APPENDIX F

Noise and Vibration Study

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752 Chestnut Street Radio Service Facility Project

Noise and Vibration Study

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1 Project Description and Impact Summary

1.1 Introduction

This study analyzes the potential noise and vibration impacts of the proposed 752 Chestnut Street Radio Facility Project (project) in San Mateo County, California. Rincon Consultants, Inc. (Rincon) prepared this study under contract to Circlepoint for use in support of the environmental documentation for the project. The purpose of this study is to analyze the project's noise and vibration impacts related to both temporary construction activity and long-term operation of the project. Table 1 provides a summary of the conclusions of the study.

Table 1 Summary of Impacts

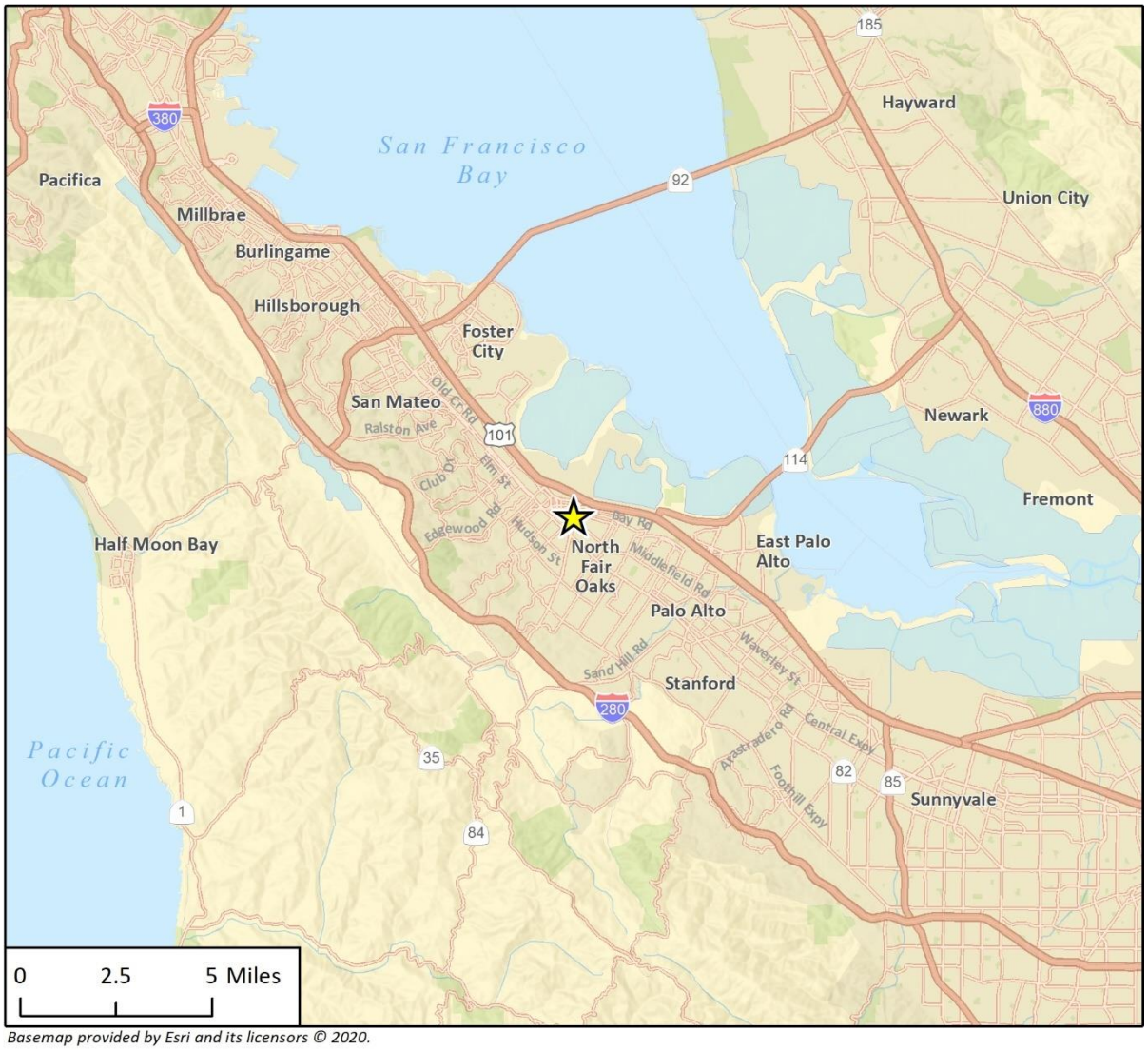
Issue	Level of Significance	Mitigation
Issue 1: Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	Less Than Significant Impact (Construction) Less Than Significant Impact with Mitigation (Operation)	NOI-1 (Operational Noise Reductions)
Issue 2: Generation of excessive ground-borne vibration or ground-borne noise levels.	Less Than Significant Impact	None
Issue 3: For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels.	No Impact	None

1.2 Project Summary

Project Location

The project site is located at 752 Chestnut Street in the eastern portion of the City of Redwood City in San Mateo County. The project would be located on the southwestern corner of the Grant Corporation parcel (Assessor's Parcel Number 054-063-180), which is an approximately 5.71-acre public works facility owned by San Mateo County on the southeastern corner of Chestnut Street and Spring Street. Adjacent land uses include multi-family and single-family residential development to the south and the other portions of the Grant Corporation Yard to the north and east. Chestnut Street borders the project site to the west. Figure 1 shows the project site in its regional location, and Figure 2 shows an aerial view of the project site and surrounding area.

Figure 1 Regional Location



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Project Location

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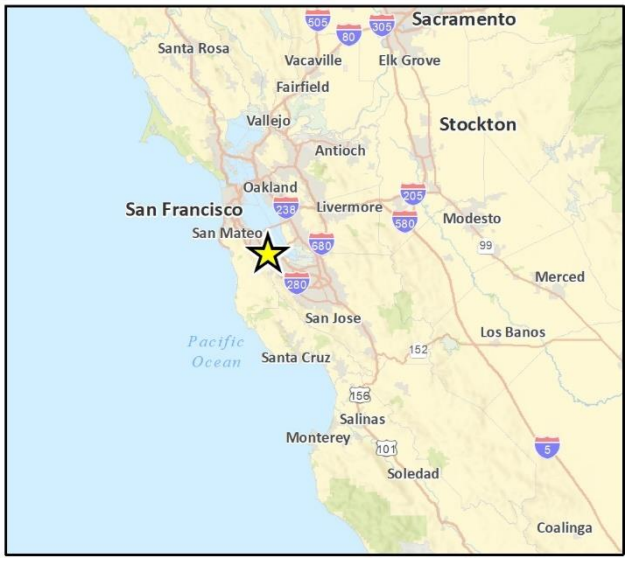

Figure 2 Project Site

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Project Description

The proposed project would involve construction and operation of a radio service facility with a parking lot on the existing Grant Yard Corporation site (see Figure 3). The project would include demolition of the existing general light industrial buildings (approximately 3,095 square feet square feet)[1] and development of a two-story, 13,000 square feet radio service facility that would include a radio shop, conference rooms, and office space on the first floor. Parking would also be provided in an enclosed structure on the first floor with nine vehicle spaces. Three additional spaces would be provided in a surface parking lot, with two of those spaces being electric vehicle (EV) charging spaces and one being an ADA-compliant accessible space. The radio service facility would be accessible via an existing driveway off of Chestnut Street.

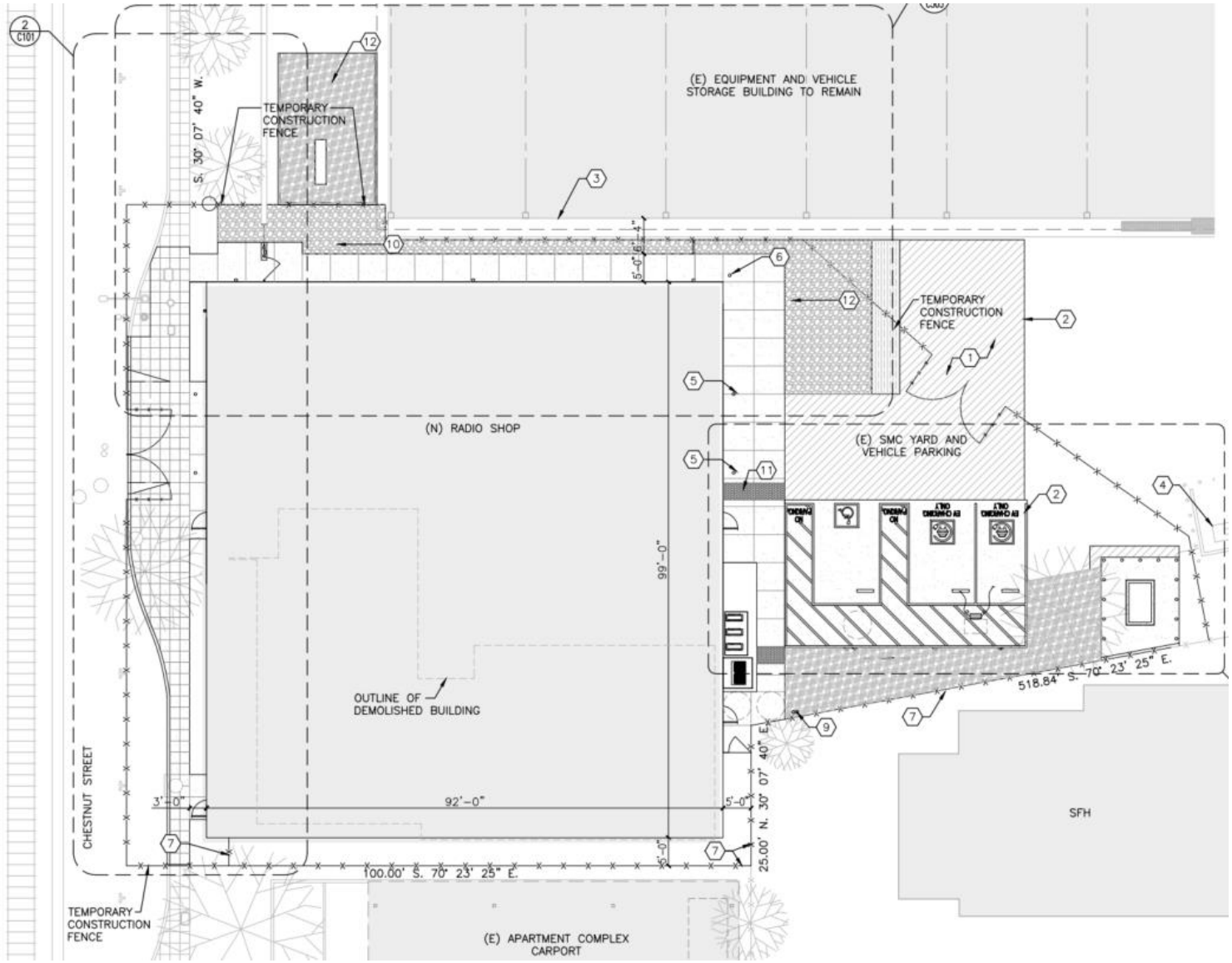
The project would include an air source heat recovery unit and three ductless mini-split system outdoor condensing units on the ground level outside of the southeastern corner of the proposed building. These units would not operate during the nighttime hours (10:00 p.m. to 7:00 a.m.). The project would also include a 200-kW emergency generator, located at the southeastern edge of the project site near the southern property boundary. The generator would not be tested during nighttime hours.

Construction

Project construction is expected to commence in spring/early summer 2021, with full buildout completed by winter/early spring2023. The project would require the export of approximately 450 cubic yards and the import of approximately 400 cubic yards of material from the site during grading.

[1] The building footprint of both existing buildings was estimated using Google Earth.

Figure 3 Site Plan



2 Background

2.1 Overview of Sound Measurement

Sound is a vibratory disturbance created by a moving or vibrating source, which is capable of being detected by the hearing organs. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired and may therefore be classified as a more specific group of sounds. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and, in the extreme, hearing impairment (California Department of Transportation [Caltrans] 2013).

Noise levels are commonly measured in decibels (dB) using the A-weighted sound pressure level (dBA). The A-weighting scale is an adjustment to the actual sound pressure levels so that they are consistent with the human hearing response, which is most sensitive to frequencies around 4,000 Hertz and less sensitive to frequencies around and below 100 Hertz (Kinsler, et. al. 1999). Decibels are measured on a logarithmic scale that quantifies sound intensity in a manner similar to the Richter scale used to measure earthquake magnitudes. A doubling of the energy of a noise source, such as doubling of traffic volume, would increase the noise level by 3 dB; dividing the energy in half would result in a 3 dB decrease (Crocker 2007).

Human perception of noise has no simple correlation with sound energy. The perception of sound is not linear in terms of dBA or in terms of sound energy. Two sources do not "sound twice as loud" as one source. It is widely accepted that the average healthy ear can barely perceive changes of 3 dBA, increase or decrease (i.e., twice the sound energy); that a change of 5 dBA is readily perceptible (eight times the sound energy); and that an increase (or decrease) of 10 dBA sounds twice (half) as loud ([10.5x the sound energy] Crocker 2007).

Sound changes in both level and frequency spectrum as it travels from the source to the receiver. The most obvious change is the decrease in level as the distance from the source increases. The manner by which noise reduces with distance depends on factors such as the type of sources (e.g., point or line, the path the sound will travel, site conditions, and obstructions). Noise levels from a point source typically attenuate, or drop off, at a rate of 6 dBA per doubling of distance (e.g., construction, industrial machinery, ventilation units). Noise from a line source (e.g., roadway, pipeline, railroad) typically attenuates at about 3 dBA per doubling of distance (Caltrans 2013). The propagation of noise is also affected by the intervening ground, known as ground absorption. A hard site, such as a parking lot or smooth body of water, receives no additional ground attenuation and the changes in noise levels with distance (drop-off rate) result from simply the geometric spreading of the source. An additional ground attenuation value of 1.5 dBA per doubling of distance applies to a soft site (e.g., soft dirt, grass, or scattered bushes and trees) (Caltrans 2013). Noise levels may also be reduced by intervening structures; the amount of attenuation provided by this "shielding" depends on the size of the object and the frequencies of the noise levels. Natural terrain features such as hills and dense woods, and man-made features such as buildings and walls, can significantly alter noise levels. Generally, any large structure blocking the line of sight will provide at least a 5-dBA reduction in source noise levels at the receiver (Federal Highway Administration [FHWA] 2018). Structures can substantially reduce exposure to noise as well. The FHWA's guidelines indicate that modern building construction generally provides an exterior-to-interior noise level reduction of 20 to 35 dBA with closed windows.

The impact of noise is not a function of loudness alone. The time of day when noise occurs, and the duration of the noise are also important factors of project noise impact. Most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors have been developed. One of the most frequently used noise metrics is the equivalent noise level (L_{eq}); it considers both duration and sound power level. L_{eq} is defined as the single steady A-weighted level equivalent to the same amount of energy as that contained in the actual fluctuating levels over time. Typically, L_{eq} is summed over a one-hour period. L_{max} is the highest root mean squared (RMS) sound pressure level within the sampling period, and L_{min} is the lowest RMS sound pressure level within the measuring period (Crocker 2007).

Noise that occurs at night tends to be more disturbing than that occurring during the day. Community noise is usually measured using Day-Night Average Level (DNL), which is the 24-hour average noise level with a +10 dBA penalty for noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours; it is also measured using Community Noise Equivalent Level (CNEL), which is the 24-hour average noise level with a +5 dBA penalty for noise occurring from 7:00 p.m. to 10:00 p.m. and a +10 dBA penalty for noise occurring from 10:00 p.m. to 7:00 a.m. (Caltrans 2013). Noise levels described by DNL and CNEL usually differ by about 1 dBA. The relationship between the peak-hour L_{eq} value and the DNL/CNEL depends on the distribution of traffic during the day, evening, and night. Quiet suburban areas typically have CNEL noise levels in the range of 40 to 50 dBA, while areas near arterial streets are in the 50 to 60-plus CNEL range. Normal conversational levels are in the 60 to 65-dBA L_{eq} range; ambient noise levels greater than 65 dBA L_{eq} can interrupt conversations (Federal Transit Administration [FTA] 2018).

2.2 Vibration

Groundborne vibration of concern in environmental analysis consists of the oscillatory waves that move from a source through the ground to adjacent structures. The number of cycles per second of oscillation makes up the vibration frequency, described in terms of Hz. The frequency of a vibrating object describes how rapidly it oscillates. The normal frequency range of most groundborne vibration that can be felt by the human body starts from a low frequency of less than 1 Hz and goes to a high of about 200 Hz (Crocker 2007).

While people have varying sensitivities to vibrations at different frequencies, in general they are most sensitive to low-frequency vibration. Vibration in buildings, such as from nearby construction activities, may cause windows, items on shelves, and pictures on walls to rattle. Vibration of building components can also take the form of an audible low-frequency rumbling noise, referred to as groundborne noise. Groundborne noise is usually only a problem when the originating vibration spectrum is dominated by frequencies in the upper end of the range (60 to 200 Hz), or when foundations or utilities, such as sewer and water pipes, physically connect the structure and the vibration source (FTA 2018). Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors. The primary concern from vibration is that it can be intrusive and annoying to building occupants and vibration-sensitive land uses.

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. High-frequency vibrations diminish much more rapidly than low frequencies, so low frequencies tend to dominate the spectrum at large distances from the source. Discontinuities in the soil strata can also cause diffractions or channeling effects that affect the propagation of vibration over long distances (Caltrans 2020). When a building is impacted by

vibration, a ground-to-foundation coupling loss will usually reduce the overall vibration level. However, under rare circumstances, the ground-to-foundation coupling may actually amplify the vibration level due to structural resonances of the floors and walls.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean squared (RMS) vibration velocity. The PPV and RMS velocity are normally described in inches per second (in./sec.). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (Caltrans 2020).

2.3 Sensitive Receivers

Noise exposure goals for various types of land uses reflect the varying noise sensitivities associated with those uses. Noise sensitive receivers typically include residential uses, hospitals, convalescent homes, schools, and churches. Noise sensitive receivers near the site include single and multi-family residences located adjacent to the south and across Chestnut Street to the west.

Vibration sensitive receivers are similar to noise sensitive receivers, such as residences, and institutional uses, such as schools, churches, and hospitals. However, vibration sensitive receivers also include buildings where vibrations may interfere with vibration-sensitive equipment, affected by levels that may be well below those associated with human annoyance. Vibration sensitive receivers near the site include single and multi-family residences located adjacent to the south and across Chestnut Street to the west.

2.4 Project Noise Setting

As part of a previous noise report for a previous version of the project, Illingworth & Rodkin, Inc. performed a noise monitoring survey to quantify ambient noise levels in the project area (see Appendix A). Noise levels were measured from Friday, November 14, 2014 through Tuesday, November 18, 2014. The survey included four 10-minute short-term (ST-1 through ST-4) and one 24-hour long-term noise measurement (LT-1) within the project vicinity. See Table 2 for short-term measurement results and Figure 4 for all five measurement locations (long-term measurement discussed below under table). Measurement locations were selected to quantify baseline noise levels at representative sensitive receiver locations surrounding the project site. The primary source of noises at sensitive receivers surrounding the site were local traffic on Chestnut Street, local construction, and existing on-site activities. Noise measurements were made with Larson Davis Model 820 Integrating Sound Level Meters set at “slow” response. The sound level meters were equipped with a G.R.A.S. Type 40AQ ½ - inch random incidence microphones fitted with windscreens. All instrumentation used met the requirements of the American National Standards Institute (ANSI) SI.4-1983 for Type 1 use. The sound level meters were calibrated prior to the noise measurements using a Larson Davis Model CAL200 acoustical calibrator. The response of the system was checked after each measurement session and was within 0.2 dBA. These measurements are considered representative of current site conditions as traffic levels and existing on-site operations on the project site are largely the same as when the measurements were conducted.

Table 2 Project Site Noise Monitoring Results – Short Term

Measurement	Location	Sample Times[1]	Primary Noise Source	dBA L_{eq}	dBA L_{max}
ST-1	715 Chestnut Street	11:10 – 11:20 a.m.	Traffic on Chestnut Street	63	73
ST-2	643 Buckeye Street	11:30 – 11:40 a.m.	Distant traffic, on-site operations	48	64
ST-3	End of Spruce Street	11:50 a.m. – 12:00 p.m.	Traffic on Woodside Road	61	73
ST-4	South of large building on project site	10:40 – 10:50 a.m.	Occasional on-site operations	55	69

[1] Measurements taken on November 18, 2014, by Illingworth & Rodkin, Inc. (Appendix A).

Measurement location LT-1 was conducted at the northern terminus of Pine Street, directly south of the project site. This location was chosen to ascertain noise levels at the nearest residential area to the proposed project. The primary daytime noise source at this location was ongoing construction activity at a residential site located to the west of the project site, across Winslow Street. Noise levels across the measurement period are shown in Figure 5. Hourly average daytime noise levels ranged from 50 to 60 dBA L_{eq} over the weekend at this location and from 53 to 62 dBA L_{eq} on weekdays. Hourly average nighttime noise levels dropped as low as 47 dBA L_{eq}. The L_{dn} at this location ranged from 59 to 62 dBA.

Figure 4 Noise Measurement Locations

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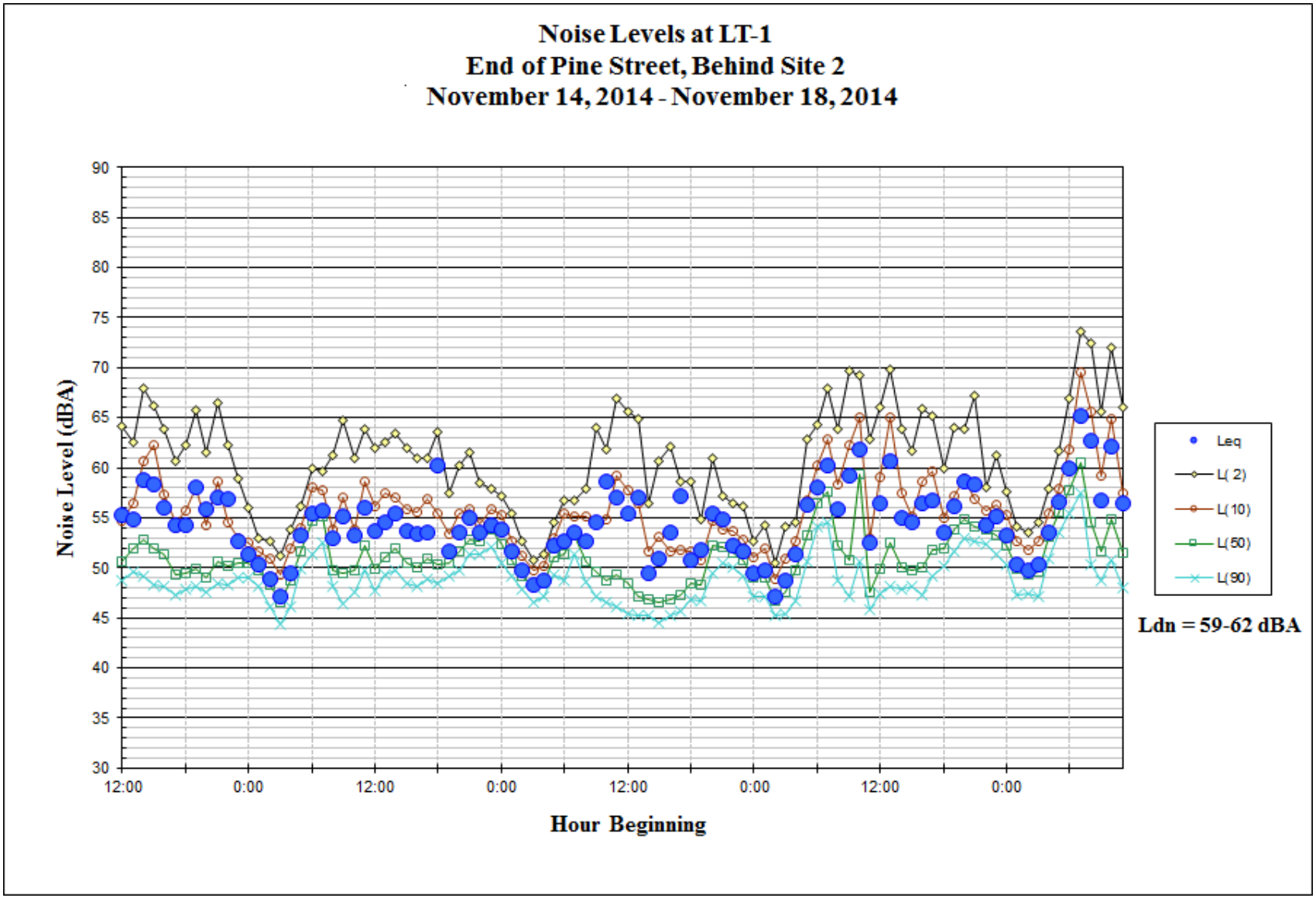
Fig 4 Noise Measurement Locations

Figure 5 Long-term Noise Measurement



2.5 Regulatory Setting

State

The state of California regulates freeway noise, sets standards for sound transmission, provides occupational noise control criteria, identifies noise standards, and provides guidance for local land use compatibility. State law requires each county and city to adopt a General Plan that includes a Noise Element prepared per guidelines adopted by the Governor's Office of Planning and Research. The purpose of the Noise Element is to limit the exposure of the community to excessive noise levels. The California Environmental Quality Act requires all known environmental effects of a project be analyzed, including environmental noise impacts.

California Noise Control Act of 1973

California Health and Safety Code Sections 46000 through 46080, known as the California Noise Control Act, find that excessive noise is a serious hazard to public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. The act also finds that there is a continuous and increasing bombardment of noise in urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians that is free from noise that jeopardizes their health or welfare.

Local

San Mateo County Code of Ordinances

Chapter 4.88 (Noise Control) of the San Mateo County Code of Ordinances is intended to protect noise-sensitive receivers from annoying or disturbing noise generated at nearby properties. Section 4.88.330 sets maximum exterior noise levels for activities on properties in the unincorporated County, as measured at single or multiple family residence, school, hospital, church, public library uses in either incorporated or unincorporated areas. Table 3 shows these exterior noise standards. Higher noise levels are permitted if the noise source operates for 15 minutes or less in a one-hour period. The exterior noise standards are more stringent during nighttime hours from 10 p.m. to 7 a.m.

Table 3 Exterior Noise Standards, dBA

Category	Cumulative Number of Minutes in Any One Hour Time Period	Daytime 7 a.m.—10 p.m.	Nighttime 10 p.m.—7 a.m.
1	30	55	50
2	15	60	55
3	5	65	60
4	1	70	65
5	0	75	70

Source: San Mateo Code of Ordinances, Section 4.88.330.

Notes:

1) In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in 5 dBA increments so as to encompass the background noise level.

2) Each of the noise standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

3) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards above.

Table 4 shows the County's interior noise standards at dwelling units, as written in Section 4.88.340.

Table 4 Interior Noise Standards, dBA

Category	Cumulative Number of Minutes in Any One Hour Time Period	Daytime 7 a.m.—10 p.m.	Nighttime 10 p.m.—7 a.m.
1	5	45	40
2	1	50	45
3	0	55	50

Source: San Mateo Code of Ordinances, Section 4.88.340.

Notes:

1) In the event the measured background noise level exceeds the applicable nose level standard in any category above, the applicable standard shall be adjusted in 5 dBA increments so as to encompass the background noise level.

2) Each of the noise standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

3) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards above.

In addition to these quantitative noise standards, Section 4.88.350 sets a qualitative standard prohibiting "any unreasonably loud, unnecessary, or unusual noise which disturbs the peace and quiet of any neighborhood or which causes any discomfort or annoyance to any person of normal sensitivity residing in the area."

Section 4.88.360 lists exemptions from the provisions of the San Mateo Code of Ordinance noise regulations, which include:

- Any mechanical device, apparatus, or equipment used, related to or connected with emergency machinery, vehicle, or work.
- Noise sources associated with demolition, construction, repair, remodeling, or grading of any real property, provided said activities do not take place between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, 5:00 p.m. and 9:00 a.m. on Saturdays, or at any time on Sundays, Thanksgiving, and Christmas.

San Mateo County General Plan

Chapter 16 of the San Mateo County General Plan offers noise goals and objectives for the County, including: to 1) strive toward a livable noise environment, 2) reduce noise impacts through noise and land use compatibility and noise mitigation, 3) promote protection of noise sensitive land uses and noise reduction in quiet areas and noise impact areas, 4) give priority to reducing noise at the source rather than at the receiver, and 5) promote noise reduction through the use of techniques such as site planning, noise barriers, and architectural design and construction (County of San Mateo 2013).

The General Plan states that noise-sensitive land uses, such as residential neighborhoods, hotels, hospitals, schools, and outdoor recreation areas, must be protected from new development that causes discernable increases in noise levels as a result of on-site activities. Noise generators such as machinery or parking lots must be mitigated through physical measures or operational limits.

Redwood City Municipal Code

Chapter 24 (Noise Regulation) of the Redwood City Municipal Code (RCMC) promotes the health, safety, and general welfare of the public by regulating excessive and unreasonable noises. RCMC Section 24.31(A) prohibits noise levels generated by construction activities (including demolition, alteration, repair, or remodeling) to exceed 110 dBA as measured at any point within a residential district. In addition, RCMC Section 24.31(B) prohibits noise levels generated by individual pieces of machinery, equipment, or devices used during construction activities to exceed 110 dBA at a distance of 25 feet from said machinery, equipment, or device within a residential district.

3 Methodology

3.1 Construction Noise

Construction noise was estimated using the FHWA Roadway Construction Noise Model (RCNM) (FHWA 2006). RCNM predicts construction noise levels for a variety of construction operations based on empirical data and the application of acoustical propagation formulas. Using RCNM, construction noise levels were estimated at noise sensitive receivers near the project site. RCNM provides reference noise levels for standard construction equipment, with an attenuation of 6 dBA per doubling of distance for stationary equipment.

Variation in power imposes additional complexity in characterizing the noise source level from construction equipment. Power variation is accounted for by describing the noise at a reference distance from the equipment operating at full power and adjusting it based on the duty cycle of the activity to determine the L_{eq} of the operation (FHWA 2018). Each phase of construction has a specific equipment mix, depending on the work to be accomplished during that phase. Each phase also has its own noise characteristics; some will have higher continuous noise levels than others, and some have high-impact noise levels.

Construction activity would result in temporary noise in the project area, exposing surrounding sensitive receivers to increased noise levels. The project would involve demolition, site preparation, grading, building construction, and paving. Construction noise would typically be higher during the heavier periods of initial construction (i.e., grading) and would be lower during the latter construction phases. Typical heavy construction equipment during project grading could include dozers, forklifts, cranes, and pavers. It is assumed that diesel engines would power all construction equipment. Construction equipment would not all operate at the same time or location. In addition, construction equipment would not be in constant use during the 8-hour operating day.

3.2 Groundborne Vibration

Operation of the proposed project would not include any substantial vibration sources. Thus, construction activities have the greatest potential to generate ground-borne vibration affecting nearby receivers, especially during grading and excavation of the project site. The greatest vibratory source during construction would be a dozer. Neither blasting nor pile driving would be required for construction of the proposed project. Construction vibration estimates are based on vibration levels reported by Caltrans and the FTA (Caltrans 2020, FTA 2018). Table 5 shows typical vibration levels for various pieces of construction equipment used in the assessment of construction vibration (FTA 2018).

Table 5 Vibration Levels Measured during Construction Activities

Equipment	PPV at 25 ft. (in./sec.)
Large Bulldozer	0.089
Loaded Trucks	0.076
Small Bulldozer	0.003

Source: FTA 2018

Vibration limits used in this analysis to determine a potential impact to local land uses from construction activities are based on information contained in Caltrans' *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020). Maximum recommended vibration limits by the American Association of State Highway and Transportation Officials (AASHTO) are identified in Table 6.

Table 6 AASHTO Maximum Vibration Levels for Preventing Damage

Type of Situation	Limiting Velocity (in./sec.)
Historic sites or other critical locations	0.1
Residential buildings, plastered walls	0.2–0.3
Residential buildings in good repair with gypsum board walls	0.4–0.5
Engineered structures, without plaster	1.0–1.5

Source: Caltrans 2020

Based on AASHTO recommendations, limiting vibration levels to below 0.4 in./sec. PPV at residential structures would prevent structural damage (plastered walls are indicative of construction processes that have not been common for over a 100 years and are therefore not anticipated to be near project construction). These limits are applicable regardless of the frequency of the source. However, as shown in Table 7 and Table 8 potential human annoyance associated with vibration is usually different if it is generated by a steady state or a transient vibration source.

Table 7 Human Response to Steady State Vibration

PPV (in./sec.)	Human Response
3.6 (at 2 Hz)–0.4 (at 20 Hz)	Very disturbing
0.7 (at 2 Hz)–0.17 (at 20 Hz)	Disturbing
0.10	Strongly perceptible
0.035	Distinctly perceptible
0.012	Slightly perceptible

Source: Caltrans 2020

Table 8 Human Response to Transient Vibration

PPV (in./sec.)	Human Response
2.0	Severe
0.9	Strongly perceptible
0.24	Distinctly perceptible
0.035	Barely perceptible

Source: Caltrans 2020

As shown in Table 7, the vibration level threshold at which steady vibration sources are considered to be distinctly perceptible is 0.035 in./sec. PPV. However, as shown in Table 8, the vibration level threshold at which transient vibration sources (such as construction equipment) are considered to be distinctly perceptible is 0.24 in./sec. PPV. This analysis uses the distinctly perceptible threshold for purposes of assessing vibration impacts.

Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors and the vibration level threshold for human perception is assessed at occupied structures (FTA 2018). Therefore, vibration impacts are assessed at the structure of an affected property.

3.3 Operational Noise Sources

On site noise sources were modeled with SoundPLAN. Propagation of modeled stationary noise sources was based on ISO Standard 9613-2, "Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation." The assessment methodology assumes that all receivers would be downwind of stationary sources. This is a conservative assumption for total noise impacts since only some receivers would be downwind at any one time.

Noise sources associated with operation of the proposed project would consist of low speed on-site vehicular noise, landscaping maintenance, general conversations, and mechanical equipment (e.g., air source heat recovery unit, outdoor condensing units, and emergency generator). Due to the low noise levels associated with general site activities, on-site traffic associated with the proposed radio service facility, and the relatively low maintenance associated with the limited landscaping on-site, these sources would not be substantial and are not analyzed further.

An existing, approximate 5-foot wooden fence is located on the southern edge of the property. The fence is worn down with gaps and missing sections; therefore, while this fence would provide some noise attenuation, due to its condition it was not included in modeling.

Mechanical Equipment

The primary mechanical equipment associated with the project would include an air source heat recovery unit, a ductless mini-split system outdoor condensing unit, and an emergency generator.

Air Source Heat Recovery Unit

The project would have an air source heat recovery unit located outside of the eastern façade of the building. The unit would be a 12-ton Daikin Model REYQ144XATJU. According to the manufacturer's specifications, the unit would have a sound power level of 87 dBA (see Appendix B for manufacturer's specifications). For modeling, it was assumed that this equipment would not operate during the nighttime.

Ductless Mini-split System Outdoor Condensing Unit

The project would have three ductless mini-slit system outdoor condensing units located outside of the eastern façade of the building. The units would be a 1.5-ton Daikin Model FTK18NMVJU. According to the manufacturer's specifications, the unit would have a sound pressure level of 54 dBA at 7 meters (23 feet) (see Appendix B for manufacturer's specifications). For modeling, it was assumed that this equipment would not operate during the nighttime.

Emergency Generator

The project would use a 200-kW emergency generator, located at the southeastern edge of the project site near the southern property boundary. The project applicant identified that the generator would be located within a weatherproof sound attenuated enclosure. A sample 200-kW emergency generator would be a CAT DE200E0 with enclosure that would have a sound power level

of 97 dBA (see Appendix B for manufacturer's specifications). Per Section 4.88.360 of the San Mateo County Code of Ordinances, the generator's noise levels are exempt from noise limits during emergency operation. Testing to prepare for emergency operations would occur for 5 to 15 minutes, biweekly or monthly. Due to the short duration when operated and since testing is for emergency preparation, it is considered exempt from noise limits by San Mateo County. In addition, while the generator may be perceptible to nearby receivers during testing, it would of such short duration and infrequent use that it would not be considered a substantial noise impact. Therefore, generator use is not analyzed further in this analysis.

Traffic Noise

According to the County of San Mateo, the proposed project would not increase vehicle trips compared to the existing uses on site. Therefore, no increase in traffic noise levels would occur, and this issue is not analyzed further.

4 Significance Thresholds

The following thresholds are based on County noise standards and Appendix G of the CEQA Guidelines. Noise impacts would be considered significant if:

- **Issue 1 – Noise in Excess of Established Standards:** The project would result in the 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.
  - **Temporary:** Construction noise would be significant if:
    - As the County of San Mateo does not define a quantitative construction noise threshold, for purposes of analyzing impacts from this project, the City has determined that using Redwood City quantitative thresholds would be applicable to the project. Therefore, construction noise would be significant if it exceeds 110 dBA as measured at any point within a residential district.; or
    - Construction noise is generated outside of allowable construction hours as stated in Section 4.88.360 lists of the San Mateo Code of Ordinances.
  - **Permanent:** Operational noise would be significant if:
    - Exterior and interior noise levels exceeded the San Mateo County Code of Ordinances standards listed in Table 3 and Table 4, respectively.
- **Issue 2 – Vibration:** The project would result in the generation of excessive ground-borne vibration or ground-borne noise levels.
  - This would occur if the project would subject vibration-sensitive land uses to construction-related ground-borne vibration that exceeds the distinctly perceptible vibration annoyance potential criteria for human receivers of 0.24 in./sec. PPV, or the residential structural damage criteria of 0.4 in./sec. PPV.
- **Issue 3 – Airport Noise:** For a project located in the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, if the project exposes people residing or working in the project area to excessive noise levels.

5 Impact Analysis

5.1 Issue 1 – Temporary and Permanent Noise Increase

Issue 1: Would the project result in 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? *(Less Than Significant Impact with Mitigation)*

Construction

Project construction would not occur within the prohibited hours of the San Mateo Code of Ordinances (between the hours of 6:00 pm and 7:00 am on weekdays, 5:00 pm and 9:00 am on Saturdays, or at any time on Sundays, Thanksgiving, and Christmas). Therefore, project construction hours would be consistent with the San Mateo Code of Ordinances.

Project construction would occur nearest to sensitive noise uses located adjacent to the southern portion of the project site. Over the course of a typical construction day, project construction may operate at an average distance of 25 feet from the single-family backyard of 639 Pine Street and from the multi-family uses at 622-634 Chestnut Street and 95 feet from the multi-family uses across Chestnut Street (715 Chestnut Street). Although construction equipment may operate at closer distances than those listed above, during the course of a construction day the equipment would be mobile across the site and the average distance listed above is used for analysis purposes. Table 9 shows the construction noise levels attributable to each construction phase modeled.

Table 9 Construction Noise Levels at Receivers

Phase	Construction Equipment[1]	Land Use	Distance to Receiver (feet)	Noise Level (dBA L_{eq})	Exceed Threshold?[2]
Demolition	Excavator, Man Lift, Crane	639 Pine Street, Single-Family/ 622-634 Chestnut Street, Multi-Family	25	85	No
		715 Chestnut Street, Multi-Family	95	73	No
Site Preparation	Dump Truck, Loader, Backhoe	639 Pine Street, Single-Family/ 622-634 Chestnut Street, Multi-Family	25	85	No
		715 Chestnut Street, Multi-Family	95	73	No

Phase	Construction Equipment[1]	Land Use	Distance to Receiver (feet)	Noise Level (dBA L_{eq})	Exceed Threshold?[2]
Building Construction	Crane, Man Lift, Compressor	639 Pine Street, Single-Family/ 622-634 Chestnut Street, Multi-Family	25	83	No
		715 Chestnut Street Multi-Family	95	73	No
Asphalt Paving	Compactor, Paver, Roller	639 Pine Street Single-Family/ 622-634 Chestnut Street Multi-Family	25	86	No
		715 Chestnut Street, Multi-Family	95	73	No

[1] Typical construction equipment for these phases was assumed.

[2] Applicable threshold is Redwood City's 110 dBA residential threshold.

L_{eq}: one-hour equivalent noise level; L_{max}: instantaneous maximum noise level; dBA: A-weighted decibel

See Appendix C for RCNM results.

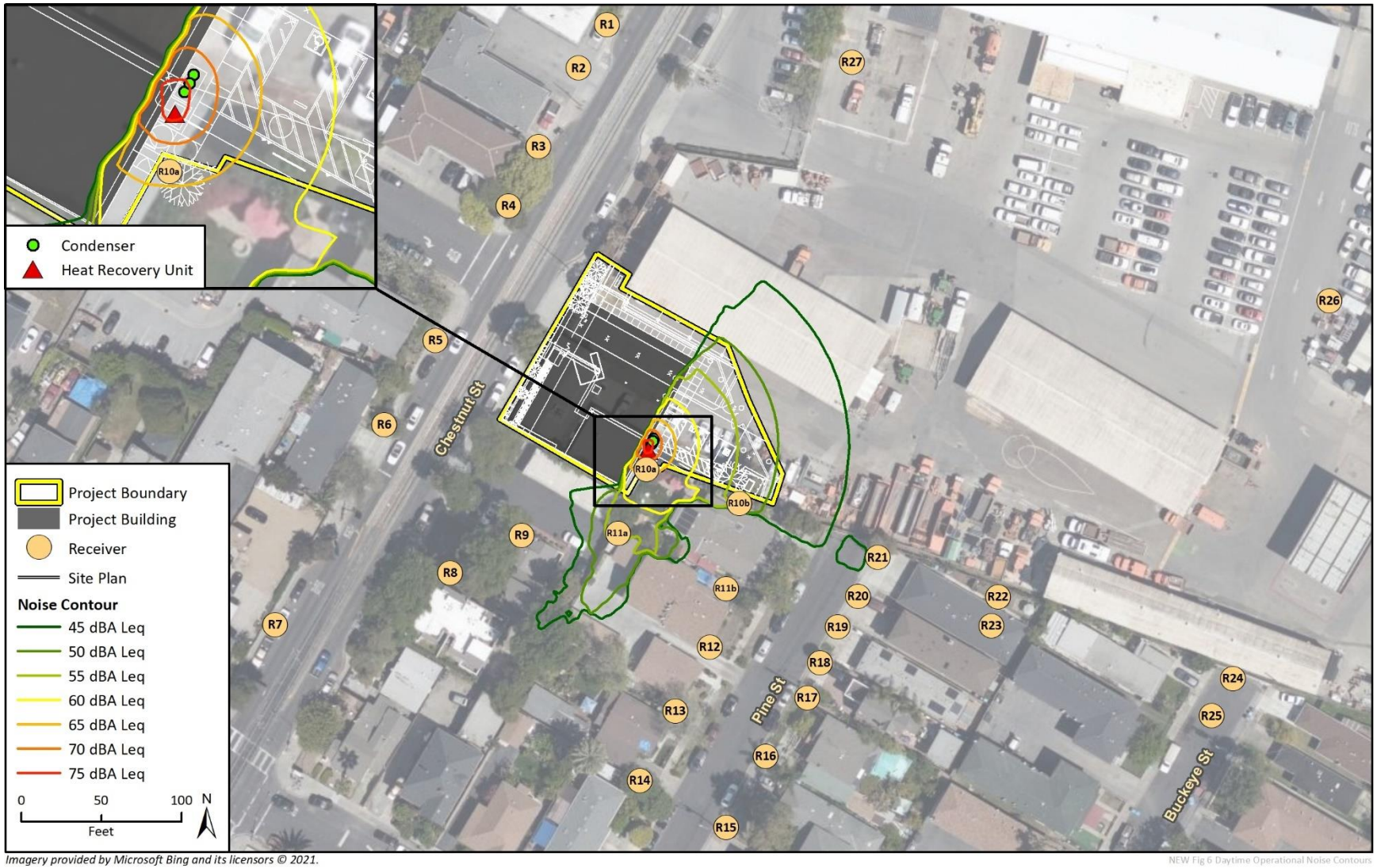
As shown in Table 9, noise levels at the residences to the south would not exceed Redwood City's construction noise threshold of 110 dBA; therefore, construction noise impacts would be less than significant.

Operation

The project would introduce operational noise sources to the site, including condensers and a heat recovering unit. Assumptions for these pieces of equipment are discussed in Section 3.3. A daytime scenario with the condensers and heat recovery unit running was modeled; as the condensers and heat recovery unit would not be operated during the nighttime house of 10 p.m. to 7 a.m., a nighttime scenario was not analyzed.

Noise levels at the nearest properties from operation of the condensers and heat recovery units during the daytime are shown in Table 10. Receiver locations and noise contours are shown on Figure 6. As shown in Table 10, daytime operational noise levels from the project would exceed standards at the single-family residences to the south (639 Pine Street and 633 Pine Street). Therefore, daytime operational noise levels would be potentially significant.

Figure 6 Daytime Operational Noise Levels



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NEW Fig 6 Daytime Operational Noise Contours

Table 10 Daytime Operational Noise Levels

Receiver	Land Use	Description	Heat Recovery Unit and Condensers Noise Levels (dBA L_{eq}) Exterior	Interior[1]	Exceed Thresholds?[2]
R1	Residential	729 Chestnut St.	19	0	No
R2	Residential	721 Chestnut St.	18	0	No
R3	Residential	715 Chestnut St.	20	0	No
R4	Residential	675 Hilton St.	20	0	No
R5	Residential	626 Hilton St.	22	2	No
R6	Residential	671 Chestnut St.	22	2	No
R7	Residential	627 Stambaugh St.	21	1	No
R8	Residential	622 Chestnut St.	23	3	No
R9	Residential	635 Chestnut St.	32	12	No
R10a	Residential	639 Pine St. (western property)	**67**	**47**	**Yes**
R10b	Residential	639 Pine St. (eastern property)	53	33	No
R11a	Residential	633 Pine St. (western property)	**56**	36	**Yes**
R11b	Residential	633 Pine St. (eastern property)	38	18	No
R12	Residential	627 Pine St.	28	8	No
R13	Residential	619 Pine St.	27	7	No
R14	Residential	607 Pine St.	25	5	No
R15	Residential	602 Pine St.	27	7	No
R16	Residential	620 Pine St.	30	10	No
R17	Residential	626 Pine St.	34	14	No
R18	Residential	632 Pine St.	35	15	No
R19	Residential	638 Pine St.	36	16	No
R20	Residential	644 Pine St.	39	19	No
R21	Residential	660 Pine St.	45	25	No
R22	Residential	655 Buckeye St.	41	21	No
R23	Residential	643 Buckeye St.	27	7	No
R24	Residential	654 Buckeye St.	35	15	No
R25	Residential	644 Buckeye St.	32	12	No
R26	Industrial	1900 Spring St.	33	13	N/A[3]
R27	Industrial	752 Chestnut St. (northern building)	37	17	N/A[3]

[1] In accordance with FHWA guidelines, an interior noise reduction of 20 dBA was assumed (FHWA 2018).

[2] In accordance with Section 4.88.330 of the San Mateo Code of Ordinances, the applicable threshold is that operational noise shall not exceed an exterior noise level of 55 dBA or an interior noise level of 45 dBA L_{eq} at noise sensitive receivers.

[3] No applicable threshold because the uses are not noise-sensitive land uses; noise levels provided for informational purposes.

Mitigation Measure

NOI-1 Operational Noise Reductions

The project applicant shall reduce operational noise levels from the project's heat recovery unit and condensers to not exceed San Mateo Code of Ordinances' daytime exterior and interior noise limits contained in Section 4.88.330, which states that during the daytime hours (7 a.m. to 10 p.m.), operational noise levels shall not exceed an exterior noise level of 55 dBA L_{eq} or an interior noise level 45 dBA L_{eq}.

The project shall achieve consistency with the noise limits by one or more of the following measures:

- Installation of an eight-foot tall solid barrier on the southern property boundary where it abuts single-family residential properties. The barriers/enclosures shall be constructed of a material with a minimum weight of 4 pounds per square foot with no gaps of perforations to the east, west, or south. Noise barriers may be constructed of, but are not limited to, masonry block, concrete panels, 1/8 inch thick steel sheets, 1-1/2 inch wood fencing, or 1/4 inch glass panels. If wood is used as the primary barrier component, the fence boards must overlap or be of "tongue and groove" construction with a joining compound between the boards to ensure there would be gaps or holes in the fence; and annual inspection and maintenance must be conducted for the life of the project to ensure the barrier continues to perform to the minimum requirements; and/or
- Use of quieter equipment than analyzed; and/or
- Move the equipment to a different part of the project site, further from the residences to the south. Examples include moving the heat recovery unit and condensers to the rooftop.

These measures may be combined to achieve noise limit compliance (e.g., a six-foot barrier and moving the heat recovery unit slightly to the north). Revised site and detail plans implementing the selected measure or combination of measures shall be analyzed by a qualified noise consultant to determine that the project's operational noise levels would be consistent with San Mateo Code of Ordinances' exterior and interior noise limits. This analysis shall be submitted to the County planning department for verification prior to the granting of building permits.

Significance After Mitigation

With implementation of the eight-foot tall solid barrier at the southern property boundary, as described under Mitigation Measure NOI-1, noise levels at the potentially affected residences would not exceed the San Mateo Code of Ordinances' noise limits, as shown in Table 11 and Figure 7. Therefore, this measure or an appropriate combination of measures would be effective in reducing operational noise below significance thresholds.

Figure 7 Mitigated Daytime Operational Noise Levels

Table 11 Mitigated Daytime Operational Noise Levels

Receiver	Land Use	Description	Heat Recovery Unit and Condensers Noise Levels (dBA L_{eq}) Exterior	Interior[1]	Exceed Thresholds?[2]
R10a	Residential	639 Pine Street (western property)	53	33	No
R11a	Residential	633 Pine Street (western property)	48	28	No

[1] In accordance with FHWA guidelines, an interior noise reduction of 20 dBA was assumed (FHWA 2018).

[2] In accordance with Section 4.88.330 of the San Mateo Code of Ordinances, the applicable threshold is that operational noise shall not exceed an exterior noise level of 55 dBA or an interior noise level of 45 dBA L_{eq} at noise sensitive receivers.

5.2 Issue 2 – Vibration

Issue 2: Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels? *(Less Than Significant Impact)*

Construction activities known to generate excessive ground-borne vibration, such as pile driving, would not be conducted by the project. The greatest anticipated source of vibration during general project construction activities would be from a dozer, which may be used within 25 feet of the nearest off-site structures to the north and south when accounting for setbacks. A dozer would create approximately 0.089 in/sec PPV at a distance of 25 feet (Caltrans 2020). This would be lower than what is considered a distinctly perceptible impact for humans of 0.24 in/sec PPV, and the structural damage impact of 0.4 in/sec PPV. Therefore, although a dozer may be perceptible to nearby human receivers, temporary impacts associated with the dozer (and other potential equipment) would be less than significant.

Operation of the project would not include substantial vibration sources. Therefore, operational vibration impacts would be less than significant.

5.3 Issue 3 – Airport Noise

Issue 3: For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? *(No Impact)*

The San Carlos Airport is located 2.25 miles to the northwest of the project site. According to the Comprehensive Land Use Plans for the airports, the project is not located within the noise contours for the airports (County Association of Governments of San Mateo County 2015). Therefore, no substantial noise exposure would occur to construction workers or users of the project site from aircraft noise, and no impacts would occur.

6 Conclusions

Construction noise would generate noise levels of up to 86 dBA L_{eq} at the closest noise-sensitive land uses, which would not exceed Redwood City's 110 dBA construction noise threshold

The project would introduce sources of operational noise to the site, including mechanical equipment (heat recovery unit and condensers). Operational noise levels would exceed daytime operational noise standards for the County at the residences to the south. Operational noise would be mitigated through Mitigation Measure NOI-1, which includes options for measures to reduce noise such as installing a sound barrier on the southern property boundary.

The project would not increase vehicle trips compared to the previous use, and no noise impacts from the project's vehicle trips would occur.

Operation of the project would not include substantial vibration sources. Groundborne vibration from construction activities, such as the use of a dozer, would not exceed the applicable vibration thresholds. Therefore, vibration impacts would be less than significant.

The project is not located within the noise contours for San Carlos Airport. Therefore, no substantial noise exposure would occur to construction workers or users of the project site from aircraft noise, and no impacts would occur.

7 References

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Appendix A

Previous Project Site Noise Report

SAN MATEO COUNTY NEW EMERGENCY MANAGEMENT CENTER (EMC) AND MOTORPOOL RELOCATION REDWOOD CITY, CALIFORNIA NOISE AND VIBRATION ASSESSMENT

December 10, 2014

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INTRODUCTION

This report presents the results of the noise and vibration assessment completed for the San Mateo County New Emergency Management Center (EMC) and Motor Pool Relocation Project, proposed in Redwood City, California. The project proposes to relocate existing Motor Pool Radio Shop facilities (Motor Pool) from 551 Winslow Street (Site 1) to 752 Chestnut Street (Site 2). A new EMC building would then be constructed at Site 1.

This report evaluates the project's potential to result in significant noise or vibration impacts with respect to applicable California Environmental Quality Act (CEQA) Guidelines. The report is divided into two sections. The Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions. The Impacts and Mitigation Measures Section evaluates the project with respect to the applicable regulatory noise and vibration criteria, temporary noise level increases resulting from project construction, and permanent noise level increases resulting from the operation of the project. Mitigation is then presented to reduce potentially significant impacts to less than significant levels.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level* (*dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the

variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the *Peak Particle Velocity (PPV)*. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Criteria

The project is located in the City of Redwood City. However, as a government entity, San Mateo County would be exempt from the City of Redwood City's regulatory thresholds. The project would be subject to noise-related regulations, plans, and policies established by the State of California and San Mateo County. These planning documents are implemented during the environmental review process to limit noise exposure at existing and proposed noise sensitive land uses.

Applicable planning documents include: (1) the CEQA Guidelines, Appendix G, (2) the San Mateo County General Plan, (3) the San Mateo County Municipal Code, and (4) the Federal Transit Administration (FTA). Regulations, plans, and policies presented within these documents form the basis of the significance criteria used to assess project impacts.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. CEQA asks the following applicable questions. Would the project result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies?

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

(e) For a project located within an airport land use plan or, where such a plan has not been adopted within two miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels?

(f) For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels?

Of these guidelines, items (a), (b), (c), and (d) are applicable to the proposed project. The project is not located in the vicinity of a public or private airstrip; therefore, checklist items (e) and (f) are not carried forward in this analysis.

San Mateo County General Plan, Chapter 16. San Mateo County offers qualitative noise goals and objectives, including: to 1) strive toward a livable noise environment, 2) reduce noise impacts through noise and land use compatibility and noise mitigation, 3) promote protection of noise sensitive land uses and noise reduction in quiet areas and noise impact areas, 4) give priority to reducing noise at the source rather than at the receiver, and 5) promote noise reduction through the use of techniques such as site planning, noise barriers, and architectural design and construction.

San Mateo County Code of Ordinances.

4.88.330 – Exterior noise standards. It is unlawful for any person at any location within the incorporated area of the County to create any noise, or to allow the creation of any noise on property owned, leased, occupied, or otherwise controlled by such person which causes the exterior noise level when measured at any single or multiple family residence, school, hospital, church, or public library situated in either the incorporated of unincorporated area to exceed the noise level standards as set forth in Table 4, below:

TABLE 4 Receiving Land Use: Single or Multiple Family Residence, School, Hospital, Church, or Public Library Properties.

Category	Cumulative Number of Minutes in Any One Hour Time Period	Daytime 7 am – 10 pm	Nighttime 10 pm – 7 am
1	30	55	50
2	15	60	55
3	5	65	60
4	1	70	65
5	0	75	70

a) In the event the measured background noise level exceeds the applicable nose level standard in any category above, the applicable standard shall be adjusted in five (5) dBA increments so as to encompass the background noise level.

b) Each of the noise standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

c) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in Table 4.

4.88.340 – Interior noise standards. No person shall, at any location within the unincorporated area of the County operate, or cause to be operated within a dwelling unit, any source of sound, or create, or allow the creation of, any noise which causes the noise level when measured inside a receiving dwelling unit with windows in their normal seasonal configuration to exceed the following noise level standards as set forth in Table 5:

TABLE 5 Interior Noise Level Standards – Dwelling Unit

Category	Cumulative Number of Minutes in Any One Hour Time Period	Daytime 7 am – 10 pm	Nighttime 10 pm – 7 am
1	5	45	40
2	1	50	45
3	0	55	50

a) In the event the measured background noise level exceeds the applicable nose level standard in any category above, the applicable standard shall be adjusted in five (5) dBA increments so as to encompass the background noise level.

b) Each of the noise standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

c) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in Table 5.

4.88.360 – Exemptions. The following activities shall be exempted from the provisions of this chapter:

d) Any mechanical device, apparatus, or equipment used, related to or connected with emergency machinery, vehicle, or work.
e) Noise sources associated with demolition, construction, repair, remodeling, or grading of any real property, provided said activities do not take place between the hours of 6:00 pm and 7:00 am on weekdays, 5:00 pm and 9:00 am on Saturdays, or at any time on Sundays, Thanksgiving, and Christmas.

4.88.380 – Exemption. Whenever, for the good of the public, a government agency, public utility, or private utility determines a project must be done before 7:00 am or after 6:00 pm, or weekends, and so states in its contract, change order(s), or bid documents, said work shall be exempted from this chapter.

Construction Vibration Guidelines. San Mateo County does not establish vibration thresholds applicable to the Project. The FTA establishes the following construction vibration damage criteria for various structural categories:

TABLE 6 Construction Vibration Damage Criteria

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

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Federal Transit Agency, Office of Planning and Environment, May 2006.

Existing Noise Environment

Illingworth & Rodkin, Inc. performed a noise monitoring survey to quantify ambient noise levels in the project area. Noise levels were measured from Friday, November 14th, 2014 through Tuesday, November 18th, 2014 adjacent to off-site noise sensitive receptors (residences).

The noise monitoring survey included three long-term (LT) noise measurements, approximately 96 hours in duration, and five short-term (ST) noise measurements, 10-minutes in duration. Measurement locations were selected to quantify baseline noise levels at representative sensitive receptor locations surrounding the project site. Sensitive receptors were identified through a review of aerial photos, plans for the proposed project, and during field reconnaissance. The primary source of noises at sensitive receptors surrounding the site were local traffic, local construction, and existing on-site activities.

Noise measurements were made with Larson Davis Model 820 Integrating Sound Level Meters set at "slow" response. The sound level meters were equipped with a G.R.A.S. Type 40AQ ½ - inch random incidence microphones fitted with windscreens. All instrumentation used meets the requirements of the American National Standards Institute (ANSI) SI.4-1983 for Type 1 use. The sound level meters were calibrated prior to the noise measurements using a Larson Davis Model CAL200 acoustical calibrator. The response of the system was checked after each measurement session and was always found to be within 0.2 dBA.

Measurement location LT-1 was at the end of Pine Street, south of Site 2. The primary daytime noise source at this location was ongoing construction activity at a residential site located to the west of the project site, across Winslow Street. Hourly average daytime noise levels typically ranged from 50 to 60 dBA L_{eq} over the weekend at this location and from 53 to 62 dBA L_{eq} on weekdays. Hourly average nighttime noise levels dropped as low as 47 dBA L_{eq}. The L_{dn} at this location ranged from 59 to 62 dBA.

Location LT-2 was southeast of the childcare facility located adjacent to Site 1. The primary daytime noise sources at this location were distant traffic and occasional project site operations. Hourly average daytime noise levels typically ranged from 55 to 60 dBA L_{eq}, but increased to 65 to 69 dBA L_{eq} on Saturday evening and Sunday afternoon. Hourly average nighttime noise levels dropped as low as 48 dBA L_{eq}. The L_{dn} at this location ranged from 61 to 66 dBA.

Measurement location LT-3 was about 55 feet south of the center of Brewster Avenue, to the north of Site 1. The primary daytime noise source at this location was traffic on Brewster Avenue. Hourly average daytime noise levels typically ranged from 58 to 66 dBA L_{eq}. Hourly average nighttime noise levels dropped as low as 51 to 53 dBA L_{eq}. The L_{dn} at this location ranged from 64 to 66 dBA.

Data collected during the short-term (10-minute) measurements are summarized in Table 7.

TABLE 7 Summary of Short-Term Noise Measurement Data

Noise Measurement Location (date, time)		Measured Noise Level, dBA						Est. L_{dn}, dBA	Primary Noise Source(s)
		L_{max}	$L_{(2)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}		
Site 2	ST-1: 715 Chestnut Street, (11/18/14, 11:10-11:20)	73	71	68	58	50	63	64	Traffic on Chestnut Street
	ST-2: 643 Buckeye Street, (11/18/14, 11:30-11:40)	64	53	50	47	45	48	50	Distant traffic, On-site operations
	ST-3: End of Spruce Street, (11/18/14, 11:50-12:00)	73	68	63	58	54	61	62	Traffic on Woodside Road
	ST-4: In Front of Shop (11/14/14, 10:40-10:50)	69	63	58	50	48	55	57	Occasional on-site operations
Site 1	ST-5: North of Site 1 Service Bays (11/18/14, 12:10-12:20)	63	60	58	56	52	56	58	Traffic on Woodside Road, Occasional on-site operations

Figures 1 and 2 show the project vicinity and noise monitoring locations at Sites 1 and 2, respectively. The long term measurement results are shown in Figures 3, 4, and 5.

FIGURE 1 Long-Term (LT) and Short-Term (ST) Noise Measurement Locations, Site 1

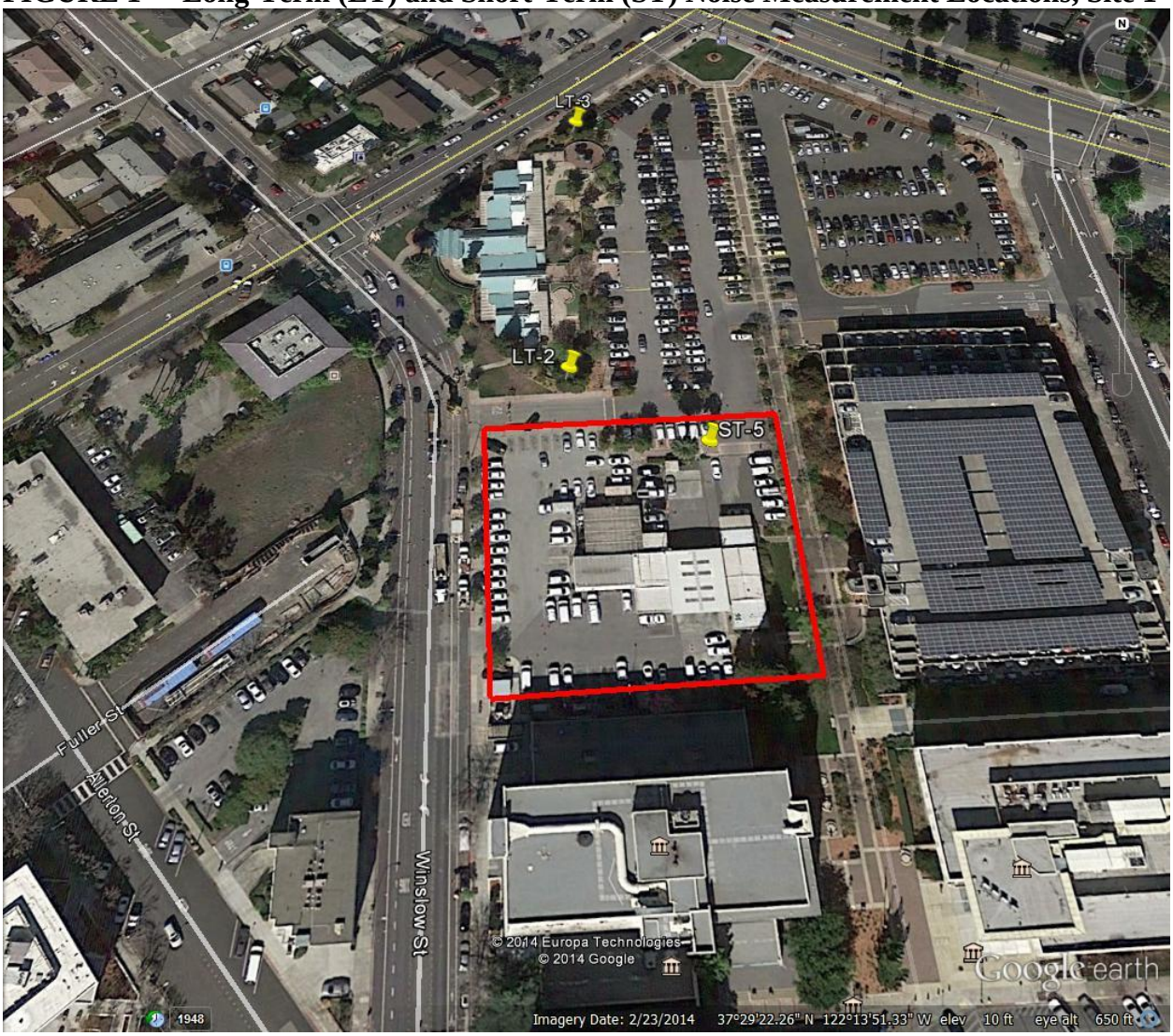


FIGURE 2 Long-Term (LT) and Short-Term (ST) Noise Measurement Locations, Site 2

FIGURE 3 Measured Noise Levels at Location LT-1

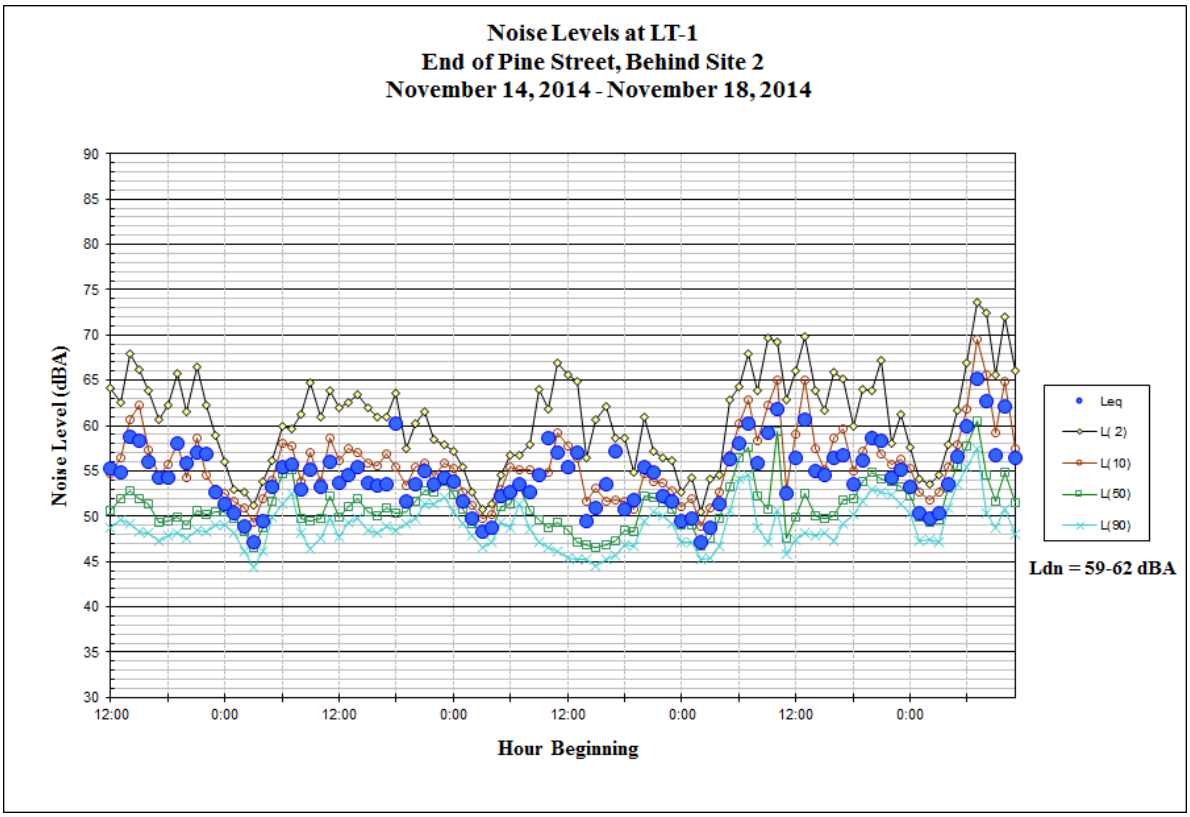


FIGURE 4 Measured Noise Levels at Location LT-2

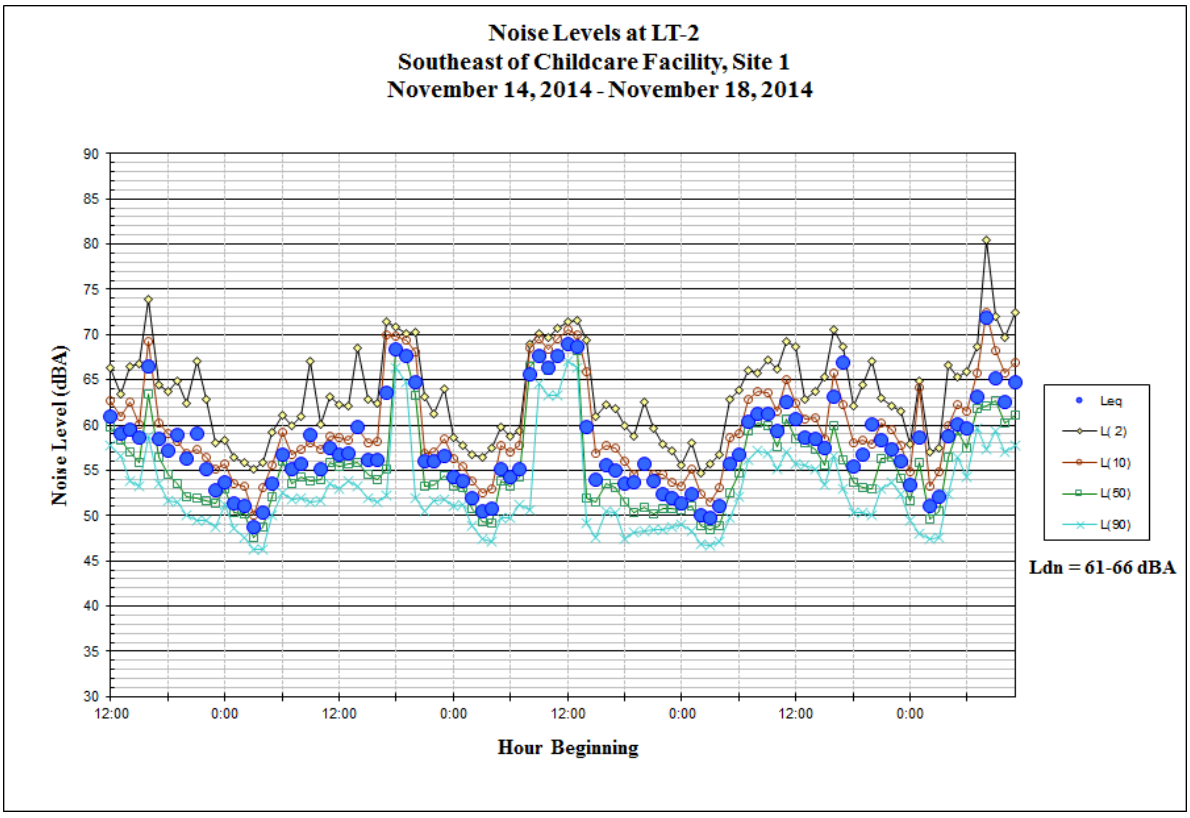
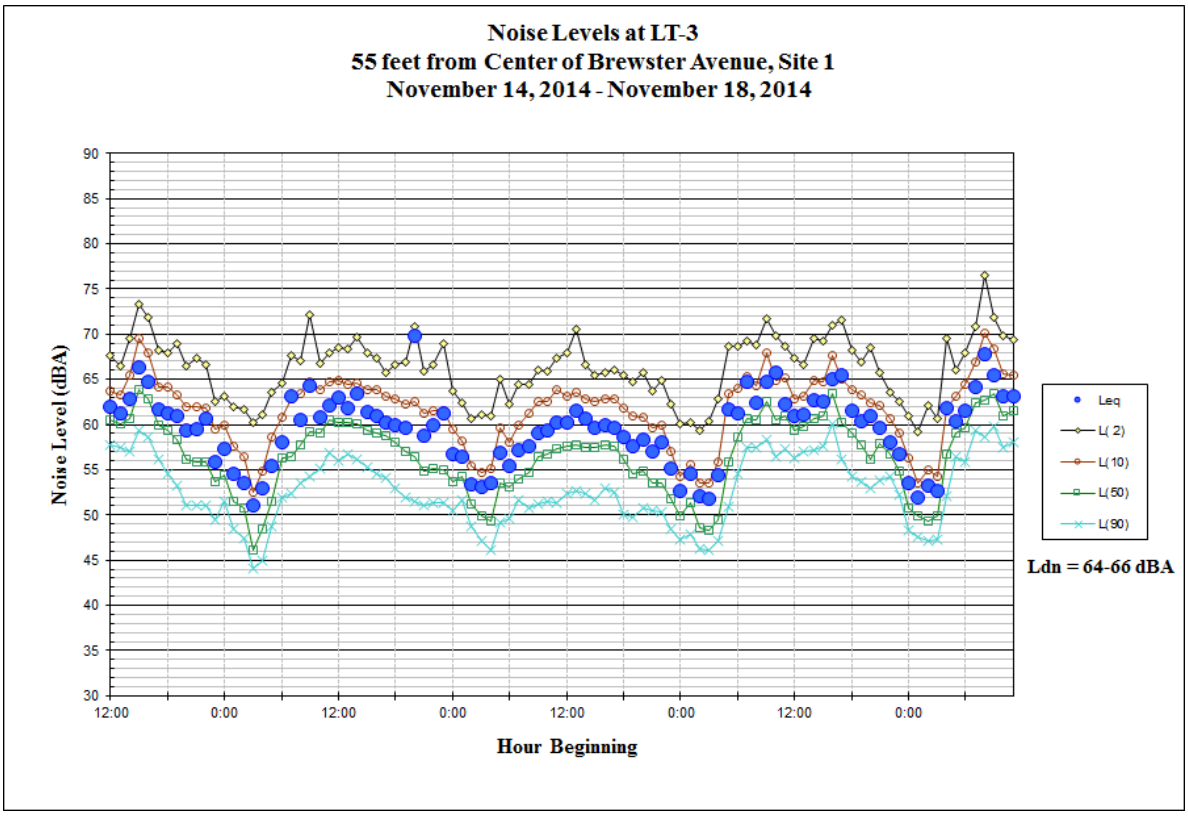


FIGURE 5 Measured Noise Levels at Location LT-3



NOISE IMPACTS AND MITIGATION MEASURES

Significance Thresholds

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise and groundborne vibration resulting from the Project:

a) Excess of Noise Standards: A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the San Mateo County General Plan or Municipal Code.

- Operational noise at adjacent single family residential property lines is limited to the following:
  - 55 dBA L_{50} (the sound level exceeded more than 30 minutes in any hour) between the hours of 7:00 am and 10:00 pm and 50 dBA L_{50} between the hours of 10:00 pm and 7:00 am.
  - 60 dBA L_{25} (the sound level exceeded more than 15 minutes in any hour) between the hours of 7:00 am and 10:00 pm and 55 dBA L_{25} between the

hours of 10:00 pm and 7:00 am.

- 65 dBA L_8 (the sound level exceeded more than 5 minutes in any hour) between the hours of 7:00 am and 10:00 pm and 60 dBA L_{10} between the hours of 10:00 pm and 7:00 am.
- 70 dBA L_2 (the sound level exceeded more than 1 minute in any hour) between the hours of 7:00 am and 10:00 pm and 65 dBA L_2 between the hours of 10:00 pm and 7:00 am.
- 75 dBA L_{max} (the sound level exceeded more than 0 minutes in any hour) between the hours of 7:00 am and 10:00 pm and 70 dBA L_2 between the hours of 10:00 pm and 7:00 am.
- If the measured ambient level exceeds the limits above, the noise limits are increased in five dB increments in each category as appropriate.
- Noise limits are reduced by 5 dB for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

- Noise generating construction activities are limited to between the hours of 7:00 am and 6:00 pm on Weekdays and 9:00 am and 5:00 pm on Saturdays, with no work occurring on Sundays or holidays, Thanksgiving, and Christmas. Government agencies can be exempted from these time limitation by stating the need to construct outside these hours in its contract, change order(s), or bid documents.

b) Vibration Exposure: A significant impact would be identified if the project would expose persons to excessive vibration levels. Groundborne vibration levels from construction activities exceeding 0.20 in/sec PPV would result in a significant impact as such levels would have the potential to result in damage to older residential buildings.

c) Permanent Noise Increase: San Mateo County does not define what noise level increase is considered substantial. Following standard practice, a project would result in a significant impact if the project would permanently increase existing noise levels by 5 dBA L_{dn} or more but remain below the normally acceptable noise threshold (assumed to be 55 dBA L_{dn} for residential uses based on the noise standards specified above), or permanently increase existing noise levels by 3 dBA L_{dn} or more and exceed the normally acceptable noise threshold.

d) Temporary Noise Increase: San Mateo County does not define a temporary noise increase limit for construction. Temporary noise increases, such as those resulting from project construction activities, are treated somewhat differently than operational noise sources because the increase is not permanent. Following standard practice, a significant noise impact would be identified if construction noise levels exceeded 60 dBA L_{eq} and the ambient by 5 dBA L_{eq} or more for a period of more than 12 months.

a) Would the project result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? *Less than Significant Impact With Mitigation Incorporated.*

This section evaluates the potential for the project to generate noise levels in excess of the County's noise limits.

On-Site Construction Noise

The San Mateo County Municipal Code restricts construction activities to the hours of 7:00 am and 6:00 pm on Weekdays and 9:00 am and 5:00 pm on Saturdays, with no work occurring on Sundays or holidays, Thanksgiving, and Christmas. Government agencies can be exempted from these time limitation by stating the need to construct outside these hours in its contract, change order(s), or bid documents.

Project construction is proposed to occur within these hours. As a result, this is a **less-than-significant** impact.

Project Operational Noise

The County's Municipal Code restricts operational noise to 55 dBA L_{50} between the hours of 7:00 am and 10:00 pm and 50 dBA L_{50} between the hours of 10:00 pm and 7:00 am at all residential property lines or to the level of the ambient noise environment. Based on information provided, the following would be included in the project:

- Site 1 (Proposed EMC at 551 Winslow Street)
    - Remove Motor Pool and associated noise generating activities
        - Existing activities primarily indoors with operations not audible outside
        - Existing outdoor activities primarily manual with no mechanical equipment
    - Construct EMC building
        - Primarily office uses
        - Increased use during emergencies (up to 24/7)
        - Up to 33 temporary employees during emergencies
        - Rooftop HVAC
        - Below grade emergency generators
- Site 2 (Proposed Motor Pool at 752 Chestnut Street)
    - Relocation of Motor Pool and associated activities to site
        - Noise levels would be similar to existing levels measured at Site 1
    - Replacement of southern building with larger Butler Building
        - Office and storage uses
        - Replacement of storage sheds with mechanical bays
    - Outdoor compressor with sound attenuating walls and/or enclosure

Site 1 (511 Winslow Street)

The proposed EMC building would primarily house office type uses, which would not be anticipated to generate high noise levels. Noise impacts resulting from HVAC systems can vary considerably depending on the equipment selected, the system design, and the location of the equipment relative to the noise sensitive use. Noise levels from commercial HVAC systems are typically in the range of 60 to 70 dBA L_{eq} at a distance of 15 feet. The closest noise sensitive

uses (the childcare facility and residences under construction across Winslow Street) are about 150 feet from the proposed EMC building. At this distance, rooftop HVAC noise would be inaudible, below ambient sounds due to traffic along local roadways.

Two emergency generators are proposed below grade in the southern portion of the site, about 270 feet from the childcare center and 200 feet from the residences under construction across Winslow Street. Emergency operations and generators would be exempt from the County's Code during emergency operations, but would not be exempt during testing operations. Based on our experience with similar projects, generators are anticipated to be tested weekly for a period of 10 to 20 minutes during daytime hours and would generate noise levels in the range of 70 to 80 dBA at a distance of 23 feet. At a distance of 200 feet, and assuming an insertion loss of about 20 dB due to the underground location of the equipment, generator noise would be anticipated to be in the range of 51 to 61 dBA. Noise levels would be about 3 dBA lower at the childcare facility. These levels could exceed the 55 dBA L_{50} criteria during hours when testing occurs. This is a **potentially significant** impact.

Mitigation Measure N-1: Ensure that the Site 1 emergency generators do not exceed the County's Municipal Code standards during weekly testing at any adjacent residential property line or at the childcare facility. This can be achieved through the following measures:

- All testing of the generators shall be conducted between the hours of 7:00 am and 10:00 pm on weekdays.
- The generators shall be designed to meet a combined noise level of 74 dBA or less at a distance of 23 feet from the location of the underground structure housing the generators. A combination of selecting 'quiet' equipment, locating venting away from sensitive uses, and/or using sound attenuating walls or enclosures could be used to achieve this standard.
- A project-level noise analysis, based on the final design plans, shall be prepared to identify the specific controls necessary to reduce operational noise levels to meet the standards.

The incorporation of these measures would reduce the impact to a less than significant level.

Site 2 (752 Chestnut Street)

Proposed Motor Pool activities are anticipated to be similar to activities currently occurring at the Motor Pool located at Site 1. At Site 1, existing Motor Pool operations were observed to be primarily located indoors and were not audible outside the bays during the noise monitoring survey. Outdoor activities observed during the noise monitoring survey included occasional, brief periods of truck backup alarm use and the hand washing of vehicles. Neither of these activities generated considerable noise. An outdoor compressor is proposed to be installed behind the new Butler Building, which is adjacent to residences to the south. The compressor is specified to have sound attenuating walls and/or be enclosed to mitigate noise impacts; however, the exact specifications of this piece of equipment are unavailable at this time. Without mitigation, it is possible that the compressor would exceed the Municipal Code standards. This is a **potentially significant** impact.

Mitigation Measure N-2: Ensure that noise generated by Site 2 mechanical equipment, including the proposed compressor, does not exceed the County's Municipal Code standards (55

dBA L_{50} between the hours of 7:00 am and 10:00 pm and 50 dBA L_{50} between the hours of 10:00 pm and 7:00 am) at any adjacent residential property line. This can be achieved through the selection of 'quiet' equipment, locating enclosure openings, venting, etc., away from residences, and/or the use of sound attenuating walls. A project-level noise analysis, based on the final design plans, shall be prepared to identify the specific controls necessary to reduce operational noise levels to meet the standards.

The incorporation of these measures would reduce the impact to a less than significant level.

b) Would the project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels? *Less than Significant Impact.*

For structural damage, the FTA uses a construction vibration limit of 0.5 in/sec PPV for reinforced concrete, steel, or timber buildings (no plaster), 0.3 in/sec PPV for engineered concrete and masonry buildings (no plaster), 0.2 in/sec PPV for non-engineered timber and masonry buildings, and a limit of 0.12 in/sec PPV for buildings that extremely susceptible to vibration damage. The conservative building damage limit of 0.2 in/sec PPV is used in this discussion.

Construction activities would result in varying levels of groundborne vibration, depending on the equipment used, construction activities, and the location of equipment. Typically, the primary source of major construction vibration impacts for this type of project would be impact pile driving, blasting, and possibly the movement of large tracked dozers and compactors. For the EMC Project, the use of blasting, impact pile driving, and tracked dozers and compactors is not anticipated. Typical vibration levels for construction equipment at a distance of 25 feet are indicated in Table 8.

TABLE 8 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)
Pile Driver (Impact)	upper range	1.158
	typical	0.644
Pile Driver (Sonic)	upper range	0.734
	typical	0.170
Clam shovel drop		0.202
Hydromill (slurry wall)	in soil	0.008
	in rock	0.017
Vibratory Roller		0.210
Hoe Ram		0.089
Large bulldozer		0.089
Caisson drilling		0.089
Loaded trucks		0.076
Jackhammer		0.035
Small bulldozer		0.003

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Federal Transit Agency, Office of Planning and Environment, May 2006.

Based on an analysis of equipment likely to be used by contractors, vibration levels generated by project construction equipment would be below the 0.2 in/sec PPV criterion used to assess the potential for cosmetic or structural damage to nearby buildings within a distance of 25 feet. There are no existing structures located within 25 feet of proposed construction activities. As such, structural damage on the surrounding structures would not be expected. This is a **less-than-significant** impact.

Mitigation Measures: None Required

c) Would the project result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project? *Less than Significant Impact With Mitigation Incorporated.*

The project would be considered to result in a significant impact if the project would permanently increase existing noise levels by 5 dBA or more but remain below the normally acceptable noise threshold (55 dBA L_{dn} for residential uses), or permanently increase existing noise levels by 3 dBA or more and exceed the normally acceptable noise threshold.

On-site Operations

Based on noise monitoring conducted for this study (see discussion under Existing Noise Environment), ambient noise levels at the childcare facility and adjacent residences under construction nearest Site 1 were calculated to be 61 to 66 dBA L_{dn}, based on their proximity to Winslow Street and Brewster Avenue. Ambient noise levels at residences nearest Site 2 were calculated to be 50 to 64 dBA L_{dn}, depending on their proximity to local roadways.

Operational noise was described in Item a) with respect to the applicable local limits contained in the San Mateo County Municipal Code. As described in Item a), new operational activities at Site 1would not be anticipated to be audible during daytime or nighttime hours at the adjacent childcare facility or residences under construction. At Site 2, proposed operational activities are not anticipated to increase noise levels by more than 1 dBA L_{dn} above existing levels, which the possible exception of the proposed compressor, as described in Item a). **Mitigation Measure N-1** would reduce this impact to a less-than-significant level.

Project Traffic

The County Public Works Department determined that a traffic study was not warranted for this project and thus, a traffic study was not prepared. Due to the proximity of the two sites to each other, the relocation of the Motor Pool from Site 1 to Site 2 is not anticipated to generate any substantial changes in traffic volumes or patterns. During emergency operations, up to 33 additional staff would utilize the EMC Building; however, emergency operations would typically be exempt from the County's standards and this small increase in vehicles would not be anticipated to substantially increase traffic noise levels on the roadway network. This is a **less-than-significant** impact.

Mitigation Measures: None Required.

d) Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project? *Less than Significant Impact.*

Item a) evaluated construction noise with regard to applicable local limits contained in the San Mateo County Municipal Code. The discussion below evaluates the noise impacts resulting from project construction activities when compared to ambient noise conditions. Typically, construction activities would be considered to result in a significant temporary noise increase if noise generating activities would occur for longer than 12-months and noise levels are anticipated to exceed 60 dBA L_{eq} and the ambient by 5 dBA L_{eq} or more at nearby noise sensitive receptors.

Construction equipment noise varies greatly depending on the construction activity performed, type and specific model of equipment, and the condition of equipment used. Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise generating activities, the distance between construction noise sources and noise sensitive receptors, any shielding provided by intervening barriers or structures, and existing ambient noise levels.

Construction noise levels would vary by phase and vary within phases based on the amount of equipment in operation and location where the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 9 and 10. Table 9 shows the average noise level range by construction phase and Table 10 shows the maximum noise level range for different construction equipment. Table 9 levels are consistent with construction noise levels calculated for the project using the Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM), including the anticipated equipment that would be used for each phase of the project. Most demolition and construction noise is in the range of 80 to 90 dBA at a distance of 50 feet from the source.

TABLE 9 Typical Ranges of Construction Noise Levels at 50 Feet, dBA L_{eq}

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	**II**	**I**	**II**	**I**		**I**	**II**
Ground Clearing	83	83	84	84	84	8	84	84
Excavation	88	75	89	79	89	7	88	78
Foundations	81	81	78	78	77	7	88	88
Erection	81	65	87	75	84	7	79	78
Finishing	88	72	89	75	89	7	84	84
I - All pertinent equipment present at site, **II** - Minimum required equipment present at site.								

Source: U.S. EPA., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 10 Construction Equipment 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:
1 Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.
2 Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
3 Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

The highest noise levels would be generated during demolition, site preparation, excavation, grading, and trenching. Noise generated during construction of structures is generally lower. Once construction moves indoors, minimal noise would be generated at off-site locations. During construction, maximum noise levels would vary depending on the equipment operating on site. The typical range of maximum noise levels would be 80 to 90 dBA L_{max} at a distance of 50 feet. Hourly average noise levels generated by construction are about 81 dBA to 88 dBA L_{eq} measured at a distance of 50 feet from the center of a busy construction site. Hourly average construction noise levels associated with the erection of the project buildings would be anticipated to range from approximately 63 to 71 dBA at a distance of 50 feet. The noise levels associated with construction of the project buildings would be substantially less than the noise levels associated with demolition, grading, and pavement activities during project site preparation.

Noise sensitive properties closest to Site 1 include the childcare facility and residences under construction across Winslow Street, both located about 150 feet from the location of the proposed EMC Building. At Site 2, residences are located directly adjacent to the project site. Construction noise levels typically drop off at a rate of about 6 dBA per doubling of distance. Noise levels at a distance of 150 feet would be about 10 dBA lower than those specified above and in Tables 9 and 10. Shielding provided by barriers or structures can provide an additional 5 to 10 dBA noise reduction at distant receptors.

Construction would occur within the allowable hours under the County's municipal code. The duration of construction is anticipated to be about 14 months at Site 1 and about 6 months at Site

2. At Site 1, existing daytime noise levels range from about 55 to 65 dBA L_{eq} at nearby noise sensitive land uses (childcare facility and residences under construction across Winslow Street). Construction noise levels are anticipated to be 71 dBA to 78 dBA L_{eq} at the sensitive uses during periods of heavy construction. Noise levels would be substantially lower during building construction and when construction is moved indoors. Although construction noise is anticipated to exceed 60 dBA L_{eq} and the ambient by 5 dBA L_{eq} or more at nearby noise sensitive receptors during periods of heavy construction such as demolition and site preparation, these higher noise levels are not anticipated to occur for a period greater than 12 months. Construction at Site 2 would exceed 60 dBA L_{eq} and the ambient by 5 dBA L_{eq} or more at nearby noise sensitive receptors; however, construction is anticipated to be completed within 6 months. As a result, this would be considered a **less-than-significant** impact, assuming the following list of 'best practices' is included in the project:

- Per San Mateo County's Municipal Code, construction activities and noise generating construction activities shall be limited to between the hours of 7:00 am and 6:00 pm on Weekdays and 9:00 am and 5:00 pm on Saturdays, with no work occurring on Sundays or holidays, Thanksgiving, and Christmas. If construction is necessary outside of these hours, the County shall state the need to construct outside these hours in its contract, change order(s), or bid documents.

- Prohibit unnecessary idling of internal combustion engines. Equip all equipment driven by internal combustion engines with mufflers which are in good mechanical condition, appropriate for the equipment, and no less effective that those originally installed by the manufacturer.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Locate stationary noise-generating equipment such as air compressors or portable power generators as far as possible from sensitive receptors and place equipment so that emitted noise is directed away from nearby sensitive receptors.

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment when located within 200 feet of adjoining sensitive land uses. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receiver and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- Notify all neighbors located adjacent to the construction site of the construction schedule in writing.

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine

the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and instituting reasonable measures as warranted to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule.

Mitigation Measures: None Required.

Appendix B

Operational Equipment Specifications

DAIKIN

User Guide Daikin City

CAD CART (0)

By Keyword

All Categories > VRV > VRV Heat Recovery Outdoor Units > VRV IV X Heat Recovery Outdoor Units – REYQ_XA Series > Item # REYQ144XATJU

ITEM # REYQ144XATJU, VRV HEAT RECOVERY OUTDOOR UNITS - REYQ_XATJU SERIES

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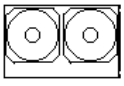
3D

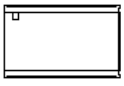
2D Front View

2D Left Side View

2D Right Side View



2D Top View



2D Bottom View

2D Back View

Specifications | Dimensions

Power Supply	3 phase, 208 / 230 V, 60 Hz
Nominal Cooling Capacity	144000 Btu/h 42.2 kW
Rated Cooling Capacity	138000 Btu/h 40.4 kW
Nominal Heating Capacity	162000 Btu/h 47.5 kW
Rated Heating Capacity	154000 Btu/h 45.1 kW
Min/Max Volts	187/253 V
Maximum Overcurrent Protection	70 A
Min. Circuit Ampacity	58.3 A
Compressor Rated Load Amps	42.6 A
Outdoor Fan Motor - Rated Output	0.8 × 2 kW 2.9 × 2 A
Short-Circuit Current Rating	SCCR kA rms, Symmetrical 600 V MAX: 5
Color	Ivory White (5Y7.5/1)
Heat Exchanger	Cross Fin Coil
Compressor Type	Hermetically Sealed Scroll Type
Compressor Volume	27.7 m³/h
Compressor Number of Revolutions	5.214

Compressor Number of Revolutions	5.214 rpm
Compressor Motor Output x Number of Units	8.0 x 1 kW
Compressor Starting Method	Soft Start
Fan Type	Propeller Fan
Fan Motor Output	0.8 x 2 kW
Fan Air Flow Rate	9480 ft³/min 268 m³/min
Fan Drive	Direct Drive
Weight	360 kg 793 lb
Sound Level	65 dB
Sound Power Level (Reference Data)	87 dB
Safety Devices	High Pressure Switch, Fan Driver Overload Protector, Overcurrent Fuse, Inverter Overload Protector, Leak Detecting Device
Defrost Method	Deicer
Capacity Control	14 to 100 %
Refrigerant Name	R410A
Refrigerant Control	Electronic Expansion Valve
Refrigerant Charge	25.8 lb 11.7 kg
Standard Accessories	Installation Manual, Operation Manual, Connection Pipes, Clamps

Revit Model

DAIKIN

User Guide Daikin City

CAD CART (0)

By Keyword

All Categories > Single Zone Systems > Single Zone Cooling Only Outdoor Units > Single Zone Cooling Only Outdoor Units - RK Series > Model Number RK18NMVJU

MODEL NUMBER RK18NMVJU, 1.5-TON WALL MOUNTED UNIT COOLING ONLY

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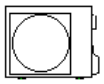
Specifications | Dimensions | System Efficiency Metrics | Features | Benefits

DOWNLOADS

Revit Family Download

VIEW CAD DRAWING

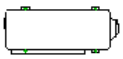
3D



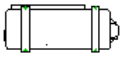
2D Front View

2D Left Side View

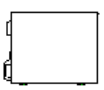
2D Right Side View



2D Top View

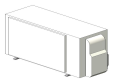


2D Bottom View



Frequency	60 Hz
Voltage	208-230 V
Current	6.77 - 6.12 A
Cooling Capacity	18000 Btu/h
Airflow Rate (H)	69.7 m³/min 2461 ft³/min
Airflow Rate (SL)	59.7 m³/min 2108 ft³/min
Compressor Type	Hermetically Sealed Swing Type
Compressor Model	2YC36PXD
Compressor Motor Output	1100 W
Refrigerant Oil Type	FVC50K
Refrigerant Type	R-410A
Refrigerant Charge	2.49 lb 1.13 kg
Fan Type	Propeller
Fan Motor Output	69 W
Power Consumption (Rated)	1383 - 1383 W
Power Factor	98.2 - 98.3 %
Sound Pressure Level (H) - Cooling	54 dBA
Max/Min Cooling Capacity	20000/5500 Btu/h
Rated Cooling Conditions	Ambient (°F DB/WB): 95 / 75 Indoor (°F DB/WB): 80 / 67
Rated Heating Conditions	Ambient (°F DB/WB): 47 / 43 Indoor (°F DB/WB): 70 / 70
Power Supply	208-230 V/ 60 Hz / 1 Phase
Heat Insulation	Both Liquid and Gas Pipes
Moisture Removal	1.00 gal/h
Starting Current	7.20 A
Chargeless	32-13/16 ft 10 m
Gross Weight	115 lb 52 kg
Weight	97 lb 44 kg

2D Back View



Revit Model

Cat® C7.1 DIESEL GENERATOR SETS

Image shown may not reflect actual configuration

125 ekW – 200 ekW

60 Hz

Standby	Prime
125 ekW	114 ekW
150 ekW	135 ekW
175 ekW	158 ekW
200 ekW	-

BENEFITS & FEATURES

CAT® GENERATOR SET PACKAGE

Cat generator set packages have been fully prototype tested and certified torsional vibration analysis reports are available. The packages are designed to meet the NFPA 110 requirement for loading, conform to the ISO 8528-5 steady state and fill transient response requirements.

CAT DIESEL ENGINES

The four-cycle Cat diesel engine combines consistent performance with excellent fuel economy and transient response that meets or exceeds ISO 8528-5. The engines feature a reliable, rugged, and durable design that has been field proven in thousands of applications worldwide in emergency standby installations.

COOLING SYSTEM

The cooling system has been designed and tested to ensure proper generator set cooling, and includes the radiator, fan, belts, and all guarding installed as standard. Contact your Cat dealer for specific ambient and altitude capabilities.

GENERATORS

The generators used on Cat packages have been designed and tested to work with the Cat engine. The generators are built with robust Class H insulation and provide industry-leading motor starting capability and altitude capabilities.

EMCP CONTROL PANELS

The EMCP controller features the reliability and durability you have to come to expect from your Cat equipment. The EMCP 4 is a scalable control platform designed to ensure reliable generator set operation, providing extensive information about power output and engine operation. EMCP 4 systems can be further customized to meet your needs through programming and expansion modules.

SPECIFICATIONS

ENGINE SPECIFICATIONS

Engine Model	Cat® C7.1 ACERT In-line 6, 4-cycle diesel
Bore x Stroke	105mm x 127mm (4.1in x 5.0 in)
Displacement	7.01 L (428 in^3)
Compression Ratio	16.7:1
Aspiration	Turbocharged Air-to-Air-Aftercooled
Fuel Injection System	Electronic, Common Rail
Governor	Electronic ADEM™ A4
Emission Certifications	US EPA TIER III Non-Road

GENERATOR SET SPECIFICATIONS

Alternator Design	Brushless Single Bearing, 4 Pole
Stator	2/3 Pitch
No. of Leads	12
Available Voltage Options	600/480/440/240/220V
Frequency	60Hz
Alternator Voltage	12V
Alternator Insulation & IP	Class H; IP23
Standard Temperature Rise	125/130 Deg C
Available Excitation Options	Self-Excited, AREP
Voltage Regulation, Steady State+/-	≤1%

Cat® C7.1 DIESEL GENERATOR SETS

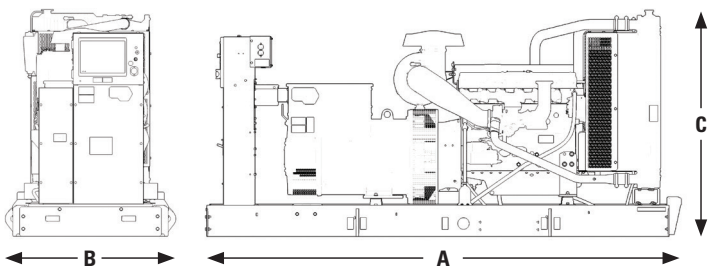
STANDARD EQUIPMENT

Air inlet system	Aftercooler core Turbocharger
Control panels	EMCP4.2 control panel
Cooling system	Radiator and cooling fan complete with protective guards Standard ambient temperatures up to 50degC (122degF) 50% coolant antifreeze/corrosion inhibitor Coolant Reservoir
Fuel system	Primary & secondary fuel filters Fuel priming pump Flexible fuel lines
Generators and generator attachments	Brushless, self-excited 2/3 pitch, random wound IP23 Protection Insulation Class H and temperature rise Integrated Voltage Regulator
Governing system	Cat Electronic Governor (ADEM A4)
Protection System	Safety Shutoff – Low Oil Pressure Safety Shutoff – Overspeed Coolant Level Sensor
Starting/charging system	12-Volt Electric Starting Motor Batteries with rack & cables
General	Paint – Caterpillar Yellow except rails and radiators gloss black

OPTIONAL EQUIPMENT

Air inlet system	Single Element air filter Cartridge type air filter
Exhaust	Industrial, residential, critical mufflers
Control panels	Remote Annunciators Discrete I/O Module Earth (Ground) Fault Relay
Circuit Breakers	3-Pole 100% Rated – Single & Dual breaker combination
Enclosures	Sound Attenuated (SA) – Level 1 & Level 2 Weather Protective Aluminum Enclosure
Cooling system	Radiator Stone guards
Mufflers	Industrial grade (10 dBA) Residential and Critical grade (25 dBA) & 35 dBA mufflers
Fuel System	Sub Tank Bases: 408, 777 Gal
Generators and generator attachments	Excitation – Self Excitation –PMG Oversize
Starting/charging system	Standard Battery Set
Certifications	UL2200 Listed Certification of Compliance – IBC Seismic
General	Tool Set

WEIGHTS & DIMENSIONS



Note: General configuration not to be used for installation. See general dimension drawings for detail.

Standby Ratings	Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Generator Set Weight kg (lb)
125 ekW	3039 (120)	1110 (44)	1476 (58)	1500 (3307)
150 ekW	3039 (120)	1110 (44)	1476 (58)	1500 (3307)
175 ekW	3039 (120)	1110 (44)	1476 (58)	1500 (3307)
200 ekW	3039 (120)	1110 (44)	1476 (58)	1500 (3307)

Image shown may not reflect actual configuration

Integral and Sub Base Fuel Tanks

Features

- UL Listed for United States (UL 142) and Canada (CAN/ULC S601)
- Facilitate compliance with NFPA 30 code, NFPA 37 and 110 standards and CSA C282 code and B139-09 standard
- Welded, heavy steel gauge construction with a containment basin sized as a minimum 110% of the tank
- Gloss black polyester triglycidyl isocyanurate
- (TGIC) powder coating
- Dedicated external customer interface area with access to the 4" (101.6 mm) fuel fill, visual level gauge, normal and emergency vents
- Rear electrical stub-up area with removable access panel
- Removable engine supply and return dip tubes
- Two additional 1" (25.4 mm) ports for customer use
- Tanks are rated to safely support the weight of the generator
- 8 gal (30.3 L) drip pan for oil and coolant (for generator sets up to 60 ekW only)
- Standard NPT tank fittings
- UL listed emergency vents sized as per UL standards 3" (76.2 mm), 4" (101.6 mm), and 5" (127 mm) NPT
- Normal atmospheric vent 1-1/4" (31.75 mm)
- Top-mounted fuel level sensor with control panel alarms
- Top-mounted leak detection switch
- Lockable fuel fill cap, 4" (101.6 mm) NPT

Description

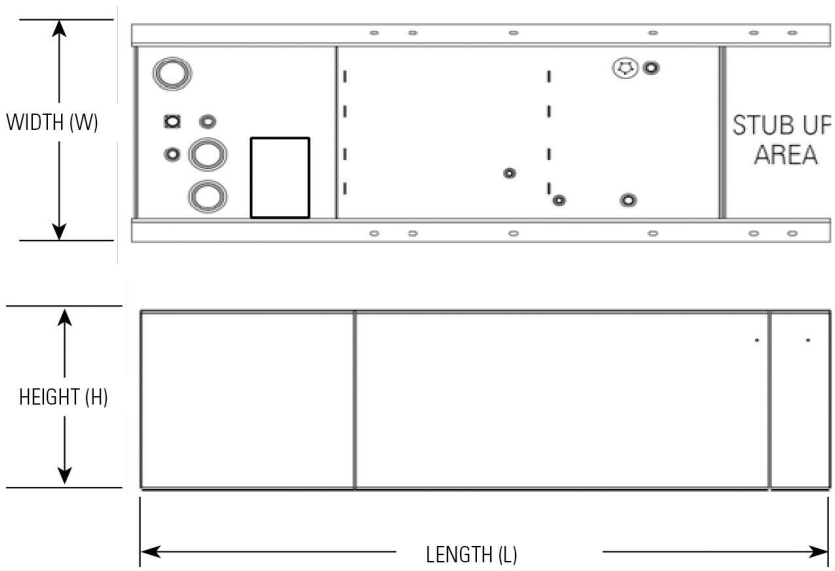
- Dual wall, secondary containment
- Pressure tested to UL requirements
- Fuel tank mounts directly below generator skid base
- Modular tank design is compatible with all factory units open and enclosed

Options

- Emergency vent and normal vent extension kits 12' (3.66 m)
- 5 gal (18.9 L) spill containment
- Overfill prevention valve
- Tank riser to allow for visual secondary containment leak inspection
- Drop tube

Sub-Base Fuel Tank Capacities with Fuel Tank Dimensions

Engine Model	Tank Feature Code	Generator Set Rating ekW	Est. Run Time hrs	Fillable Capacity		Usable Capacity		Vent	Length 'L'		Width 'W'		Height 'H'		Weight (Dry)	
				L	gal	L	gal	in	mm	in	mm	in	mm	in	kg	lb
C7.1	FSBTI24	125	40	1520	402	1495	395	4	4035	158.9	100	39.4	647	25.5	720	1587
		150	35													
		175	29													
		200	27													
	FSBTJ48	125	78	2940	777	2918	771	5	5035	198.2			933	36.7	1145	2524
		150	68													
		175	57													
		200	52													



Tanks are UL Listed and constructed in accordance with UL Standard for Safety UL 142, Steel Aboveground Tanks for Flammable and Combustible Liquids and Canada CAN/ULC Fabricated Steel above ground Horizontal Tanks for Flammable and Combustible Liquids

Fuel tanks facilitate compliance with the following United States NFPA Code and Standards:
N FPA 30: Flammable and Combustible Liquids code
NFPA 37: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 110: Standard for Emergency and Standby Power Systems

Fuel tanks facilitate compliance with the following Canadian Standard and Code:
CSA C282 – Emergency Electrical Power Supply for Buildings
CSA B139-09 – Installation Code for Oil-Burning Equipment

Image shown may not reflect actual configuration

Weather Protective and Sound Attenuated Enclosures

60Hz

Features

Robust/Highly Corrosion Resistant Construction

- Stainless steel flush fitting latches and hinges tested and proven to withstand extreme conditions of corrosion
- Zinc plated or stainless steel fastener

Excellent Access

- Single side access for service and controls
- All non-service sides have removable doors and/or panels
- Radiator fill access
- Lube oil and coolant drains piped to the exterior of the enclosure base
- Large cable entry area for installation ease
- Double doors on both sides
- Vertically hinged doors with solid bar door stays to hold doors in place when open

Security and Safety

- Lockable access doors which give full access to control panel and breaker
- Cooling fan and battery charging alternator fully guarded
- Fuel fill, oil fill, and battery can only be reached via lockable access
- Stub-up area is rodent proof.

Transportability

- These enclosures are of extremely rugged construction to withstand outdoor exposure and rough handling common on many construction sites. The sound deadening material is of a self-extinguishing design
- This range of enclosures are designed on modular principles with many interchangeable components permitting on site repair

Options

- Weather Protective – constructed with 16 gauge steel; industrial silencer mounted within the main enclosure body.
- Sound Attenuated Level 1 – constructed with 16 gauge steel; weather protective with critical silencer - silencer mounted in separate upward discharging radiator hood.
- Sound Attenuated Level 2 – constructed with 16 gauge steel; weather protective with critical silencer and 100% lined with sound deadening material – silencer mounted in separate upward discharging radiator hood.
- Sound Attenuated Aluminum constructed with 14 gauge Aluminum 5052 grade. Weather protective with critical silencer and 100% lined with sound deadening material – silencer mounted in separate upward discharging radiator hood.
- Caterpillar Yellow* or white paint.
- UL Listed sub base tanks.
- Externally mounted emergency stop button.
- Seismic certification per applicable building codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012, CBC 2007, CBC 2010.
- IBC certification for 180 mph wind loading

*Not available with Aluminium enclosures

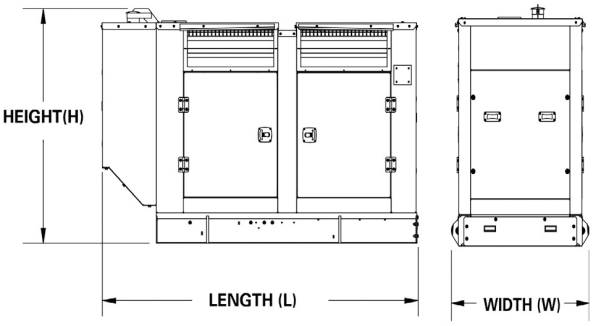
Enclosure Sound Pressure Levels (SPL) at 100%

Weather Protective Enclosure		Cooling Air Flow Rate		SPL @7m (23ft)
Model	**Standby ekW**	**m^3/s**	**cfm**	**dBA**
D125-8	125	4.6	9676	78
D150-10	150	4.6	9676	79
D175-4	175	5.9	12431	84
D200-2	200	5.9	12431	89
SA Level 1 Enclosure				
Model	**Standby ekW**	**m^3/s**	**cfm**	**dBA**
D125-8	125	4.2	8899	74
D150-10	150	4.2	8899	74
D175-4	175	5.6	11830	78
D200-2	200	5.5	11654	81
SA Level 2 Enclosure				
Model	**Standby ekW**	**m^3/s**	**cfm**	**dBA**
D125-8	125	4.2	8899	74
D150-10	150	4.2	8899	74
D175-4	175	5.2	11018	74
D200-2	200	5.1	10806	75
SA Aluminium Enclosure				
Model	**Standby ekW**	**m^3/s**	**cfm**	**dBA**
D125-8	125	4.2	8899	74
D150-10	150	4.2	8899	75
D175-4	175	5.2	11018	75
D200-2	200	5.1	10806	75

Note: The sound pressure level data shown above is quoted as free field and is for guidance only. Actual levels produced may vary according to site conditions

Enclosure Weights

Model	Standby ekW	WP Industrial		SA Level 1		SA Level 2		SA Aluminium	
		kg	lb	kg	lb	kg	lb	kg	lb
D125-8	125	348	768	393	867	406	896	176	387
D150-10	150								
D175-4	175								
D200-2	200								



Enclosure Dimensions: Skid Bases

Engine Model	Generator Set Rating ekW	Enclosure	Width 'W'		Length 'L'		Height 'H'	
			mm	in	mm	in	mm	in
C7.1	125	WP	1110	43.7	3204	126.1	1773	69.8
	150							
	175							
	200							
	125	SA Level 1, SA Level 2 and SA Aluminium	1110	43.7	3659	144.1	1852	72.9
	150							
	175							
	200							

Enclosure Dimensions: UL Listed Sub Tank Base

Engine Model	Generator Set Rating ekW	Enclosure	402 Gallon Sub Base Tank				777 Gallon Sub Base Tank			
			Length 'L'		Height 'H'		Length 'L'		Height 'H'	
			mm	in	mm	in	mm	in	mm	in
C7.1	125	WP	4035	158.9	2420	95.3	5035	198.2	2706	106.5
	150									
	175									
	200									
	125	SA Level 1, SA Level 2 and SA Aluminium	4035	158.9	2499	98.4	5035	198.2	2785	106.5
	150									
	175									
	200									

Note: Weight includes oil and coolant but not fuel
Ref: WPIA, WPIB, WPIC, SATCBA, SATCBB, SAT, CBC, SATFBA, SATFBB, SATFBC, ENCAL02, ENCAL03, ENCAL04.

EMCP 4 CONTROL KEY FEATURES

EMCP 4 control features

- Run/Auto/Stop Control
- Speed and Voltage Adjust
- Engine Cycle Crank
- 24-volt DC operation
- Environmental sealed front face
- Text alarm/event descriptions

Digital indication for:

- RPM
- DC volts
- Operating hours
- Oil pressure (psi, kPa or bar)
- Coolant temperature
- Volts (L-L & L-N), frequency (Hz)
- Amps (per phase & average)
- ekW, kVA, kVAR, kW-hr, %kW, PF (4.2 only)

Warning/shutdown with common LED indication of:

- Low oil pressure
- High coolant temperature
- Overspeed
- Emergency Stop
- Failure to start (overcrank)
- Low coolant temperature
- Low coolant level

Programmable protective relaying functions:

- Generator phase sequence
- Over/Under voltage (27/59)
- Over/Under Frequency (81 o/u)
- Reverse Power (kW) (32) (4.2 only)
- Reverse reactive power (kVAr) (32RV)
- Overcurrent (50/51)

Communications:

- 4 digital inputs & 4 relay outputs (4.1)
- 6 digital inputs & 8 relay outputs (4.2)
- 12 digital inputs & 8 relay outputs (4.4)
- Customer data link (Modbus RTU) (4.2 only)
- Accessory module data link (4.2 only)
- Serial annunciator module data link (4.2 only)
- Emergency stop pushbutton

Compatible with the following:

- Digital I/O module
- Local Annunciator
- Remote CAN annunciator
- Remote serial annunciator

FINANCING

Caterpillar offers an array of financial products to help you succeed through financial service excellence. Options include loans, finance lease, operating lease, working capital, and revolving line of credit. Contact your local Cat dealer for availability in your region.

WORLDWIDE PRODUCT SUPPORT

Cat dealers provide extensive post-sale support including maintenance and repair agreements. Cat dealers have over 1,800 dealer branch stores operating in 200 countries. The Caterpillar® SOS℠ program effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products.

LET'S DO THE WORK.™

www.Cat.com/electricpower

LEHE1586-04 (06/20)

Image shown may not reflect actual configuration

Sound Attenuated Level 2 Enclosures

24 – 220 kVA Range

The sound attenuated Level 2, factory installed enclosures incorporate internally mounted critical level silencers. They are the premium enclosure offering for this range, designed for safety and aesthetic value on an integral fuel tank base. Extremely durable and weather resistant, these enclosures are designed to resist corrosion and handling damage.

The enclosures are the result of continuing research and development by our specialist acoustic engineers.

These enclosures reduce sound levels to comply with the Stage 2 levels of the European Community Directive 2000/14/EC which became effective January 3, 2006.

Features

Durable and Robust Construction

- Manufactured from galvanized steel
- Advanced powder-coated paint finish
- Single-piece main roof
- Base frame extends beyond enclosure, protecting against handling damage
- Minimal external fixings exposed to environment
- Zinc-plated fasteners
- Corner posts and air handling units manufactured from high-grade engineering thermoplastic

Security and Safety

- Secure, lockable doors prevent unauthorized access to control panel, fuel fill, and battery
- Emergency stop button mounted on exterior, convenient to control panel
- Cooling fan and battery charging altenator fully guarded

Excellent Service and Maintenance Access

- Side-hinged doors on both sides of the enclosure incorporate lift-off hinges at 45°
- Radiator fill via removeable, flush-mounted rain cap fitted with compression seal
- Lube oil cooling water drains piped to baseframe side rail, on exterior
- Removable end panels allow access to radiator, exhaust outlet, and alternator rear
- Doors positioned for optimum access of frequently serviced items

Transportability

- Optional tested and certified lifting arch
- Lifting and drag points on base frame facilitate handling from both sides

Sound Pressure Levels (dBA)

Generator Set Model Three-phase		LWA	50 Hz						60 Hz					
			15 m (50 ft)		7 m (23 ft)		1 m (3.3 ft)		15 m (50 ft)		7 m (23 ft)		1 m (3.3 ft)	
			75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load
DE33E0	Prime	94	61	62	67	68	76	77	61	63	67	69	77	79
	Standby	94	61	62	67	68	76	77	61	64	67	70	78	80
DE33E3	Prime	94	59	61	65	67	75	77	–	–	–	–	–	–
	Standby	94	60	62	66	68	76	78	–	–	–	–	–	–
DE50E0	Prime	93	57	58	63	64	74	74	60	61	66	67	76	77
	Standby	93	57	58	63	64	74	75	60	62	66	68	77	78
DE50E2	Prime	93	56	56	62	62	74	75	–	–	–	–	–	–
	Standby	93	56	57	62	63	74	75	–	–	–	–	–	–
DE55E0	Prime	93	57	58	63	64	74	75	60	62	66	68	77	78
	Standby	93	57	59	63	65	74	76	61	62	67	68	77	79
DE55E2	Prime	93	56	57	62	63	74	74	–	–	–	–	–	–
	Standby	93	56	57	62	63	74	75	–	–	–	–	–	–
DE65E0	Prime	93	58	60	64	66	74	76	61	63	67	69	77	79
	Standby	93	58	61	64	67	75	77	62	64	68	70	78	80
DE65E3	Prime	93	58	59	64	65	75	76	–	–	–	–	–	–
	Standby	93	58	59	64	65	75	76	–	–	–	–	–	–
DE88E0	Prime	93	58	59	64	65	76	76	61	61	67	67	78	79
	Standby	93	58	60	64	66	76	77	61	62	67	68	79	79
DE88E3	Prime	97	61	61	67	67	79	79	–	–	–	–	–	–
	Standby	97	61	62	67	68	79	79	–	–	–	–	–	–
DE110E2	Prime	97	62	63	68	69	80	81	65	65	71	71	84	84
	Standby	97	63	64	69	70	80	81	65	66	71	72	84	84
DE110E3	Prime	97	61	62	67	68	79	79	–	–	–	–	–	–
	Standby	97	62	62	68	68	79	79	–	–	–	–	–	–
DE150E0	Prime	97	60	61	66	67	76	76	61	61	67	67	77	77
	Standby	97	60	61	66	67	76	77	61	61	67	67	77	78
DE165E0	Prime	97	59	59	65	65	74	74	61	62	67	68	77	77
	Standby	97	59	59	65	65	74	75	62	62	68	68	77	78

Sound Pressure Levels (dBA)

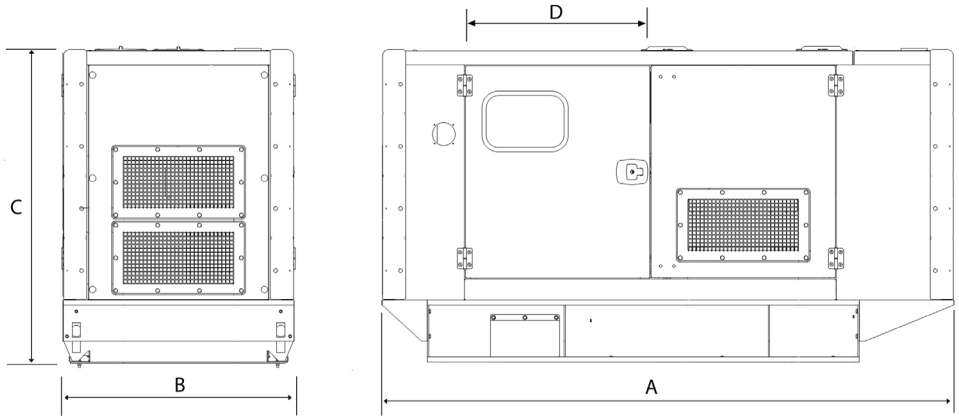
Generator Set Model Three-phase		LWA	50 Hz						60 Hz					
			15 m (50 ft)		7 m (23 ft)		1 m (3.3 ft)		15 m (50 ft)		7 m (23 ft)		1 m (3.3 ft)	
			75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load
DE165E3	Prime	–	58	59	64	65	73	74	–	–	–	–	–	–
	Standby	–	58	59	64	65	74	74	–	–	–	–	–	–
DE175E3	Prime	–	58	59	64	65	74	74	–	–	–	–	–	–
	Standby	–	58	59	64	65	74	75	–	–	–	–	–	–
DE200E0	Prime	97	62	62	68	68	78	78	65	65	71	71	81	81
	Standby	97	62	63	68	69	78	78	65	65	71	71	81	81
DE200E3	Prime	–	59	60	65	66	74	75	–	–	–	–	–	–
	Standby	–	59	60	65	66	74	75	–	–	–	–	–	–
DE220E0	Prime	97	62	64	68	70	78	79	–	–	–	–	–	–
	Standby	97	63	64	69	70	78	79	–	–	–	–	–	–

Levels in accordance with European Noise Directive (2000/14/EC).

Sound Pressure Levels (dBA)

Generator Set Model Single-phase		LWA	50 Hz						60 Hz					
			15 m (50 ft)		7 m (23 ft)		1 m (3.3 ft)		15 m (50 ft)		7 m (23 ft)		1 m (3.3 ft)	
			75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load
DE26E0S	Prime	94	61	62	67	68	76	77	61	63	67	69	77	79
	Standby	94	61	62	67	68	76	77	61	64	67	70	78	80
DE26E3S	Prime	94	59	61	65	67	75	77	–	–	–	–	–	–
	Standby	94	60	62	66	68	76	77	–	–	–	–	–	–
DE40E0S	Prime	93	57	58	63	64	74	74	60	61	66	67	76	77
	Standby	93	57	58	63	64	74	75	60	62	66	68	77	78
DE40E2S	Prime	93	56	56	62	62	74	75	–	–	–	–	–	–
	Standby	93	56	57	62	63	74	75	–	–	–	–	–	–
DE50E0S	Prime	93	57	58	63	64	75	76	60	61	66	67	78	78
	Standby	93	57	58	63	64	75	76	60	61	66	67	78	78
DE55E3S	Prime	93	58	59	64	65	75	76	–	–	–	–	–	–
	Standby	93	58	59	64	65	75	76	–	–	–	–	–	–
DE90E2S	Prime	97	62	63	68	69	80	81	65	65	71	71	84	84
	Standby	97	63	64	69	70	80	81	65	66	71	72	84	84
DE90E3S	Prime	97	61	62	67	68	79	79	–	–	–	–	–	–
	Standby	97	62	62	68	68	79	79	–	–	–	–	–	–

Levels in accordance with European Noise Directive (2000/14/EC).

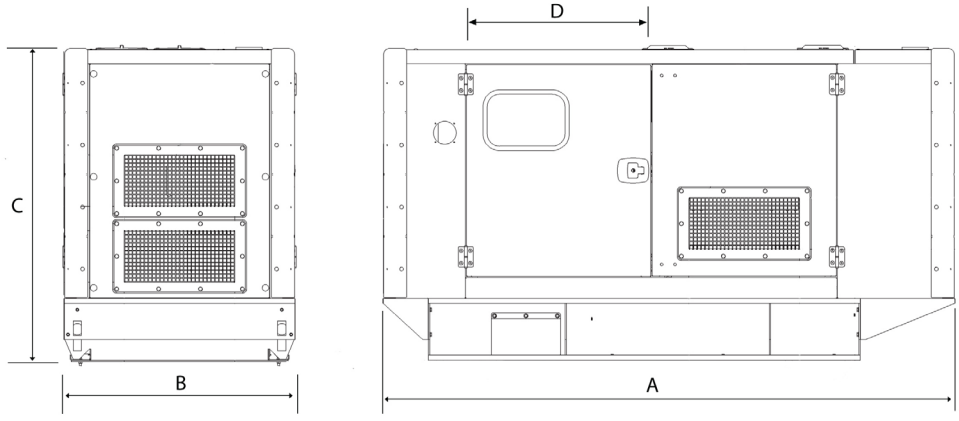


Weights and Dimensions

Generator Set Model Three-phase	A: mm (in)	B: mm (in)	C: mm (in)	D*: mm (in)	Fuel Capacity: l (US gal)	Weight: kg (lb)
DE33E0	2120 (83.5)	980 (38.6)	1519 (59.8)	716 (28.2)	161 (43.0)	1002 (2209)
DE33E3	2120 (83.5)	980 (38.6)	1519 (59.8)	716 (28.2)	161 (43.0)	1002 (2209)
DE50E2	2300 (90.6)	1132 (44.6)	1519 (59.8)	761 (30.0)	219 (58.0)	1237 (2727)
DE50E0	2300 (90.6)	1132 (44.6)	1519 (59.8)	761 (30.0)	219 (58.0)	1237 (2727)
DE55E0	2300 (90.6)	1132 (44.6)	1519 (59.8)	761 (30.0)	219 (58.0)	1229 (2709)
DE55E2	2300 (90.6)	1130 (44.5)	1525 (60.0)	761 (30.0)	219 (58.0)	1277 (2815)
DE65E0	2300 (90.6)	1132 (44.6)	1519 (59.8)	761 (30.0)	219 (58.0)	1249 (2754)
DE65E3	2300 (90.6)	1130 (44.5)	1519 (59.8)	761 (30.0)	219 (58.0)	1319 (2908)
DE88E0	2300 (90.6)	1130 (44.5)	1519 (59.8)	761 (30.0)	219 (58.0)	1416 (3122)
DE88E3	2770 (109.1)	1130 (44.5)	1530 (60.2)	893 (35.2)	250 (66.0)	1554 (3426)
DE110E2	2770 (109.1)	1130 (44.5)	1530 (60.2)	893 (35.2)	250 (66.0)	1615 (3560)
DE110E3	2770 (109.1)	1130 (44.5)	1530 (60.2)	893 (35.2)	250 (66.0)	1744 (3845)
DE150E0	3520 (138.6)	1130 (44.5)	1809 (71.2)	1143 (45.0)	349 (92.2)	1918 (4228)
DE165E0	3520 (138.6)	1130 (44.5)	1809 (71.2)	1143 (45.0)	349 (92.2)	2016 (4445)
DE165E3	3520 (138.6)	1130 (44.5)	1809 (71.2)	1143 (45.0)	349 (92.2)	2158 (4758)
DE175E3	3520 (138.6)	1130 (44.5)	1809 (71.2)	1143 (45.0)	349 (92.2)	2158 (4758)
DE200E0	3520 (138.6)	1330 (52.4)	1809 (71.2)	1078 (42.4)	418 (110.0)	2198 (4836)
DE200E3	3520 (138.6)	1330 (52.4)	1809 (71.2)	1078 (42.4)	418 (110.0)	2248 (4956)
DE220E0	3520 (138.6)	1330 (52.4)	1809 (71.2)	1078 (42.4)	418 (110.0)	2238 (4934)

*Clearance required on both sides of set.

Weight with lube oil and coolant, no fuel.



Weights and Dimensions

Generator Set Model Single-phase	A: mm (in)	B: mm (in)	C: mm (in)	D*: mm (in)	Fuel Capacity: l (US gal)	Weight: kg (lb)
DE26E0S	2120 (83.5)	980 (38.58)	1519 (59.8)	716 (28.2)	161 (43.0)	991 (2185)
DE26E3S	2120 (83.5)	980 (38.58)	1519 (59.8)	716 (28.2)	161 (43.0)	991 (2185)
DE40E0S	2300 (90.6)	1132 (44.7)	1519 (59.8)	761 (30.0)	219 (58.0)	1247 (2749)
DE40E2S	2300 (90.6)	1132 (44.7)	1519 (59.8)	761 (30.0)	219 (58.0)	1199 (2643)
DE50E0S	2300 (90.6)	1132 (44.7)	1519 (59.8)	761 (30.0)	219 (58.0)	1315 (2899)
DE55E3S	2300 (90.6)	1130 (44.5)	1519 (59.8)	765 (30.1)	219 (58.0)	1355 (2987)
DE90E2S	2770 (109.1)	1130 (44.5)	1530 (60.2)	893 (35.2)	250 (66.0)	1613 (3556)
DE90E3S	2770 (109.1)	1130 (44.5)	1530 (60.2)	893 (35.2)	250 (66.0)	1653 (3644)

*Clearance required on both sides of set.
Weight with lube oil and coolant, no fuel.

Appendix C

Roadway Construction Noise Model (RCNM) Results

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 12/14/20
Case Description: Demolition - 752 Chestnut Street Radio Service Facility

---- Receptor #1 ----

		Baselines (dBA)		
Description	**Land Use**	**Daytime**	**Evening**	**Night**
Multi-family 622-634 Chestnut	Residential	63	55	50

Equipment

Description	**Impact Device**	**Usage (%)**	**Spec Lmax** (dBA)	**Actual Lmax** (dBA)	**Receptor Distance** (feet)	**Estimated Shielding** (dBA)
Excavator	No	40		80.7	25	0
Man Lift	No	20		74.7	25	0
Crane	No	16		80.6	25	0

Results

		Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
				Day		Evening		Night		Day		Evening		Night	
Equipment		***Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**
Excavator		87	83	80	80	N/A	N/A	N/A	N/A	7	3	N/A	N/A	N/A	N/A
Man Lift		81	74	80	80	N/A	N/A	N/A	N/A	1	None	N/A	N/A	N/A	N/A
Crane		87	79	80	80	N/A	N/A	N/A	N/A	7	None	N/A	N/A	N/A	N/A
	Total	87	85	80	80	N/A	N/A	N/A	N/A	7	5	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Baselines (dBA)

Description		Land Use	Daytime	Evening	Night
Multi-family Chestnut	715	Residential	63	55	50

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Excavator	No	40		80.7	95	0
Man Lift	No	20		74.7	95	0
Crane	No	16		80.6	95	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	***Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**
Excavator	75	71	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Man Lift	69	62	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Crane	75	67	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Total	75	73	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

Description		Land Use	Daytime	Evening	Night
Single-family Pine	639	Residential	62	50	47

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Excavator	No	40		80.7	25	0
Man Lift	No	20		74.7	25	0
Crane	No	16		80.6	25	0

Results

		Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
				Day		Evening		Night		Day		Evening		Night	
Equipment		*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Excavator		87	83	80	80	N/A	N/A	N/A	N/A	7	3	N/A	N/A	N/A	N/A
Man Lift		81	74	80	80	N/A	N/A	N/A	N/A	1	None	N/A	N/A	N/A	N/A
Crane		87	79	80	80	N/A	N/A	N/A	N/A	7	None	N/A	N/A	N/A	N/A
	Total	87	85	80	80	N/A	N/A	N/A	N/A	7	5	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 12/14/20
Case Description: Site Preparation - 752 Chestnut Street Radio Service Facility

---- Receptor #1 ----

		Baselines (dBA)		
Description	**Land Use**	**Daytime**	**Evening**	**Night**
Multi-family 622-634 Chestnut	Residential	63	55	50

			Equipment			
	Impact Device	**Usage (%)**	**Spec Lmax** (dBA)	**Actual Lmax** (dBA)	**Receptor Distance** (feet)	**Estimated Shielding** (dBA)
Description						
Dump Truck	No	40		76.5	25	0
Front End Loader	No	40		79.1	25	0
Backhoe	No	40		77.6	25	0

			Results											
	Calculated (dBA)		**Noise Limits (dBA)**						**Noise Limit Exceedance (dBA)**					
			Day		**Evening**		**Night**		**Day**		**Evening**		**Night**	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Dump Truck	83	79	80	80	N/A	N/A	N/A	N/A	3	None	N/A	N/A	N/A	N/A
Front End Loader	85	81	80	80	N/A	N/A	N/A	N/A	5	1	N/A	N/A	N/A	N/A
Backhoe	84	80	80	80	N/A	N/A	N/A	N/A	4	None	N/A	N/A	N/A	N/A
Total	85	85	80	80	N/A	N/A	N/A	N/A	5	5	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Multi-family 715 Chestnut	Residential	63	55	50

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	95	0
Front End Loader	No	40		79.1	95	0
Backhoe	No	40		77.6	95	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	***Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**
Dump Truck	75	71	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Front End Loader	69	62	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Backhoe	75	67	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Total	75	73	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

Description		Land Use	Daytime	Evening	Night
Single-family Pine	639	Residential	62	50	47

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Dump Truck	No	40		76.5	25	0
Front End Loader	No	40		79.1	25	0
Backhoe	No	40		77.6	25	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	***Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**
Dump Truck	83	79	80	80	N/A	N/A	N/A	N/A	3	None	N/A	N/A	N/A	N/A
Front End Loader	85	81	80	80	N/A	N/A	N/A	N/A	5	1	N/A	N/A	N/A	N/A
Backhoe	84	80	80	80	N/A	N/A	N/A	N/A	4	None	N/A	N/A	N/A	N/A
Total	85	85	80	80	N/A	N/A	N/A	N/A	5	5	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 12/14/20
Case Description: Building Construction - 752 Chestnut Street Radio Service Facility

---- Receptor #1 ----

		Baselines (dBA)		
Description	**Land Use**	**Daytime**	**Evening**	**Night**
Multi-family 622-634 Chestnut	Residential	63	55	50

			Equipment			
Description	**Impact Device**	**Usage (%)**	**Spec Lmax** (dBA)	**Actual Lmax** (dBA)	**Receptor Distance** (feet)	**Estimated Shielding** (dBA)
Crane	No	16		80.6	25	0
Man Lift	No	20		74.7	25	0
Compressor (air)	No	40		77.7	25	0

		Results													
		Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
				Day		Evening		Night		Day		Evening		Night	
Equipment		*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Crane		87	79	80	80	N/A	N/A	N/A	N/A	7	None	N/A	N/A	N/A	N/A
Man Lift		81	74	80	80	N/A	N/A	N/A	N/A	1	None	N/A	N/A	N/A	N/A
Compressor (air)		84	80	80	80	N/A	N/A	N/A	N/A	4	None	N/A	N/A	N/A	N/A
	Total	87	83	80	80	N/A	N/A	N/A	N/A	7	3	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Multi-family 715 Chestnut	Residential	63	55	50

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	95	0
Man Lift	No	20		74.7	95	0
Compressor (air)	No	40		77.7	95	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	***Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**
Crane	75	71	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Man Lift	69	62	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Compressor (air)	75	67	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Total	75	73	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

Description		Land Use	Daytime	Evening	Night
Single-family	639	Residential	62	50	47
Pine					

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	25	0
Man Lift	No	20		74.7	25	0
Compressor (air)	No	40		77.7	25	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	***Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**	**Lmax**	**Leq**
Crane	81	73	80	80	N/A	N/A	N/A	N/A	7	None	N/A	N/A	N/A	N/A
Man Lift	75	68	80	80	N/A	N/A	N/A	N/A	1	None	N/A	N/A	N/A	N/A
Compressor (air)	78	74	80	80	N/A	N/A	N/A	N/A	4	None	N/A	N/A	N/A	N/A
Total	81	77	80	80	N/A	N/A	N/A	N/A	7	3	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 12/14/20
Case Description: Asphalt Paving - 752 Chestnut Street Radio Service Facility

---- Receptor #1 ----

		Baselines (dBA)		
Description	**Land Use**	**Daytime**	**Evening**	**Night**
Multi-family 622-634 Chestnut	Residential	63	55	50

Equipment

Description	**Impact Device**	**Usage (%)**	**Spec Lmax** (dBA)	**Actual Lmax** (dBA)	**Receptor Distance** (feet)	**Estimated Shielding** (dBA)
Compactor (ground)	No	20		83.2	25	0
Paver	No	50		77.2	25	0
Roller	No	20		80	25	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Compactor (ground)	89	82	80	80	N/A	N/A	N/A	N/A	9	2	N/A	N/A	N/A	N/A
Paver	83	80	80	80	N/A	N/A	N/A	N/A	3	0	N/A	N/A	N/A	N/A
Roller	86	79	80	80	N/A	N/A	N/A	N/A	6	None	N/A	N/A	N/A	N/A
Total	89	86	80	80	N/A	N/A	N/A	N/A	9	6	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

Baselines (dBA)

Description		Land Use	Daytime	Evening	Night
Multi-family Chestnut	715	Residential	63	55	50

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compactor (ground)	No	20		83.2	95	0
Paver	No	50		77.2	95	0
Roller	No	20		80	95	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Compactor (ground)	75	71	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Paver	69	62	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Roller	75	67	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A
Total	75	73	80	80	N/A	N/A	N/A	N/A	None	None	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

Description	Land Use	Daytime	Evening	Night
Single-family 639 Pine	Residential	62	50	47

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compactor (ground)	No	20		83.2	25	0
Paver	No	50		77.2	25	0
Roller	No	20		80	25	0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Compactor (ground)	89	82	80	80	N/A	N/A	N/A	N/A	9	2	N/A	N/A	N/A	N/A
Paver	83	80	80	80	N/A	N/A	N/A	N/A	3	0	N/A	N/A	N/A	N/A
Roller	86	79	80	80	N/A	N/A	N/A	N/A	6	None	N/A	N/A	N/A	N/A
Total	89	86	80	80	N/A	N/A	N/A	N/A	9	6	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.