71.75	48.9
5/24/19 1:00	01:00:00	55.36	77.81	48.61
5/24/19 2:00	01:00:00	59.37	84.65	48.79
5/24/19 3:00	01:00:00	54.53	79.95	48.77
5/24/19 4:00	01:00:00	58.42	88.76	48.65
5/24/19 5:00	01:00:00	56.81	84.97	49.99
5/24/19 6:00	01:00:00	62.1	93.99	49.46
5/24/19 7:00	01:00:00	63.35	86.82	49.78
5/24/19 8:00	01:00:00	67.07	86.95	59.32
5/24/19 9:00	01:00:00	63.38	80.34	51.17
5/24/19 10:00	01:00:00	61.76	79.96	53.43
5/24/19 11:00	01:00:00	60.94	83.48	51.38
5/24/19 12:00	01:00:00	63.81	85.66	54.58
5/24/19 13:00	01:00:00	61.86	82.13	53.68
5/24/19 14:00	01:00:00	59.99	80.53	54.21
5/24/19 15:00	01:00:00	58.93	78.91	53.51
5/24/19 16:00	01:00:00	60.98	78.98	54.32

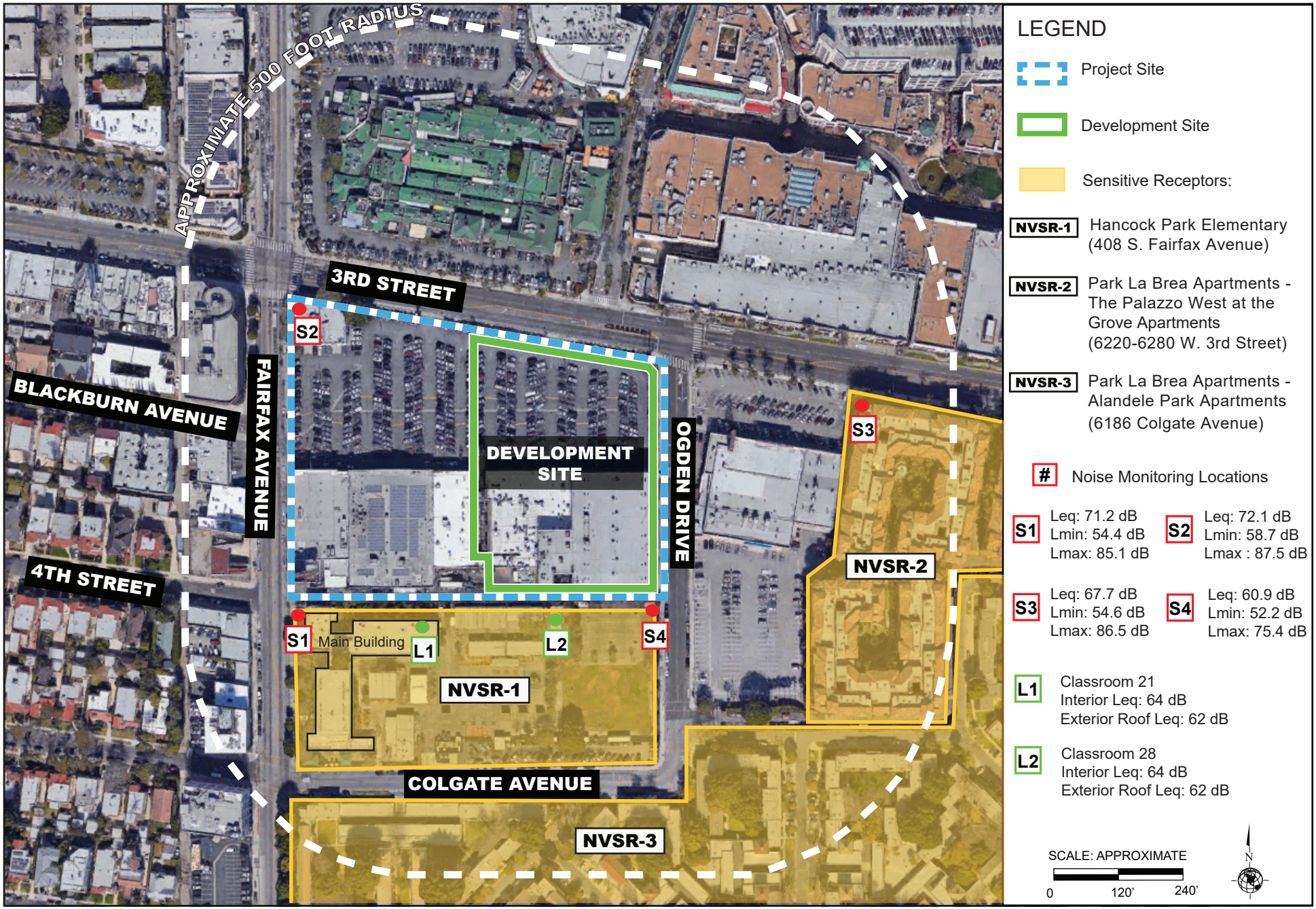
L2 Bungalow Rooftop

5/24/19 17:00	01:00:00	58.63	79.19	52.62
5/24/19 18:00	01:00:00	55.6	77.39	51.17
5/24/19 19:00	01:00:00	59.89	83.64	50.9
5/24/19 20:00	01:00:00	56.41	79.43	50.19
5/24/19 21:00	01:00:00	56.83	76.65	48.52
5/24/19 22:00	01:00:00	54.79	83.62	48.89
5/24/19 23:00	01:00:00	54.38	76.8	48.67
5/25/19 0:00	01:00:00	55.12	77.22	49.83
5/25/19 1:00	01:00:00	53.7	68.97	49.93
5/25/19 2:00	01:00:00	51.99	65.1	49.9
5/25/19 3:00	01:00:00	52.28	64.08	49.57
5/25/19 4:00	01:00:00	51.8	68.26	49.22
5/25/19 5:00	01:00:00	54.86	74.27	50
5/25/19 6:00	01:00:00	54.92	80.68	49.63
5/25/19 7:00	01:00:00	53.22	70.16	49.7
5/25/19 8:00	01:00:00	57.14	79.8	49.74
5/25/19 9:00	01:00:00	53.64	70.75	49.46
5/25/19 10:00	01:00:00	53.52	66.32	50.05
5/25/19 11:00	01:00:00	56.12	81.59	48.78
5/25/19 12:00	01:00:00	55.62	78.02	50.21
5/25/19 13:00	01:00:00	55.12	74.19	50.64
5/25/19 14:00	01:00:00	55.82	76.38	51.12
5/25/19 15:00	01:00:00	55.43	72.67	50.77
5/25/19 16:00	01:00:00	55.97	79.03	51.36
5/25/19 17:00	01:00:00	56.29	69.58	52.09
5/25/19 18:00	01:00:00	55.65	78.42	50.32
5/25/19 19:00	01:00:00	55.35	76.2	50.59
5/25/19 20:00	01:00:00	53.53	76.91	49.79
5/25/19 21:00	01:00:00	52.71	72.32	49.31
5/25/19 22:00	01:00:00	52.18	67.8	48.82
5/25/19 23:00	01:00:00	53.86	78.32	48.59
5/26/19 0:00	01:00:00	50.57	71.16	47.69
5/26/19 1:00	01:00:00	51.16	71.82	48.27
5/26/19 2:00	01:00:00	55.48	75.17	48.26
5/26/19 3:00	01:00:00	57.41	75.41	47.9
5/26/19 4:00	01:00:00	51.05	69.1	48.35
5/26/19 5:00	01:00:00	54.98	77.01	47.63
5/26/19 6:00	01:00:00	54.61	76.8	48.18
5/26/19 7:00	01:00:00	53.57	70.45	49.23
5/26/19 8:00	01:00:00	53.22	71.31	49.73
5/26/19 9:00	01:00:00	55.48	73.81	49.78
5/26/19 10:00	01:00:00	56.58	81.42	50.4
5/26/19 11:00	01:00:00	58.24	82.71	50.78

Appendix F.2
Noise

Appendix F.2

Operational Noise Calculation Worksheets, Parker Environmental Consultants, October 2020



Source: Google Earth, Aerial View, 2018; Parker Environmental Consultants.

Figure IV.F-2
Noise Monitoring and Sensitive Receptor Location Map

Ambient CNEL at Sensitive Receptors

Receptor 1 Noise @ Source

L_{eq}(Day):	dbA	L_{eq}(Night):	dbA
L_{eq}(7am):	60.9	L_{eq}(10pm):	40
L_{eq}(8am):	60.9	L_{eq}(11pm):	40
L_{eq}(9am):	60.9	L_{eq}(12am):	40
L_{eq}(10am):	60.9	L_{eq}(1am):	40
L_{eq}(11am):	60.9	L_{eq}(2am):	40
L_{eq}(12pm):	60.9	L_{eq}(3am):	40
L_{eq}(1pm):	60.9	L_{eq}(4am):	40
L_{eq}(2pm):	60.9	L_{eq}(5am):	40
L_{eq}(3pm):	60.9	L_{eq}(6am):	40
L_{eq}(4pm):	60.9		
L_{eq}(5pm):	60.9		
L_{eq}(6pm):	60.9		
L_{eq}(7pm):	60.9		
L_{eq}(8pm):	60.9		
L_{eq}(9pm):	60.9		

L_d:	60.9
L_n:	40
L_{dn} (CNEL):	**59.07**

Receptor 3 Noise @ Source

L_{eq}(Day):	dbA	L_{eq}(Night):	dbA
L_{eq}(7am):	60.9	L_{eq}(10pm):	40
L_{eq}(8am):	60.9	L_{eq}(11pm):	40
L_{eq}(9am):	60.9	L_{eq}(12am):	40
L_{eq}(10am):	60.9	L_{eq}(1am):	40
L_{eq}(11am):	60.9	L_{eq}(2am):	40
L_{eq}(12pm):	60.9	L_{eq}(3am):	40
L_{eq}(1pm):	60.9	L_{eq}(4am):	40
L_{eq}(2pm):	60.9	L_{eq}(5am):	40
L_{eq}(3pm):	60.9	L_{eq}(6am):	40
L_{eq}(4pm):	60.9		
L_{eq}(5pm):	60.9		
L_{eq}(6pm):	60.9		
L_{eq}(7pm):	60.9		
L_{eq}(8pm):	60.9		
L_{eq}(9pm):	60.9		

L_d:	60.9
L_n:	40
L_{dn} (CNEL):	**59.07**

Receptor 2 Noise @ Source

L_{eq}(Day):	dbA	L_{eq}(Night):	dbA
L_{eq}(7am):	67.7	L_{eq}(10pm):	40
L_{eq}(8am):	67.7	L_{eq}(11pm):	40
L_{eq}(9am):	67.7	L_{eq}(12am):	40
L_{eq}(10am):	67.7	L_{eq}(1am):	40
L_{eq}(11am):	67.7	L_{eq}(2am):	40
L_{eq}(12pm):	67.7	L_{eq}(3am):	40
L_{eq}(1pm):	67.7	L_{eq}(4am):	40
L_{eq}(2pm):	67.7	L_{eq}(5am):	40
L_{eq}(3pm):	67.7	L_{eq}(6am):	40
L_{eq}(4pm):	67.7		
L_{eq}(5pm):	67.7		
L_{eq}(6pm):	67.7		
L_{eq}(7pm):	67.7		
L_{eq}(8pm):	67.7		
L_{eq}(9pm):	67.7		

L_d:	67.7
L_n:	40
L_{dn} (CNEL):	**65.70**

Composite Noise Levels for Outdoor Decks

Project: 3rd and Fairfax
Date: October 2020
Analyst: Elise Lorenzana-Cronkrite

Receptor	Ambient CNEL	24-HR CNEL						
		4th Level Outdoor Deck	5th Level Outdoor Deck	7th Level Outdoor Deck	Composite CNEL	Composite + Ambient CNEL	Significance Criteria (dBA Leq)	Significant Impact?
1	59.07	46.29	32.86	21.87	46.50	59.30	64.07	NO
2	65.70	30.27	25.32	17.19	31.63	65.70	70.70	NO
3	59.07	28.94	27.26	18.77	31.43	59.08	64.07	NO

Note: formulas provided by Caltrans Technical Noise Supplement (September 2013): "Adding and Subtracting Unequal Sound Pressure Levels"

Stationary Mechanical Equipment Noise Worksheets

Project: 3rd and Fairfax Mixed-Use
Date: October 2020
Analyst: Elise Lorenzana-Cronkrite

Sensitive Receptor	Distance to HVAC Equipment (feet)	HVAC Mechanical Noise		
		Reference Level* (dBA Leq)	Estimated Shielding (dBA)	Estimated Noise Level @ Reciever (dBA)
		39.9		
1	90	34.79	0	34.79
2	290	24.63	0	24.63
3	340	23.25	0	23.25

Distances from Rooftop HVAC to Sensitive Receptors

	Distance (x)	Height (y)	Distance
R1	30	83	88
R2	280	83	292
R3	330	83	340

Receptor	Ambient CNEL	HVAC Equipment	Composite CNEL
1	59.07	34.79	59.09
2	65.70	24.63	65.70
3	59.07	23.25	59.07

NOTES: *Reference Level of 74 dBA repressents sound power level provided by Carrier Corporation, Product Data Sheet for 25HBC5 Base 15 Heat Pump with Puron Refrigerant (1 1/2 to 5 Nominal Tons).
*The 74 dBA Sound Power Level was converted to Sound Pressure Level at a reference distance of 50 feet. This converts to a SPL of 39.9 dBA. Formula: Lp = Lw +10log(Q/(4π(d^2)))+k (Source: Dalkin HVAC Acoustic Fundamentals, pg 16)
Source: Calculations based on Federal Transit Administration, Transit Noise and Vibration Impact Assessment, Final Report, May 2006.

Computation of L_{eq} and L_{dn} at 50 feet for Stationary Source General Assessment

Variables	Value:		Unit:
SEL_{ref}:	92		dB
C_N for parking garage:	-7.281583935		(volume adjustment (dB))
N_A:	187		automobiles/hr

Formulas:

Hourly L_{eq} at 50 feet:	$L_{eq}(h) = SELref + CN - 35.6$
Daytime L_{eq} at 50 feet:	$L_{eq}(day) = 10*log[(1/15)*sum\ 7am\text{-}10pm(10^{\wedge}L_{eq}(h)/10))$
Nighttime L_{eq} at 50 feet:	$L_{eq}(night) = 10*log[(1/9)*sum\ from\ 10pm\text{-}7am(10^{\wedge}L_{eq}(h)/10))$
L_{dn} at 50 feet:	$L_{dn} = 10*log[[15*10^{\wedge}(L_{eq}(day))/10] + [9*10^{\wedge}(L_{eq}(night))/10]\text{-}13.8$

Parking Garage Noise Computations:

$L_{eq}(h)$:	49.12
$L_{eq}(day)$:	48.82
$L_{eq}(night)$:	40.00
L_{dn}:	47.11
Loading Dock Reference Noise Level	66.00

Receptor	Distance from Parking Garage	Distance from Loading Dock	Ambient Noise Level	Garage Noise at Receptor	Loading Dock at Receptor	Ambient + Garage/Loading Dock Noise
1	30	280	59.07	53.6	31.0	60.2
2	270	270	65.70	34.5	51.4	65.9
3	315	565	59.07	33.1	24.9	59.1

Notes:

1) Loading Dock noise incorporates a 20 dB reduction due to the loading bay being enclosed/shielded from receptors 1 and 3. No attenuation factor was applied to Receptor No. 2, although the Ross departmet store wodul block the line of sight and attenuate noise levels from the loading dock.

2) Automobiles/hour was conservatively estimated by assuming highest trip rate of 187/hour during the AM peak hour per Traffic Impact Study, 6300 W. 3rd Street Mixed Use Project City of Los Angeles, California, Linscott, Law & Greenspan Engineers, July 17, 2019.

3) Garage noise calculations conservatively assume all 187 peak hour trips utilize the southerly garage driveway nearest Sensitive Receptor No. 1. This conservatively overstates the garage traffic flow as vehicles entering and leaving the garage would be distributed among two driveway entrances on S. Ogden Drive, one driveway connection to the retail parking lot on th ewest side of the Center, and the southerly garage driveway (which is limited to egress traffic only).

Composite Noise Levels for Proposed Project

Project: 3rd and Fairfax
Date: October 2020
Analyst: Elise Lorenzana-Cronkrite

Receptor	Ambient CNEL	24-HR CNEL						Composite CNEL	Composite + Ambient CNEL	Significance Criteria (dBA CNEL)	Significant Impact?
			Roadway Traffic	Outdoor Decks	HVAC Equipment	Parking Garage	Loading Dock				
1	59.07		60.26	46.50	34.79	53.60	31.00	61.27	63.32	64.07	NO
2	65.70		61.00	31.63	24.63	34.50	51.40	61.47	67.09	70.70	NO
3	59.07		60.26	31.43	23.25	33.10	24.90	60.28	62.73	64.07	NO

Note: formulas provided by Caltrans Technical Noise Supplement (September 2013): "Adding and Subtracting Unequal Sound Pressure Levels"

Project: 3rd and Fairfax Mixed Use Project
Date: October 15, 2020
Analyst: Shane Parker

Haul Truck Vibration Reference Levels at 50 feet
VdB: 0.00566

		Building Damage	
Sensitive Receptors	Distance to Nearest Lane of Travel (feet)	Vibration Level at Receptor (PPV (in/sec))	
Residences	20	0.022	
Residences	25	0.016	
Residences	30	0.012	
Residences	35	0.010	
Residences	40	0.008	
Residences	45	0.007	
Residences	50	0.006	

Source: FTA Noise and Vibration Assessment Manual, September 2018.

PARKER ENVIRONMENTAL CONSULTANTS

OFF-SITE TRAFFIC NOISE LEVELS PEAK HOUR AND CNEL

Project Name: 3rd and Fairfax Mixed-Use Project
Analyst: Elise Lorenzana
Date: 7/5/19

Background Information

Model Description: FHWA Highway Noise Prediction Model (FHWA-RD-77-108) with California Vehicle Noise (CALVENO) Emission Levels.
Analysis Scenario(s): (1)Existing, (2)Existing with Project, (3)Future without project, and (4)Future with Project
Source of Traffic Volumes: Linscott, Law, and Greenspan Engineers, June 25, 2019.
Community Noise Descriptor: L_{dn}: _____ CNEL: X

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

Traffic Noise Levels

Analysis Condition Roadway Name Roadway Segment	Lanes	Median Width	Peak Hour Volume	ADT Volume[1]	Design Speed (mph)	Dist. from Center to Receptor[2]	Alpha Factor	Barrier Attn. dB(A)	Vehicle Mix: Medium Trucks	Vehicle Mix: Heavy Trucks	Peak Hour dB(A) L_{eq}	24-Hour dB(A) CNEL	Traffic Volumes: 24-Hour Day	Traffic Volumes: Eve	Traffic Volumes: Night	Peak Hour MTp	Peak Hour HTp	24-Hour MTd	24-Hour HTd	24-Hour MTe
Existing (2019) Traffic Volumes																				
1 Fairfax Avenue																				
between 3rd Street and Colgate Avenue	4	12	2,457	24,570	35	35	0	0	1.8%	0.7%	72.3	71.57	19,091	3,120	2,359	39	15	387	153	22
2 3rd Street																				
between Fairfax Avenue and Ogden Drive	4	0	2,297	22,970	35	35	0	0	1.8%	0.7%	71.3	70.57	17,848	2,917	2,205	36	14	361	143	21
3 Ogden Drive																				
between 3rd Street and Colgate Avenue	2	0	565	5,650	25	35	0	0	1.8%	0.7%	61.6	60.84	4,390	718	542	9	4	89	35	5
4 Colgate Avenue																				
between Fairfax Avenue and Ogden Drive	2	0	474	4,740	25	35	0	0	1.8%	0.7%	60.9	60.08	3,683	602	455	7	3	75	30	4
Existing (2019) With Project Traffic Volumes																				
1 Fairfax Avenue																				
between 3rd Street and Colgate Avenue	4	12	2,469	24,690	35	35	0	0	1.8%	0.7%	72.4	71.59	19,184	3,136	2,370	39	15	389	154	22
2 3rd Street																				
between Fairfax Avenue and Ogden Drive	4	0	2,344	23,440	35	35	0	0	1.8%	0.7%	71.4	70.65	18,213	2,977	2,250	37	15	369	146	21
3 Ogden Drive																				
between 3rd Street and Colgate Avenue	2	0	637	6,370	25	35	0	0	1.8%	0.7%	62.1	61.36	4,949	809	612	10	4	100	40	6
4 Colgate Avenue																				
between Fairfax Avenue and Ogden Drive	2	0	506	5,060	25	35	0	0	1.8%	0.7%	61.1	60.36	3,932	643	486	8	3	80	32	5
Future Without Project (2023) Traffic Volumes																				
1 Fairfax Avenue																				
between 3rd Street and Colgate Avenue	4	12	2,755	27,550	35	35	0	0	1.8%	0.7%	72.8	72.07	21,406	3,499	2,645	43	17	434	172	25
2 3rd Street																				
between Fairfax Avenue and Ogden Drive	4	0	2,461	24,610	35	35	0	0	1.8%	0.7%	71.6	70.87	19,122	3,125	2,363	39	15	387	153	22
3 Ogden Drive																				
between 3rd Street and Colgate Avenue	2	0	587	5,870	25	35	0	0	1.8%	0.7%	61.8	61.00	4,561	745	564	9	4	92	37	5

4 Colgate Avenue																				
between Fairfax Avenue and Ogden Drive	2	0	494	4,940	25	35	0	0	1.8%	0.7%	61.0	60.26	3,838	627	474	8	3	78	31	4
Future With Project (2023) Traffic Volumes																				
1 Fairfax Avenue																				
between 3rd Street and Colgate Avenue	4	12	2,767	27,670	35	35	0	0	1.8%	0.7%	72.9	72.09	21,500	3,514	2,656	44	17	435	173	25
2 3rd Street																				
between Fairfax Avenue and Ogden Drive	4	0	2,508	25,080	35	35	0	0	1.8%	0.7%	71.7	70.95	19,487	3,185	2,408	39	16	395	156	23
3 Ogden Drive																				
between 3rd Street and Colgate Avenue	2	0	659	6,590	25	35	0	0	1.8%	0.7%	62.3	61.51	5,120	837	633	10	4	104	41	6
4 Colgate Avenue																				
between Fairfax Avenue and Ogden Drive	2	0	524	5,240	25	35	0	0	1.8%	0.7%	61.3	60.51	4,071	665	503	8	3	82	33	5

PARKER ENVIRONMENTAL CONSULTANTS

OFF-SITE TRAFFIC NOISE LEVELS PEAK HOUR AND CNEL

Project Name: 3rd and Fairfax Mixed-Use Project
Analyst: Elise Lorenzana-Cronkrite
Date: 8/10/20

Background Information

Model Description:	FHWA Highway Noise Prediction Model (FHWA-RD-77-108) with California Vehicle Noise (CALVENO) Emission Levels.
Analysis Scenario(s):	(1)Existing, (2)Existing with Haul Route
Source of Traffic Volumes:	Est. max 272 haul trips per day, non-peak hours
Community Noise Descriptor:	L_{dn}: _____ CNEL: X

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

Traffic Noise Levels

Analysis Condition / Roadway Name / Roadway Segment	Lanes	Median Width	Peak Hour Volume	ADT Volume[1]	Design Speed (mph)	Dist. from Center to Receptor[2]	Alpha Factor	Barrier Attn. dB(A)	Vehicle Mix: Medium Trucks	Vehicle Mix: Heavy Trucks	Peak Hour dB(A) L_{eq}	24-Hour dB(A) CNEL
Existing (2020) Traffic Volumes												
1 3rd Street												
between Ogden Dr and La Brea Ave	4	0	2,384	23,840	35	35	0	0	1.8%	0.7%	71.5	70.73
2 La Brea Avenue												
between 3rd Street and San Vicente Blvd	6	0	3,306	33,060	35	35	0	0	1.8%	0.7%	75.1	74.37
3 La Brea Avenue												
between San Vicente Blvd and 10 Fwy	4	0	3,306	33,060	35	35	0	0	1.8%	0.7%	72.9	72.15
4 3rd Street												
between La Brea Ave and Highland Ave	4	0	2,463	24,630	35	25	0	0	1.8%	0.7%	74.0	73.25
5 Highland Avenue												
between 3rd Street and 101 Fwy	4	16	2,527	25,270	35	35	0	0	1.8%	0.7%	72.8	72.06
Existing (2020) With Haul Route Traffic Volumes												
1 3rd Street												
between Ogden Dr and La Brea Ave	4	0	2,384	24,112	35	35	0	0	3.0%	3.0%	73.4	72.60
2 La Brea Avenue												
between 3rd Street and San Vicente Blvd	6	0	3,306	33,332	35	35	0	0	3.0%	3.0%	77.0	76.23
3 La Brea Avenue												
between San Vicente Blvd and 10 Fwy	4	0	3,306	33,332	35	35	0	0	3.0%	3.0%	74.8	74.01
4 3rd Street												
between La Brea Ave and Highland Ave	4	0	2,463	24,902	35	25	0	0	3.0%	3.0%	75.9	75.13
5 Highland Avenue												
between 3rd Street and 101 Fwy	4	16	2,527	25,542	35	35	0	0	3.0%	3.0%	74.7	73.93

Note: The number of daily haul trips (272 trips rounded) was added to the Existing Traffic Volumes. The "Vehicle Mix" was increased to account for increase of medium and heavy duty trucks.

4 Colgate Avenue																				
between Fairfax Avenue and Ogden Drive	2	0	494	4,940	25	35	0	0	1.8%	0.7%	61.0	60.26	3,838	627	474	8	3	78	31	4
Future With Project (2023) Traffic Volumes																				
1 Fairfax Avenue																				
between 3rd Street and Colgate Avenue	4	12	2,767	27,670	35	35	0	0	1.8%	0.7%	72.9	72.09	21,500	3,514	2,656	44	17	435	173	25
2 3rd Street																				
between Fairfax Avenue and Ogden Drive	4	0	2,508	25,080	35	35	0	0	1.8%	0.7%	71.7	70.95	19,487	3,185	2,408	39	16	395	156	23
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4 Colgate Avenue																				
between Fairfax Avenue and Ogden Drive	2	0	524	5,240	25	35	0	0	1.8%	0.7%	61.3	60.51	4,071	665	503	8	3	82	33	5