Environmental Noise and Vibration Assessmentfor the Santa Cruz Medical Office Building Project Santa Cruz County, California

Prepared for:

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ACRONYMS AND ABBREVIATIONS

CNEL	community noise equivalent level
dB	decibel
dBA	A-weighted decibel
Hz	hertz
In/Sec	inches per second
Ldn	day-night sound level
Leq	equivalent sound level
Lmin	minimum sound level
Lmax	maximum sound level
Ln	sound level exceeded n percentile of time
RMS	root mean square
SEL	sound exposure level

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1 INTRODUCTION

PMB Real Estate Services has proposed the development and construction of a Specialty Medical Office Building in the Live Oak region of Santa Cruz County California. The proposed project site is located at 5940 Soquel Avenue (Assessor's Parcel Number (APN) 029-021-47). The site is bounded by Soquel Avenue and Highway 1 to the north and is between Chanticleer Avenue and Mattison Lane. The project location is shown in Figure 1

This report reviews applicable noise standards and criteria, evaluates the existing noise environment, and describes modeling assumptions and methodologies used to predict noise impacts and effects associated with the proposed project. The report assesses the potential for project-generated noise levels to result in noise impacts on nearby noise-sensitive receptors and the compatibility of the proposed project with existing and future noise levels in the area. Appendix A provides a discussion of acoustical fundamentals and terminology used in this memorandum.

1.1 Project Description

The proposed project would clear the approximately five-acre (216,711 square-foot) project site and construct a four-story medical office building measuring 60 feet in height to finished roof, and with a maximum height of 74 feet to top of roof mechanical screens. The proposed medical office building would provide approximately 160,000 gross square feet (gsf) of medical office use for outpatient services including advanced medical and urgent care clinics, urgent care and outpatient surgery facilities, support services for urgent care and outpatient surgery including pharmacy, laboratory, and imaging facilities, and administrative office space.

The facility is expected to be open to the public from 8:00 a.m. to 8:00 p.m., with the exception of urgent care and ancillary functions which would operate on a 24-hour a day basis. The expected number of staff, at peak, would be approximately 365 people. The proposal also includes the construction of a four-story parking garage that would accommodate five levels of parking, for a total of 730 new vehicle parking spaces to serve the on-site medical uses. The parking garage would measure approximately 42 feet to roof level with solar canopies, elevator and stair penthouses above.

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SOURCE: DigitalGlobe 2016

DUDEK

0 0.01 0.02 Miles

FIGURE 1

Project Location and Noise Monitoring Sites

Santa Cruz Medical Office Building

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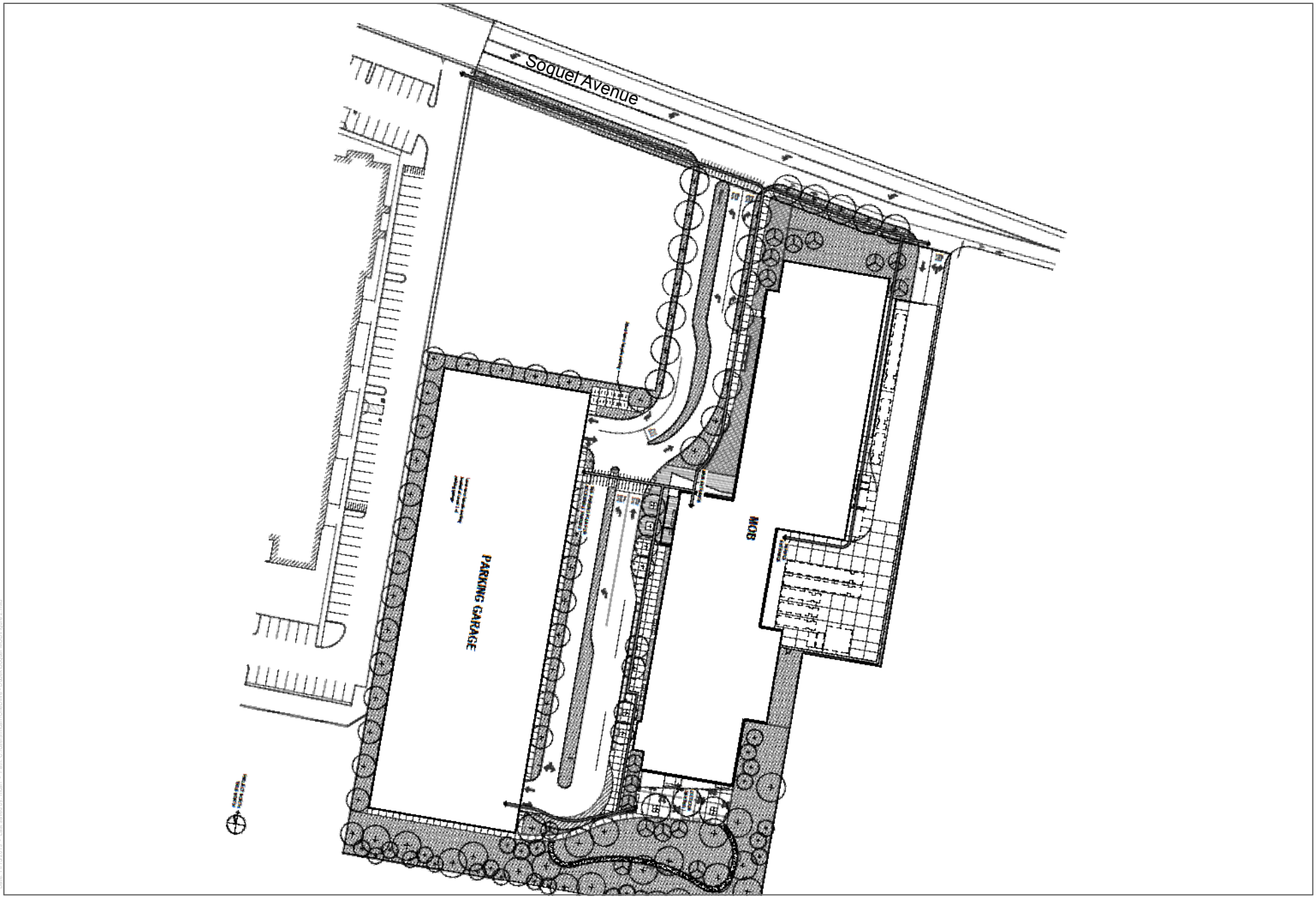

SOURCE: Smith Group

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0 0.01 0.02 Miles

FIGURE 2

Project Site Plan

Santa Cruz Medical Office Building

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2 EXISITING NOISE ENVIRONMENT

The proposed Santa Cruz Medical Office Building project is located in the unincorporated Live Oak area of Santa Cruz County, California. The proposed project site is generally bounded by Soquel Avenue and the Highway 1 corridor to the north; general commercial and light industrial to the east and west; and a residential neighborhood to the south.

The proposed project area has a number of existing noise sources influencing the ambient noise environment. The most dominant noise source affecting the overall area is transportation noise; primarily generated from vehicular traffic on the regional and local roadway network. Light industrial and commercial areas to the east and west of the project site contribute to the ambient noise levels in the plan area to a lesser extent.

The existing ambient noise environment in the plan area was quantified through field surveys, implementation of a noise-monitoring program and through the application of accepted reference data and noise prediction methodologies. Separate discussions of identified major noise sources and their respective effects are provided in the following sections.

Existing Noise-Sensitive Land Uses

Noise-sensitive land uses generally include those uses where exposure to noise would result in adverse effects, as well as uses where quiet is an essential element of the intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Existing land uses within the plan area consist of public education facilities, residential, neighborhood commercial and mixed-use. Noise-sensitive land uses in the vicinity of the proposed project are primarily single-family residences located immediately adjacent to the southern project boundary and an assisted living facility located approximately 100-feet west of the southwestern project boundary.

Existing Ambient Noise Survey

An ambient noise survey was performed on September 10th, 2019 to document the existing noise environment within the proposed project area. Specific consideration was given to document noise levels in the vicinity of nearby noise-sensitive receptors, and additionally to document existing transportation noise source levels in the proposed project area. Noise measurements were performed in accordance with relevant American National Standards Institute (ANSI) and American Standards for Testing and Measurement (ASTM) guidelines.

Noise measurements were performed using Larson Davis Laboratories (LDL) Model 831 Type 1 precision integrating sound level meters (SLMs). Field calibrations were performed on the SLMs with acoustic calibrators before and after the noise level measurements. All instrumentation components, including microphones, preamplifiers and field calibrators have laboratory certified calibrations traceable to the National Institute of Standards and Technology (NIST). The equipment used meets all pertinent specifications of the ANSI for Type 1 SLMs (ANSI S1.4-1983 [R2006]). Meteorological conditions during the monitoring periods were stable with temperatures of approximately 72 degrees Fahrenheit (F), light winds from 0 mph to 5 mph and clear skies during the monitoring period.

Short-term noise monitoring was conducted at two locations to provide insight into the existing ambient noise environment in the proposed project area. Monitoring equipment was configured to catalog pertinent

noise metrics as identified above. Ambient noise level data cataloged at the short-term monitoring locations is presented in Table 1. Concurrent to the noise monitoring performed at location ST-2, traffic counts and vehicle classification counts were performed for Soquel Ave. and Highway 1. Due to traffic volumes and speeds on Highway 1, traffic counts and classifications were performed separately for each direction of travel during the two noise measurements performed at monitoring location ST-2.

Table 1. Summary of Short-Term Ambient Noise Measurements

Site	Location	Date/Time	Duration (minutes)	Average Noise Levels (dBA)			
				Leq	*Lmax*	*L50*	*L90*
ST-1	Southern project boundary	9/10/19 12:22	15	44.0	57.2	42.5	40.6
ST-2	Adjacent to Soquel Avenue	9/10/19 13:00	15	72.0	79.2	71.5	69.2
		9/10/19 13:23	15	72.0	85.3	71.5	69.4

Notes:
dBA = A-weighted decibels; Ldn = Day Night noise level; Leq = average equivalent noise level; Lmax = maximum noise level; L50 = sound level exceeded 50 percent of the period; L90 = sound level exceeded 90 percent of the period.
Locations of noise monitoring sites are shown on Figure 1.

The primary noise source affecting the noise monitoring locations was vehicular traffic on the local and regional roadway network. Additional noise sources experienced during the noise-monitoring program included pedestrian activity, commercial activity and nearby businesses and aircraft overflight. Ambient noise level exposure at the monitoring locations were dependent on the relative distance from nearby roadways to noise measurement locations and shielding provided by intervening structures.

Existing Traffic Noise

Existing traffic noise levels were modeled for roadway segments in the project vicinity based on the Federal Highway Administration (FHWA) Highway Traffic Noise Model (TNM) prediction methodologies (FHWA 1998), and traffic data developed as part of the traffic impact study prepared for the proposed project (Kimley-Horn and Associates 2019) and the most current Caltrans traffic counts (Caltrans 2019). The FHWA TNM incorporates sound emissions and sound propagation algorithms based on well-established theory and accepted international standards. The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs and show excellent agreement in most cases for sites with and without noise barriers. The noise modeling accounted for factors such as vehicle volume, speed, vehicle type, roadway configuration, distance to the receiver, and propagation over different types of ground (acoustically soft and hard ground).

In order to ensure that modeled existing traffic noise levels correlate with measured traffic noise levels, observations and data collected during short-term noise monitoring was used to calibrate the traffic model. Modeled average traffic noise levels were found to be reasonably consistent with traffic noise measurements conducted at the project site, over predicting traffic noise levels by less than 1 dB. As this is within the tolerances of the traffic noise prediction model calibration offsets were not applied to the model.

To determine existing day-night (Ldn) traffic noise levels in the project vicinity, the average daily traffic (ADT) volumes for roadways in the immediate vicinity of the project site were used as inputs to the noise model.

Traffic data was provided in terms of peak-hour turning movements at intersections in the project area. ADT volumes were calculated by summing all traffic movements for both the AM and PM peak hours, existing on- or turning on to a particular roadway segment during the peak-hour and multiplying the total peak-hour volume by a "k-factor" of 5.

Modeled existing traffic noise levels are summarized in Table 2, at a representative distance of 100 feet from the centerline of each major roadway in the project vicinity and distances from roadway centerlines to the 60-, 65-, and 70-dBA Ldn traffic noise level contours. The extent to which existing land uses in the plan area are affected by existing traffic noise depends on their respective proximity to the roadways and their individual sensitivity to noise.

As shown in Table 2, the location of the 60-dBA Ldn traffic noise contour along the local roadway network ranges from within the right-of-way to approximately 1,800 feet from the centerline of the modeled roadways. The extent to which existing land uses in the project area are affected by existing traffic noise depends on their respective proximity to the roadways and their individual sensitivity to noise. Refer to Appendix B of this report for complete modeling inputs and results.

Existing Aircraft Operations

There are no operational public use airports in the vicinity of the proposed project. The project under consideration is located approximately 9 nautical miles northwest of the Watsonville Municipal Airport and is not located within any currently adopted 60 or 65 dB CNEL/Ldn airport noise contours. As such, noise associated with existing and future aircraft operations in the area is not a substantial contributor to the ambient noise environment.

Existing Vibration

There are no major sources of groundborne vibration in the proposed project area. Transportation-related vibration from roadways in the proposed project area is the primary source of groundborne vibration. Heavy truck traffic can generate groundborne vibration, which varies considerably depending on vehicle type, weight, and pavement conditions. However, groundborne vibration levels generated from vehicular traffic are not typically perceptible outside of the roadway right-of-way.

Table 2. Summary of Modeled Existing Traffic Noise Levels

Roadway	Segment		ADT[1]	Ldn at 100 ft. from CL	Distance to Ldn Contour (feet)[2]		
	From	*To*			*70 dBA*	*65 dBA*	*60 dBA*
17th Ave	South of Soquel Ave		7,860	58.2	16	35	76
40th Ave	South of Gross Ave		105	37.9	1	2	3
41st Ave	Gross Rd	Clares St	24,445	64.8	45	98	210
41st Ave	Hwy 1 NB Ramps	Hwy 1 SB Ramps	23,325	64.6	44	95	204
41st Ave	Hwy 1 NB Ramps	Soquel Dr	16,900	63.2	35	76	164
41st Ave	Hwy 1 SB Ramps	Gross Rd	30,355	65.8	52	113	243
Auto Plaza Dr	East of 41st		2,155	51.0	5	12	25
Chanticleer Ave	South of Soquel Ave		4,110	53.8	8	18	39
Gross Rd	40th Ave	41st Ave	8,995	57.2	14	30	65
Gross Rd	Existing Driveway	40th Ave	2,580	51.8	6	13	28
Hwy 1 NB Off-Ramp			14,870	59.4	20	42	91
Hwy 1 NB On-Ramp			1,570	49.6	4	9	20
Hwy 1 SB Off-Ramp			7,425	56.4	12	27	57
Hwy 1 SB On-Ramp			8,230	56.8	13	28	61
Paul Sweet Dr	North of Soquel Dr		4,455	54.1	9	19	41
Soquel Ave	17th Ave	Chanticleer Ave	7,555	59.7	21	45	96
Soquel Ave	Chanticleer Ave	Existing Driveway	6,645	59.2	19	41	88
Soquel Ave	Existing Driveway	40th Ave	7,095	59.5	20	43	92
Soquel Ave	North/west of Gross Rd		6,325	59.0	18	40	85
Soquel Ave	SB On/Off Ramps	17th Ave	13,800	62.4	31	67	144
Soquel Ave	West of SB On/Off Ramps		17,235	63.3	36	77	167
Soquel Dr	East of Paul Sweet Dr		21,150	64.2	41	89	191
Soquel Dr / Hwy 1 NB On-Ramp			30,685	62.5	32	68	147
Highway 1			102,000	79.4	421	908	1,955

Notes:
dBA = A-weighted decibels; Ldn = average day-night noise level. ADT – Average Daily Traffic Volumes.
1- ADT volumes calculated based on peak-hour turning movements provided in the Traffic Impact Report prepared for the Project.
2- Not accounting for shielding provided by natural or man-made intervening objects. Actual distance to real-world noise level contours will be dependent upon shielding effects in the environment under consideration.

3 REGULATORY CRITERIA

Various private and public agencies have established noise guidelines and standards to protect citizens from potential hearing damage and other adverse physiological and sociological effects associated with noise. Applicable standards and guidelines are described below.

3.1 Federal

Federal Noise Control Act of 1972

The U.S. Environmental Protection Agency's (EPA's) Office of Noise Abatement and Control was originally established to coordinate federal noise control activities. After its inception, the EPA's Office of Noise Abatement and Control issued the Federal Noise Control Act of 1972, establishing programs and guidelines to identify and address the effects of noise on public health, welfare, and the environment. In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at more local levels of government. Consequently, in 1982 responsibilities for regulating noise control policies were transferred to state and local governments. However, noise control guidelines and regulations contained in the EPA rulings in prior years are still adhered to by designated federal agencies where relevant. There are no Federal noise regulations which are directly applicable to the construction or operation of the project.

Federal Transit Administration – Vibration

FTA has set forth guidelines for maximum-acceptable vibration criteria to address the human response to groundborne vibration for different types of land uses. These include 65 VdB (re: µ-in/sec RMS) for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, laboratory facilities); 80 VdB for residential uses and buildings where people normally sleep; and 83 VdB for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, offices).

Standards have also been established to address the potential for groundborne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics (CHABA) at the request of EPA and originally published by the National Academy of Sciences (NAS 1977). For fragile structures, CHABA recommends a maximum limit of 0.25 inch per second (in/sec PPV).

3.1 State

The State of California has adopted noise standards in areas of regulation not preempted by the federal government. State standards regulate noise levels of motor vehicles, sound transmission within buildings, occupational noise control, and noise insulation.

California Code of Regulations, Title 24

Part 11 of Title 24, also known as the California Green Building Standards Code or CalGreen, provides guidance on mandatory and voluntary measures for environmental comfort and acoustical control. The CalGreen Code provides the mandatory measures that building envelopes meet a composite sound transmission class (STC) rating of at least 50 or that the building envelope be constructed in such a manner that the building interior has a maximum background noise level of 50 dBA Leq (1 hour).

Governor's Office of Planning and Research

The State of California, Governor's Office of Planning and Research (OPR), published the State of California General Plan Guidelines (OPR 2003, OPR 2017), which provides guidance for the acceptability of projects

within specific day-night average noise level (Ldn) contours. The guidelines also present adjustment factors that may be used to arrive at noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise pollution.

Generally, residential uses (e.g., single-family homes, mobile homes) are considered to be acceptable in areas where exterior noise levels do not exceed 60 dBA Ldn. Residential uses are normally unacceptable in areas exceeding 70 dBA Ldn and conditionally acceptable within 55 to 70 dBA Ldn. Schools are normally acceptable in areas up to 70 dBA Ldn and normally unacceptable in areas exceeding 70 dBA Ldn. Professional uses are normally acceptable in areas up to 70 dBA Ldn. Between 67.5 and 77.5 dBA Ldn, commercial uses are conditionally acceptable, depending on the noise insulation features and the noise reduction requirements.

California Department of Transportation – Vibration

There are no state standards for vibration; however, the California Department of Transportation (Caltrans) provides potential criteria for vibration damage to structures as a guideline, based on a synthesis of research. The Caltrans guidelines provide a threshold of 0.08 in/sec PPV for extremely fragile historic buildings and thresholds of 0.3 to 0.5 in/sec PPV for older residential structures and new residential/modern industrial and commercial buildings exposed to continuous/frequent intermittent sources (Caltrans 2020b). Caltrans also presents similar guidance for simple evaluations of the potential for human perception, ranging from barely perceptible at 0.01 in/sec PPV to severe at 0.4 in/sec PPV. Studies referenced by Caltrans state that consistent vibration sources would be annoying at 0.2 in/sec PPV, with the threshold for perception and annoyance higher for non-continuous/transient sources.

3.2 Local Plans, Policies, Regulations and Ordinances

3.2.1 Santa Cruz County General Plan

The 1994 General Plan contains the Public Safety and Noise Element, which has recently been preempted by the adoption of a stand-alone Noise Element, Chapter 9 of the General Plan (Santa Cruz County 2020). The Noise Element contains updated goals, objectives and policies intended to protect citizens from exposure to excessive noise. The Noise Element establishes standards and policy to promote compatible noise environments for new development or redevelopment projects and to control excessive noise exposure of existing land uses. The following objectives, policies and standards are applicable to the proposed project:

Objective 9.2 Noise Exposure of Existing Sensitive Uses and Receptors

> Minimize exposure of existing noise-sensitive land uses and receptors to excessive, unsafe or disruptive noise that may be generated by new land uses and development projects.

Policies

9.2.1 Require acoustical studies for all new development projects that may affect the existing noise environment affecting sensitive land uses and receptors and that may not conform to the Normally Acceptable Noise Exposure in Table 9-2 (Table 3).

9.2.2 Require site-design and noise reduction measures for any project, including transportation projects, that would cause significant degradation of the noise environment due to project effects that could:

(a) Increase the noise level at existing noise-sensitive receptors or areas by 5 dB or more, where the post-project CNEL or DNL will remain equal to or below 60 dB;

(b) Increase the noise level at existing noise-sensitive receptors or areas by 3 dB or more, where the post-project CNEL or DNL would exceed 60 dB;

This policy shall not be interpreted in a manner that would limit the ability of the County to require noise related mitigation measures or conditions of approval for projects that may generate lesser increases than the above. Special consideration may also be applied to special events or activities subject to permit requirements, or to land use development permits for uses and activities exempted from County noise control regulations.

9.2.3 Incorporate noise considerations into the site plan review process, particularly with regard to parking and loading areas, ingress/egress points and refuse collection areas.

9.2.4 For all new commercial and industrial developments which would increase noise levels above the normally acceptable standards in Table 9-2 (Table 3) or the maximum allowable standards in Table 9-3 (Table 4), the best available control technologies shall be used to minimize noise levels. In no case shall the noise levels exceed the standards of Table 9-3 (Table 4).

9.2.5 The following noise mitigation strategies are preferable to construction of conventional masonry noise barriers where these strategies are a feasible option to reduce impacts on sensitive uses:

- Avoid placement of noise sensitive uses in noisy areas.
- Avoid placement of significant noise generators in noise sensitive areas.
- Increase setbacks between noise generators and noise sensitive uses.
- Orient buildings such that the noise sensitive portions of a project (e.g. bedrooms) are shielded from noise sources (such as through careful design of floor plan).
- Use sound-attenuating architectural design and building features.
- Employ technologies that reduce noise generation, such as alternate pavement materials on roadways, when appropriate.
- Employ traffic calming measures where appropriate.

9.2.6 Require mitigation and/or best management practices to reduce construction noise as a condition of project approvals, particularly if noise levels would exceed 75 dB at neighboring sensitive land uses or if construction would occur for more than 7 days.

Table 3. Acceptable through Unacceptable Ranges of Noise Exposure by Land Use*

**Outdoor noise exposure measured at the property line of receiving land use*
(Table 9-2 from the Santa Cruz County General Plan Noise Element)

Land Use		Community Noise Exposure DNL or CNEL dB(A) 55 60 65 70 75 80
A	Residential/Lodging – Single Family, Duplex, Mobile Home, Multi Family	
B	Schools, Libraries, Religious Institutions, Meeting Halls, Hospitals	
C	Outdoor Sports Arena or Facility, Playgrounds, Neighborhood Parks	
D	Office Buildings, Business Commercial and Professional	
E	Industrial, Manufacturing, Utilities, Agriculture	

Normally Acceptable
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements, and can meet the indoor noise standards.

Conditionally Acceptable
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design to meet interior and exterior noise standards, where applicable.

Normally Unacceptable:
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design to meet interior and exterior noise standards, where applicable.

Unacceptable
New construction or development should generally not be undertaken.

Source: County of Santa Cruz General Plan Noise Element, Table 9-2.

Table 4. Maximum Allowable Noise Exposure Stationary Noise Sources[1]

	Daytime[5] (7 AM to 10 PM)	Nighttime[2,5] (10 PM to 7 AM)
Hourly Leq – average hourly noise level, dB[3]	50	45
Maximum Level (Lmax), dB[3]	70	65
Maximum Level (Lmax), dB – Impulsive Noise[4]	65	60

dB – Decibel

1. As determined at the property line of the receiving land use. When determining effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property line noise mitigation measures.
2. Applies only were receiving land use operates or is occupied during nighttime hours.
3. Sound of the measurements shall be made with "slow" meter response.
4. Sound level measurements shall be made with "fast" meter response.
5. Allowable levels shall be raised to the ambient noise level were the ambient level exceeds the allowable levels. Allowable levels shall be reduced five dBA if the ambient hourly Leq is at least 10 dBA lower than the allowable level.

Source: County of Santa Cruz General Plan Public Noise Element, Table 9-3.

3.2.2 Santa Cruz County Code

The Santa Cruz County Code contains additional guidance with the intent to control noise, to promote and maintain the health, safety and welfare of its citizens. Chapter 8.30 of the Santa Cruz County Code enumerates general standards, limitations and exemptions pertaining to noise within the County. Additionally, Chapter 13.15 institutes "Noise Planning", which codifies General Plan policies and aids in regulating noise throughout the County through land use planning and permitting. The regulations presented below are considered potentially applicable to the proposed project.

8.30.10 Offensive Noise

(A) No person shall make, cause, suffer, or permit to be made any offensive noise.

(B) Offensive noise" means any noise which is loud, boisterous, irritating, penetrating, or unusual, or that is unreasonably distracting in any other manner such that it is likely to disturb people of ordinary sensitivities in the vicinity of such noise, and includes, but is not limited to, noise made by an individual alone or by a group of people engaged in any business, activity, meeting, gathering, game, dance, or amusement, or by any appliance, contrivance, device, tool, structure, construction, vehicle, ride, machine, implement, or instrument.

(C) The following factors shall be considered when determining whether a violation of the provisions of this section exists:

(1) Loudness (Intensity) of the Sound.

(a) Day and Evening Hours. For purposes of this factor, a noise shall be automatically considered offensive if it occurs between the hours of 8:00 a.m. and 10:00 p.m. and it is:

(i) Clearly discernible at a distance of 150 feet from the property line of the property from which it is broadcast; or

(ii) In excess of 75 decibels at the edge of the property line of the property from which the sound is broadcast, as registered on a sound measuring instrument meeting the American National Standard Institute's Standard S1.4-1971 (or more recent revision thereof) for Type 1 or Type 2 sound level meters, or an instrument which provides equivalent data. A noise not reaching this intensity of volume may still be found to be offensive depending on consideration of the other factors outlined below.

(b) Night Hours. For purposes of this factor, a noise shall be automatically considered offensive if it occurs between the hours of 10:00 p.m. and 8:00 a.m. and it is:

(i) made within 100 feet of any building or place regularly used for sleeping purposes; or

(ii) clearly discernible at a distance of 100 feet from the property line of the property from which it is broadcast; or

(iii) in excess of 60 decibels at the edge of the property line of the property from which the sound is broadcast, as registered on a sound measuring instrument meeting the American

National Standard Institute's Standard S1.4-1971 (or more recent revision thereof) for Type 1 or Type 2 sound level meters, or an instrument which provides equivalent data. A noise not reaching this intensity of volume may still be found to be offensive depending on consideration of the other factors outlined below.

(2) Pitch (frequency) of the sound, e.g., very low bass or high screech;

(3) Duration of the sound;

(4) Time of day or night;

(5) Necessity of the noise, e.g., garbage collecting, street repair, permitted construction activities;

(6) The level of customary background noise, e.g., residential neighborhood, commercial zoning district, etc.; and

(7) The proximity to any building regularly used for sleeping purposes.

(D) Prior to issuing a citation for this section, the responsible person or persons will be warned by a law enforcement officer or other designated official that the noise at issue is offensive and constitutes a violation of this chapter. A citation may be issued if, after receiving the warning, the responsible person(s) continues to make or resumes making the same or similar offensive noise(s) within three months of the warning. Notwithstanding the provisions of subsection (C)(1) of this section, enforcement of violations under this chapter shall not require the use of a sound level meter.

(1) For purposes of this section "responsible person or persons" means a person or persons with a right of possession in the property from which the offensive noise is emanating, including, but not limited to, an owner or a tenant of the property if the offensive noise is coming from private property, or a permittee if the offensive noise is coming from a permitted gathering on public property, or any person accepting responsibility for such offensive noise. "Responsible person or persons" shall additionally include the landlord of another responsible party and the parents and/or legal guardians of a responsible person under the age of 18 years.

13.15.040 Exemptions.

(A) Noise sources normally and reasonably associated with construction, repair, remodeling, or grading of any real property, provided a permit has been obtained from the County as required, and provided said activities take place between the hours of 8:00 a.m. and 5:00 p.m. on weekdays unless the Building Official has in advance authorized said activities to start at 7:00 a.m. and/or continue no later than 7:00 p.m. Such activities shall not take place on Saturdays unless the Building Official has in advance authorized said activities, and provided said activities take place between 9:00 a.m. and 5:00 p.m. and no more than three Saturdays per month. Such activities shall not take place on Sunday or a federal holiday unless the Building Official has in advance authorized such work on a Sunday or federal holiday, or during earlier morning or later evening hours of a weekday or Saturday.

(B) Emergency Work. The provisions of this chapter shall not apply to the emission of sound for the purpose of alerting persons to the existence of an emergency or in the performance of emergency work.

13.15.050 General Noise Regulations and Unlawful Noise.

(A) No use, except a temporary construction operation, shall be permitted which creates noise which is found by the Planning Commission not to conform to the noise parameters established by Table 9-2 and Table 9-3 of the Santa Cruz County General Plan beyond the boundaries of the project site at standard atmospheric pressure.

(B) Backup emergency generators shall only be operated during power outages and for other temporary purposes. If the generator is located within 100 feet of a residential dwelling unit, noise attenuation measures shall be included to reduce noise levels to an A-weighted maximum exterior noise level of 60 dB at the property line and a maximum interior noise level of 45 dB within nearby residences.

13.15.060 Special Requirements for Air Conditioning/Mechanical Units in or Near Residential Uses.

Where the intruding noise source is a residential air-conditioning unit, or a commercial air-conditioning or other mechanical unit located within 100 feet of any building or place regularly used for sleeping purposes, that operates more or less continually and/or during most hours, the A-weighted exterior noise level when measured at any neighboring property line shall not exceed 60 dB for units installed before, and 55 dB for units installed after, the effective date of this chapter, and a maximum interior noise level of 45 dB within nearby residences. In permitting or designing buildings with air conditioning or mechanical units, such units shall be located away from rooms used for sleeping purposes and shall incorporate sound-attenuating measures if feasible, and/or shall provide mitigation for such rooms, such as sound-rated windows or other measures as approved by the Building Official.

13.15.070 Noise generating land use.

(A) New commercial and industrial development that would increase noise levels above the normally acceptable range in Table 9-2 or the levels in Table 9-3 of the Santa Cruz County General Plan Noise Element shall require acoustic studies to determine the noise reduction requirements to be included as conditions of approval. Noise levels shall not exceed the standards in Table 9-3, and require, as conditions of approval, site design and sound reducing measures if the project would:

  (1) Increase the noise level at existing noise-sensitive receptors or areas by five (5) dB Ldn or more, where the post-project Ldn would remain equal to or below 60 dB.

  (2) Increase the noise level at existing noise-sensitive receptors or areas by three (3) dB Ldn or more, where the post-project Ldn would exceed 60 dB.

(B) The standards in this section shall not limit the ability of the County to impose conditions of approval on projects that increase noise levels at existing noise-sensitive receptors or areas by any amount.

13.15.080 Exterior noise standards.

New development shall not be exposed to noise levels that exceed the normally acceptable levels in Table 9-2 of the Santa Cruz County General Plan Noise Element, which establishes acceptable through unacceptable ranges of noise exposure by land use.

13.15.090 Interior noise standards.

(A) Noise insulation of new structures developed within the County of Santa Cruz shall comply with applicable requirements of Title 24 of the California Health and Safety Code, as may be amended from time to time and as adopted by the County of Santa Cruz within Chapter 12.10 SCCC, Building Regulations. Interior noise levels shall not exceed 45 dB Ldn in any habitable room in a residential structure or 50 dB Ldn in any nonresidential structure. To meet this standard, special sound insulating construction is required for the following types of projects:

(1) New development activities located within the highway and local roadway future noise contour of 60 to 65 dB Ldn or higher in Figures 9-2a and 9-2b of the General Plan Noise Element.

(2) New development activities located within the future noise contour band of 60 to 65 dB Ldn or higher for the Watsonville Municipal Airport in Figure 9-4 of the General Plan Noise Element.

(3) As a condition of approval for all discretionary applications for new development in other areas where noise exposures are known to, or are determined to, exceed the standards in Table 9-2 and 9-3 of the General Plan Noise Element. Acoustical studies may be required to determine existing exterior noise levels and the level of sound insulation required.

4 PROJECT ANALYSIS

4.1 Construction Noise

Construction noise levels in the project vicinity would fluctuate depending on the particular type, number, and duration of usage for the various pieces of equipment. The effects of construction noise depend largely on the types of construction activities occurring on any given day, noise levels generated by those activities, distances to noise-sensitive receptors, and the existing ambient noise environment in the vicinity of the receiver. Construction generally occurs in several discrete stages, with each stage varying the equipment mix and equipment usage rates. These construction stages alter the characteristics of the noise environment generated on the project site and in the surrounding community for the duration of the construction stage. Construction stages for development of this project were assumed to include: site preparation, grading, building construction, paving and painting (architectural coating). As the proposed project site is currently occupied primarily with temporary structures, vehicles and storage containers, traditional demolition would not be an element of the project construction

The site preparation and grading stages generate the most substantial noise levels due to clearing, grading, compacting, and excavating of the site, which utilizes the loudest mix of construction equipment. Heavy construction equipment utilized during the site preparation and grading stages typically includes backhoes, dozers, loaders; excavation equipment such as, excavators, graders and scrapers; and compaction equipment. Erection of large structural elements and mechanical systems could require the use of a crane for placement and assembly tasks, which may also generate substantial noise levels. Table 5 lists the noise levels typically generated by various types of construction equipment. Impact pile-driving and blasting are not anticipated to be required for construction of the proposed project.

Table 5. Noise Emission Levels from Construction Equipment

Equipment Type	Typical Equipment (Lmax, dBA at 50 feet)
All Other Equipment > 5 HP	85
Backhoe	78
Compressor (air)	78
Concrete Saw	90
Crane	81
Dozer	82
Excavator	81
Front End Loader	79
Generator	72
Grader	85
Man Lift	75
Paver	77
Roller	80
Scraper	84
Tractor	84
Welder / Torch	73

Notes:
dBA = A-weighted decibels; Lmax = maximum noise level.
Source: DOT 2006, FHWA 2008.

To assess noise levels associated with the various equipment types and operations, construction equipment can be considered to operate in two modes, mobile and stationary. Mobile equipment sources move around a construction site performing tasks in a recurring manner (e.g., loaders, graders, dozers). Stationary equipment operates in a given location for an extended period of time to perform continuous or periodic operations. Thus, it is necessary to determine the location of stationary sources during specific phases, or the effective acoustical center of operations for mobile equipment during various phases of the construction process. Operational characteristics of heavy construction equipment are additionally typified by short periods of full-power operation followed by extended periods of operation at lower power, idling, or powered-off conditions. These characteristics are accounted for through the application of typical usage factors (operational percentage) to the reference noise levels.

Although specific construction requirements for build-out of the proposed project are currently unknown, it is anticipated that typical construction sources such as backhoes, compressors, bulldozers, excavators, loaders and other related equipment will be utilized. Based on the reference noise levels, usage rates, fleet mixes and operational characteristics discussed above, overall hourly average noise levels attributable to project construction activities were calculated. Construction noise levels were predicted using reference noise emission data and operational parameters contained in the FHWA RCNM and the FTA guidance manual.

As indicated in Table 5, operational noise levels for typical construction activities would generate maximum noise levels ranging from 80 to 90 dBA at a distance of 50 feet. Accounting for usage factors of individual pieces of equipment, and typical construction equipment fleet mix for grading activities, construction operations would have the potential to result in hourly average noise levels of approximately 88 dBA Leq, 50 feet from the center of construction activity areas.

Noise from localized point sources (e.g., heavy construction equipment, mobile-source construction noise, stationary-source construction noise) typically decrease at a rate of 6 dB to 7.5 dB with each doubling of distance between the noise source and the receptor. An attenuation rate of 6 dB per doubling of distance is conservatively assumed for this analysis; however, actual in-situ attenuation rates are likely greater due to the dense foliage, topography and soil type.

Existing off-site noise-sensitive receptors are located immediately adjacent to the southern boundary of the proposed project, located approximately 325 feet south of the acoustical center of the proposed construction operations. As a result, construction activities would have the potential to generate noise levels of approximately 72 dBA Leq at the residential receptors to the south. Therefore, construction noise levels associated with the proposed project are predicted to comply with the Santa Cruz County Code 75 dBA property line noise level threshold, prior to incorporating mitigation.

Consistent with Policy 9.2.6 of the Santa Cruz County General Plan, the proposed project would incorporate the required construction mitigation as a condition of the project approval. The following typical mitigation measures are assumed to be implemented as part of construction activities associated with the proposed project, in order to reduce the effects of noise levels generated from construction operations.

- Construction equipment and vehicles shall be fitted with efficient, well-maintained mufflers that reduce equipment noise emission levels at the project site. Internal combustion powered equipment shall be equipped with properly operating noise suppression devices (e.g., mufflers, silencers, wraps) that meet or exceed manufacturer specifications. Mufflers and noise suppressors shall be properly maintained and tuned to ensure proper fit, function and minimization of noise.
- Portable and stationary site support equipment (such as generators, compressors, rock crushers, and cement mixers) shall be located as far as possible from nearby noise-sensitive receptors.
- Impact tools shall have the working area/impact area shrouded or shielded, with intake and exhaust ports on power equipment muffled or suppressed. This may necessitate the use of temporary or portable, application specific noise shields or barriers.
- Construction equipment shall not be idled for extended periods (e.g., 15 minutes or longer) of time in the immediate vicinity of noise-sensitive receptors.
- A disturbance coordinator shall be designated by the general contractor, which will post contact information in a conspicuous location near the entrance of the subject construction sites, prior to construction activities so that it is clearly visible to nearby receivers most likely to be disturbed. The coordinator shall manage complaints resulting from the construction noise. Recurring disturbances shall be evaluated by a qualified acoustical consultant retained by the project proponent to ensure compliance with applicable standards.

Application of the noise control techniques affecting and controlling the construction noise at the source (i.e., heavy equipment, pumps) set forth in above mitigation measures can obtain reductions of 3 to 6 dBA; noise control techniques implemented along the path of the noise (i.e., temporary noise barriers, enclosures, relocation of equipment) has been shown to reduce construction noise levels between 2 to 7 dBA (Wu & Keller 2007). The overall noise level reduction achieved through implementation of the noise control techniques set forth in above mitigation measures is expected to range from 5 to 13 dBA. Conservatively assuming a 5 dB reduction in noise levels due to the application of the prescribed mitigation measures, construction noise levels are calculated to be approximately 66 dBA at the nearest noise-sensitive receptor adjacent to the southern project boundary.

As discussed, Santa Cruz County does not directly establish objective construction noise level thresholds; however, the Santa Cruz County Code provides subjective noise level thresholds, based around objective standards for application at a receiving property line. Through the application of the above outlined mitigation measures and through effective management of operations associated with the proposed project, construction noise levels are expected to comply with the 75 dBA standard that is established in the Santa Cruz County Code Section 8.30.010 C. Additionally, the proposed project's construction operations are anticipated to be performed during the period outlined within the Santa Cruz County construction noise exemption, 8:00 AM to 5:00 PM unless advanced authorization to operate between the hours of 7:00 AM and 7:00 PM is obtained from the County.

4.2 Groundborne Vibration

Construction activities on the project site may result in varying degrees of temporary ground vibration, depending on the specific construction equipment used and operations involved. Caltrans has collected groundborne vibration information related to construction activities (Caltrans 2020b) that indicate continuous vibrations with a peak particle velocity (PPV) of approximately 0.2 inches per second (in./sec.) is considered annoying.

Representative groundborne vibration levels for various types of construction equipment, developed by FTA, are summarized below in the Table 6. Pile driving and blasting is not currently expected to be utilized in the construction of the proposed project. As shown in Table 6, heavier pieces of construction equipment, such as a bulldozer that may be expected on the project site, have peak particle velocities of approximately 0.089 in./sec. PPV or less at a reference distance of 25 feet (FTA 2018).

Groundborne vibration attenuates rapidly, even over short distances. The attenuation of groundborne vibration as it propagates from source to receptor through intervening soils and rock strata can be estimated with expressions found in FTA and Caltrans guidance. By way of example, for a bulldozer operating on-site and as close as the southern project boundary (i.e., 15 feet from the nearest receiving sensitive land use) the estimated vibration velocity level can be predicted with the equation as follows (FTA 2006):

PPVrcvr = PPVref * (25/D)^1.5 0.19 = 0.089 * (25/15)^1.5;

Where PPVrcvr is the predicted vibration velocity at the receiver position (nearest receptor), PPVref is the reference value at 25 feet from the vibration source (the bulldozer), and D is the actual horizontal distance to the receiver. As shown in the equation above, and based on reference vibration data, a bulldozer would produce a vibration velocity of 0.19 in./sec. PPV at the nearest receptor during a pass-by. Therefore, at this

predicted PPV, the vibration from construction operations may be noticeable to immediately adjacent residences but would be below the threshold for vibration-induced annoyance at nearby existing mobile homes.

Construction vibration, at sufficiently high levels, can also present a building damage risk. However, anticipated construction vibration associated with this proposed project would yield levels of 0.19 in./sec. PPV, which is not predicted to exceed the guidance thresholds of 0.3 in./sec. PPV for preventing damage to older residential structures exposed to continuous/frequent intermittent sources (Caltrans 2020b). As such, the predicted vibration level at 15 feet is less than this guidance limit for the risk of vibration damage to nearby structures exposed to continuous/frequent intermittent sources.

Table 6. Representative Vibration Levels for Construction Equipment

Equipment	PPV at 25 feet (in/sec)[1,3]	Approximate Lv (VdB) at 25 feet[2]
Hoe Ram	0.089	87
Large Bulldozer	0.089	87
Caisson Drilling	0.089	87
Heavy-duty Trucks (Loaded)	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Notes:
1. Where PPV is the peak particle velocity.
2. Where Lv is the RMS velocity expressed in vibration decibels (VdB), assuming a crest factor of 4.
3. Vibration levels can be approximated at other locations and distances using the above reference levels and the following equation: $PPV_{equip} = PPV_{ref} (25/D)^{1.5}$ (in/sec); where "PPV ref" is the given value in the above table, "D" is the distance for the equipment to the new receiver in feet.

Source: FTA 2018

It is notable that ground-borne vibrations from construction activities do not often reach the levels that can damage structures or affect activities that are not vibration sensitive, although the vibrations may be felt by nearby persons in close proximity and result in annoyance (FTA 2018).

Additionally, the elements of the proposed project do not include elements that would generate ground-borne vibration associated with the long-term operation. As such, the generation of and exposure to groundborne vibration from the proposed project is considered less than significant

4.3 Traffic Noise

Long-term operation of the proposed project would generate an increase in traffic volumes on the local roadway network in the project vicinity. Consequently, noise levels from this vehicular traffic along affected roadway segments would have the potential to increase. To assess the effect of project-generated traffic increases, traffic noise levels were modeled for roadway segments in the project vicinity based on the Federal Highway Administration (FHWA) Highway Traffic Noise Model (TNM) prediction methodologies (FHWA 1998). Potential off-site noise impacts resulting from the increase in vehicular traffic on the local roadway network, associated with long-term operations of the proposed project, were evaluated under Existing conditions, Existing plus Project conditions, a Near-Term year (2021), and Cumulative (2040) conditions with and without implementation of the proposed project.

Traffic volumes and the distribution of those volumes were obtained from the Traffic Impact Analysis prepared for the proposed project (Kimley-Horn and Associates 2019), with the exception of existing Highway 1 volumes. ADT volumes were calculated by summing all traffic movements for both the AM and PM peak hours, existing on or turning on to a particular roadway segment during the peak-hour and multiplying the total peak-hour volume by a "k-factor" of 5. Average vehicle speeds on local area roadways were assumed to be consistent with posted speed limits and remain as such with or without implementation of the proposed project.

As discussed in Section 2, Existing Traffic Noise, the traffic model was calibrated using Caltrans and FHWA calibration procedures, based on measured traffic noise levels and concurrent vehicle classification counts for the existing scenario. The modeled traffic noise levels were found to be reasonably consistent with traffic noise measurements conducted at the project site, over predicting traffic noise levels by less than 1 dB. As this is within the tolerances of the traffic noise prediction model calibration offsets were not applied to the model.

Existing traffic volumes for Highway 1 were obtained from the most current Caltrans traffic count data (Caltrans 2019). Highway 1 traffic volumes are reported to have an ADT of 102,000 trips. The Traffic Impact Analysis prepared for the proposed project indicates that the project would generate 5,972 net daily trips. When added to the elevated traffic volumes currently existing on Highway 1, the proposed project would result in less than a 0.5 dB change in traffic noise levels. Therefore, traffic noise increases associated with the proposed project on Highway 1 would not result in an impact and is not addressed further in this analysis.

Table 7 through Table 9 summarize modeled Ldn traffic noise levels at a reference distance of 100 feet from the roadway centerline for affected roadway segments in the project vicinity. The tables also presents relative traffic noise level increase (net change) resulting from implementation of the proposed project along with an evaluation of relative significance. Actual traffic noise exposure levels at noise-sensitive receptors in the project vicinity would vary depending on a combination of factors such as variations in daily traffic volumes, relative distances between sources and receiver locations, shielding provided by existing and proposed structures, and meteorological conditions. Refer to Appendix B for complete modeling inputs and results.

As shown below in Table 8, modeled traffic noise levels along roadway segments in the vicinity of the proposed project approach or exceed the "normally acceptable" noise level threshold under the Existing No Project condition at a number of locations in the study area. Because of this and to further evaluate effects of the proposed project, the potential for the project to increase the ambient noise level in the project's vicinity is also analyzed.

Table 7. Predicted Existing No Project and Plus Project Traffic Noise Levels

Roadway	Road Segment		Ldn at 100 Feet, dBA			
	From	To	Existing	Existing Plus Project	Net Change	Impact?
17th Ave	South of Soquel Ave		58.2	58.7	<1	No
40th Ave	South of Gross Ave		37.9	39.3	1.4	No
41st Ave	Gross Rd	Clares St	**64.8**	**65.0**	<1	No
41st Ave	Hwy 1 NB Ramps	Hwy 1 SB Ramps	**64.6**	**64.7**	<1	No
41st Ave	Hwy 1 NB Ramps	Soquel Dr	**63.2**	**63.3**	<1	No
41st Ave	Hwy 1 SB Ramps	Gross Rd	**65.8**	**65.9**	<1	No
Auto Plaza Dr	East of 41st		51.0	51.0	<1	No
Chanticleer Ave	South of Soquel Ave		53.8	54.8	1	No
Gross Rd	40th Ave	41st Ave	57.2	57.9	<1	No
Gross Rd	Existing Driveway	40th Ave	51.8	51.9	<1	No
Hwy 1 NB Off-Ramp			59.4	59.5	<1	No
Hwy 1 NB On-Ramp			49.6	49.6	<1	No
Hwy 1 SB Off-Ramp			56.4	56.4	<1	No
Hwy 1 SB On-Ramp			56.8	56.9	<1	No
Paul Sweet Dr	North of Soquel Dr		54.1	54.1	<1	No
Soquel Ave	17th Ave	Chanticleer Ave	**59.7**	**61.0**	1.3	No
Soquel Ave	Chanticleer Ave	Existing Driveway	**59.2**	**61.3**	2.1	No
Soquel Ave	Existing Driveway	40th Ave	**59.5**	**60.4**	<1	No
Soquel Ave	North/west of Gross Rd		**59.0**	**60.0**	1	No
Soquel Ave	SB On/Off Ramps	17th Ave	**62.4**	**62.9**	<1	No
Soquel Ave	West of SB On/Off Ramps		**63.3**	**63.6**	<1	No
Soquel Dr	East of Paul Sweet Dr		**64.2**	**64.2**	<1	No
Soquel Dr / Hwy 1 NB On-Ramp			**62.5**	**62.6**	<1	No

Notes: dBA = A-weighted decibels; Ldn = Day/Night Level; **BOLD** = Level approaches or exceeds 60 dBA Ldn "Normally Acceptable" level.
* Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

Existing (2019) traffic noise levels presented in Table 8 indicate that traffic noise levels in the project area currently range from approximately 38 to 66 dBA Ldn, without the proposed project. Existing (2019) plus Projects traffic noise levels are predicted to remain the same; i.e., ranging from approximately 36 to 66 dBA Ldn. Development of the proposed project is calculated to result in a net change in traffic noise levels ranging from less than 1 dB to approximately 2 dB. Implementation and development of the project is not projected to result in an increase in traffic noise levels of 3 dB Ldn or more at noise-sensitive receptors in the Project area or contribute significantly to further degradation of the ambient noise environment.

Table 8. Predicted Near-Term 2021 No Project and Plus Project Traffic Noise Levels

Roadway	Road Segment		Ldn at 100 Feet, dBA			
	From	To	Near-Term	Near-Term Plus Project	Net Change	Impact?
17th Ave	South of Soquel Ave		58.5	58.9	<1	No
40th Ave	South of Gross Ave		39.3	39.3	<1	No
41st Ave	Gross Rd	Clares St	**65.2**	**65.3**	<1	No
41st Ave	Hwy 1 NB Ramps	Hwy 1 SB Ramps	**64.8**	**64.9**	<1	No
41st Ave	Hwy 1 NB Ramps	Soquel Dr	**63.4**	**63.5**	<1	No
41st Ave	Hwy 1 SB Ramps	Gross Rd	**66.0**	**66.1**	<1	No
Auto Plaza Dr	East of 41st		51.1	51.1	<1	No
Chanticleer Ave	South of Soquel Ave		53.8	54.8	1	No
Gross Rd	40th Ave	41st Ave	57.4	58.1	<1	No
Gross Rd	Existing Driveway	40th Ave	51.8	51.9	<1	No
Hwy 1 NB Off-Ramp			59.4	59.5	<1	No
Hwy 1 NB On-Ramp			50.4	50.4	<1	No
Hwy 1 SB Off-Ramp			56.7	56.7	<1	No
Hwy 1 SB On-Ramp			56.9	57.1	<1	No
Paul Sweet Dr	North of Soquel Dr		54.3	54.3	<1	No
Soquel Ave	17th Ave	Chanticleer Ave	**59.4**	**61.0**	1.6	No
Soquel Ave	Chanticleer Ave	Existing Driveway	**59.5**	**61.3**	1.8	No
Soquel Ave	Existing Driveway	40th Ave	**59.5**	**60.4**	<1	No
Soquel Ave	North/west of Gross Rd		**59.2**	**60.2**	1	No
Soquel Ave	SB On/Off Ramps	17th Ave	**62.5**	**63.0**	<1	No
Soquel Ave	West of SB On/Off Ramps		**63.4**	**63.7**	<1	No
Soquel Dr	East of Paul Sweet Dr		**64.3**	**64.3**	<1	No
Soquel Dr / Hwy 1 NB On-Ramp			**62.6**	**62.7**	<1	No

Notes: dBA = A-weighted decibels; Ldn = Day/Night Level; **BOLD** = Level approaches or exceeds 60 dBA Ldn "Normally Acceptable" level.
* Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

Near-Term (2021) traffic noise levels presented in Table 9 indicate that traffic noise levels in the project area without the proposed project would range from approximately 39 to 66 dBA Ldn, without the proposed project. Existing (2019) plus Project traffic noise levels are predicted to remain the same; i.e., ranging from approximately 39 to 66 dBA Ldn. Development of the proposed project is calculated to result in a net change in traffic noise levels ranging from less than 1 dB to approximately 2 dB. Implementation and development of the project is not projected to result in an increase in traffic noise levels of 3 dB Ldn or more at noise-sensitive receptors in the Project area or contribute significantly to further degradation of the ambient noise environment.

Table 9. Predicted Cumulative 2040 No Project and Plus Project Traffic Noise Levels

Roadway	Road Segment		Ldn at 100 Feet, dBA			
	From	To	Cumulative	Cumulative Plus Project	Net Change	Impact?
17th Ave	South of Soquel Ave		59.2	59.6	<1	No
40th Ave	South of Gross Ave		39.3	39.3	<1	No
41st Ave	Gross Rd	Clares St	66.4	66.5	<1	No
41st Ave	Hwy 1 NB Ramps	Hwy 1 SB Ramps	65.9	66.0	<1	No
41st Ave	Hwy 1 NB Ramps	Soquel Dr	64.5	64.6	<1	No
41st Ave	Hwy 1 SB Ramps	Gross Rd	66.9	67.0	<1	No
Auto Plaza Dr	East of 41st		51.5	51.5	<1	No
Chanticleer Ave	South of Soquel Ave		53.8	54.8	1	No
Gross Rd	40th Ave	41st Ave	57.5	58.1	<1	No
Gross Rd	Existing Driveway	40th Ave	51.8	51.9	<1	No
Hwy 1 NB Off-Ramp			59.9	59.9	<1	No
Hwy 1 NB On-Ramp			53.6	53.6	<1	No
Hwy 1 SB Off-Ramp			58.6	58.6	<1	No
Hwy 1 SB On-Ramp			57.6	57.7	<1	No
Paul Sweet Dr	North of Soquel Dr		55.4	55.4	<1	No
Soquel Ave	17th Ave	Chanticleer Ave	59.8	61.0	1.2	No
Soquel Ave	Chanticleer Ave	Existing Driveway	59.5	61.3	1.8	No
Soquel Ave	Existing Driveway	40th Ave	59.5	60.6	1.2	No
Soquel Ave	North/west of Gross Rd		59.0	60.0	1	No
Soquel Ave	SB On/Off Ramps	17th Ave	62.9	63.4	<1	No
Soquel Ave	West of SB On/Off Ramps		63.9	64.2	<1	No
Soquel Dr	East of Paul Sweet Dr		64.7	64.7	<1	No
Soquel Dr / Hwy 1 NB On-Ramp			63.2	63.3	<1	No

Notes: dBA = A-weighted decibels; Ldn = Day/Night Level; **BOLD** = Level approaches or exceeds 60 dBA Ldn "Normally Acceptable" level.
* Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.

Cumulative (2040) traffic noise levels presented in Table 10 indicate that traffic noise levels in the project area without the proposed project range from approximately 39 to 66 dBA Ldn, without the proposed project. Existing (2019) plus Projects traffic noise levels are predicted to remain the same; i.e., ranging from approximately 39 to 66 dBA Ldn. Development of the proposed project is calculated to result in a net change in traffic noise levels ranging from less than 1 dB to approximately 2 dB. Implementation and development of the project is not projected to result in an increase in traffic noise levels of 3 dB Ldn or more at noise-sensitive receptors in the project area or contribute significantly to further degradation of the ambient noise environment.

On-site Traffic Noise Exposure

Traffic noise exposure at the proposed project location is primarily attributable to regional traffic on Highway 1, with Soquel Ave contributing to a lesser degree. Annual average daily traffic volumes from the most recent Caltrans traffic count data indicate an ADT of 102,000 trips. Using this as an input to the FHWA traffic noise prediction model results in a predicted traffic noise level of approximately 75 dBA Ldn at the northern most façade of the proposed medical office buildings. An exterior noise exposure of 75 dBA Ldn would place the proposed project within the "conditionally acceptable" range as outlined in Table 3 of this report, requiring noise insulation features be incorporated in the project design.

The Santa Cruz County General Plan Noise Element establishes a 50 dBA Leq interior noise levels within non-residential uses, such as the proposed project, consistent with the CalGreen Code. Additionally, Chapter 13.15 of the Santa Cruz County Code requires compliance with applicable elements of the California Title 24 (CalGreen). The Cal Code establishes a 50 dBA Leq (1-hour) interior noise levels standard or requires that the building envelope be constructed to a composite STC rating of 50 or greater and incorporate windows with a minimum STC rating of 40. Additionally, the Sound and Vibration Design Guidelines for Healthcare Facilities (Sykes et al. 2010), commissioned and adopted by the Facilities Guidelines Institute, recommends a composite STC rating of 45 to 50 for proposed facility sites with similar exterior noise exposure.

The current wall details that will be specified for the proposed project are unknown at this time. As compliance with the CalGreen Code and the County of Santa Cruz Building Regulations are required for building permits and occupancy, it is assumed that the building façade will be constructed in a manner consistent with applicable codes. Based on assumed compliance with the applicable building codes, interior noise levels within the proposed project would be in compliance with the County of Santa Cruz interior noise standards contained in Chapter 13.15.

4.4 Operational Noise Levels – Mechanical

Facility mechanical equipment associated with the operation of commercial retail and office uses generally includes heating, ventilation, and air-conditioning (HVAC) equipment, backup generators, and various fans, pumps, and compressors that often can be significant noise sources. Mechanical equipment is often mounted on rooftops, partially enclosed at grade adjacent to buildings, or located within mechanical equipment rooms. Noise levels generated by the HVAC and other mechanical equipment vary significantly depending on unit size, efficiency, location, type of rotating or reciprocating components, and orientation of openings.

Mechanical equipment for the proposed project will be located within the rooftop parapet and behind rooftop mechanical equipment screens. Detailed information about equipment types and configurations has yet to be specified for the project. However, mechanical schedules for a representative commercial use, similar to the proposed Project, were provided by the project team for use as the basis of the mechanical noise calculations. The representative project utilized package rooftop mechanical systems with approximate refrigeration capacities ranging from 120 to 170 tons. These units are generally evenly distributed across the rooftops of the commercial uses, and shielded by rooftop parapets. The proposed

project's rooftop plans indicate approximate locations for rooftop mechanical equipment within the rooftop mechanical screen and parapet.

The mechanical submittal for a similar but larger medical office building in the City of Dublin, CA was provided by the applicant. Based on personal conversations with the project team, the mechanical submittal for the Dublin MOB would be provide for a conservative analysis, as it required more mechanical units and expanded cooling capacity in comparison to the Santa Cruz MOB project (Pers Com 2019). The mechanical submittal is provided as an attachment to this analysis in Appendix C. Emissions from packaged rooftop units have sound power levels ranging from 86 to 102 dB LwA (sound power level), typically resulting in noise levels between 53 and 70 dBA at a distance of 50 feet. It is conservatively assumed that the mechanical equipment operates 80 percent of each hour between 7 a.m. and 10 p.m., and 20 percent of each hour between 10 p.m. and 7 a.m. The general locations for the mechanical equipment, as illustrated on the project rooftop plans, and the assumptions outlined above were used as inputs to a noise simulation model prepared for the proposed project. Project-related operational noise levels generated by rooftop mechanical/HVAC equipment were modeled using the ISO 9613-2 noise propagation algorithms within the three-dimensional noise simulation modeling software.

Independent of other operational project noise levels, noise levels generated by rooftop mechanical/HVAC equipment are predicted to be 46.4 dBA Leq and 40.4 dB Leq at the nearest noise-sensitive receivers in the project area, during daytime and nighttime periods respectively. Santa Cruz County Code Chapter 13.15.060 establishes a special requirement for air conditioning and mechanical units near residential units to not exceed a property line noise level of 55 dB(A) and a noise level not exceeding 45 dB(A) within the nearby residences. Therefore, mechanical equipment associated with the proposed project are predicted to comply with the Santa Cruz County Code special regulations for mechanical equipment.

4.5 Operational Noise Levels – Parking Garage

Development of the proposed project would include the construction of a four-level parking structure in the southwestern portion of the project site. The project plans indicate a total of approximately 730 parking stalls, with access points at two locations on the east-facing façade. The Traffic Impact Analysis report prepared for the proposed project indicates that 590 gross vehicle trips would be generated during the AM peak hour (460 in / 130 out) and 525 gross vehicle trips would be generated during the PM peak hour (152 in / 373 out) (Kimley-Horne Associates 2019). As the gross vehicle trips would provide a more conservative assessment of the proposed project's effect on the nearby residential receptors, in comparison to the net vehicle trips associated with the project site, gross vehicle trips generated during the AM peak hour are used in this analysis.

Activities making up a single parking event included vehicle arrival, limited idling, occupants exiting the vehicle, door closures, conversations among passengers, occupants entering the vehicle, and vehicle startup and departure. These parking actions can be described based on the duration of an event, the average noise level, and the maximum noise level occurring with a discreet parking action, summarized through the single-event sound exposure level (SEL) metric. Empirical sound level measurement data for parking lot activity, documented by Dudek staff, indicate that the average SEL associated with a single parking event is approximately 71 dBA at a distance of 50 feet from the center of parking activity. The reference SEL is then used to calculate the average noise level exposure based on the overall composite

number of parking events that would occur during a period. Parking activity noise occurs at varying times and locations throughout the parking structure. Thus, it is necessary to determine the acoustical center of the parking activity within the parking structure. The acoustical center of the sound levels generated by the proposed parking structure would be located approximately 240 feet from the nearest noise-sensitive property boundary to the south.

Assuming 590 vehicle trips would occur during a peak hour, based on the TIA trip generation rates, and the average single-event SEL of 71 dBA, parking activities would generate a noise level of approximately 63 dBA at a distance of 50 feet during the peak hour of parking activities. Assuming a standard attenuation rate of 6 dB per doubling of distance, and accounting for shielding provided by the parking structure itself, noise levels generated by the proposed project parking garage would be reduced to 44.5 dBA Leq during peak hour parking activities. Noise levels generated from parking activities during the PM peak hour or other off-peak hours would be lessened commiserate with the reduced activities. Therefore, parking activity within the proposed project's parking garage would comply with the Santa Cruz County General Plan (Table 4 of this report) average hourly Leq thresholds for stationary noise source at the nearest noise-sensitive receiving property lines.

Maximum sound levels generated by car doors closing, trunk closure, engine start up, car pass-by and tire squeal have been measured to produce sound levels of 63 to 69 dBA Lmax at a distance of 50 feet (Bayer 2007). The parking structure design includes partial height walls that would provide shielding of the parking activities at the nearby residential receptors, reducing the maximum sound levels by 5 to 7 dB at lower to higher floors respectively. Accounting for the shielding provided by the parking structure itself, maximum parking activity sound levels are calculated to be below 64 dBA Lmax at the nearby residential property boundary. Therefore, parking activities associated with the proposed project are predicted to comply with the Santa Cruz County General Plan maximum allowable Lmax noise level standards at the nearest noise-sensitive receiving property lines to the south.

4.6 Other Operational Noise Levels

Additional intermittent stationary noise attributable to the long-term operation of the proposed project may include landscape maintenance activities; garbage compaction and waste collection services; children playing in the designated play area; and people congregating and talking at outdoor patio uses. Such noise-generating activities occur infrequently, are generally intermittent in nature and are consistent with other noise events occurring in a community's typical ambient noise environment. These sources are expected to be less intensive than other project-related operational contributions such as aforementioned sounds from parking activities and mechanical systems. Furthermore, due to the infrequent and intermittent in nature of these sources, noise levels generated by these sources are typically masked in the ambient environment. Additional intermittent stationary noise attributable to the operation of the proposed project is predicted to comply with the Santa Cruz County noise standards.

5 CONCLUSION

A new four-story medical office building and five-story parking structure is proposed in the Live Oak area of Santa Cruz County, California. Dudek performed an acoustical analysis to address concerns with the proposed project's effect on the existing noise environment and surrounding community.

As part of the analysis, Dudek conducted an existing ambient noise monitoring survey to characterize the existing noise environment on the site and to quantify traffic noise levels from Soquel Avenue and Highway 1. The measured traffic noise levels were found to be the primary source of ambient noise within the existing noise environment. Existing ambient noise levels measured adjacent to Soquel Avenue and Highway 1 averaged 72 dBA Leq, with ambient level reducing to 44 dBA Leq at the southern boundary of the proposed project site.

Specific construction requirements and schedules for build-out of the proposed project are currently unknown; however, it is anticipated that typical construction equipment will be utilized for the project. Consistent with Policy 9.2.6 of the Santa Cruz County General Plan, the proposed project would incorporate the required construction mitigation as a condition of approval. Project-related construction noise levels were analyzed using FHWA RCNM and FTA algorithms and reference data. Project-related construction noise levels were calculated to comply Santa Cruz County Code noise level standards after incorporation of the prescribed mitigation measures.

Construction vibration levels anticipated to be associated with the proposed project were calculated to yield levels of 0.19 in./sec. PPV. Project-related construction vibration levels are predicted to be less than the Caltrans guidance limit of 0.2 to 0.3 in./sec. PPV at the nearest sensitive receptors, located approximately 15 feet south of the proposed project boundaries. Operational activities associated with the proposed project are not anticipated to include major groundborne vibration generating sources or activities. As such, potential groundborne vibration impacts due to the proposed project operation would be less than significant.

Long-term operation of the proposed Project would generate an increase in traffic volumes on the local roadway network in the project vicinity. Consequently, noise levels from vehicular traffic sources along affected roadway segments would have the potential to increase. Existing, Near-Term (2021) and Cumulative (2040) traffic noise levels were analyzed, with and without implementation of the proposed project through the application of FHWA traffic noise prediction algorithms. Development of the proposed project is not predicted to result in a significant increase in traffic noise levels in the project study area. Additionally, construction of the proposed medical office building and parking structure would shield significant portions of the residences located to the south of the project from Highway 1 and Soquel Avenue traffic noise.

Primary noise sources associated with the long-term operation of the proposed project are anticipated to include rooftop mechanical equipment and on-site parking activities within the proposed parking garage. Based on peak hour trip generation rates contained within the project's TIA, peak hour parking activities within the parking garage are predicted to be approximately 44.5 dBA Leq at the nearest noise-sensitive property line. Based on mechanical equipment specifications provided by the project team for a similar project, rooftop mechanical equipment noise levels were calculated to be 46.4 dBA Leq during daytime operation at the nearest noise-sensitive property line. If both primary on-site operational noise levels were to occur, combined project operational noise levels would be approximately 48.5 dBA Leq. Therefore, noise associated with the on-site operational activities associated with the proposed project would comply with the Santa Cruz County General Plan daytime stationary noise level criteria of 50 dBA Leq.

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APPENDIX A

Acoustic Fundamentals and Terminology

Acoustic Fundamentals

Acoustics is the scientific study that evaluates perception, propagation, absorption, and reflection of sound waves. Sound is a mechanical form of radiant energy, transmitted by a pressure wave through a solid, liquid, or gaseous medium. Sound that is loud, disagreeable, unexpected, or unwanted is generally defined as noise; consequently, the perception of sound is subjective in nature, and can vary substantially from person to person. Common sources of environmental noise and relative noise levels are shown in Figure A-1.

A sound wave is initiated in a medium by a vibrating object (e.g., vocal chords, the string of a guitar, the diaphragm of a radio speaker). The wave consists of minute variations in pressure, oscillating above and below the ambient atmospheric pressure. The number of pressure variation cycles occurring per second is referred to as the frequency of the sound wave and is expressed in hertz (Hz), which is equivalent to one complete cycle per second.

Directly measuring sound pressure fluctuations would require the use of a very large and cumbersome range of numbers. To avoid this and have a more useable numbering system, the decibel (dB) scale was introduced. Sound level expressed in decibels (dB) is the logarithmic ratio of two like pressure quantities, with one pressure quantity being a reference sound pressure and the second pressure being that of the sound source of concern. For sound pressure in air, the standard reference quantity is generally considered to be 20 micropascals, which directly corresponds to the threshold of human hearing. The use of the decibel is a convenient way to handle the million-fold range of sound pressures to which the human ear is sensitive. A decibel is logarithmic; it does not follow normal algebraic methods and cannot be directly added. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). A sound level increase of 10 dB corresponds to 10 times the acoustical energy, and an increase of 20 dB equates to a 100-fold increase in acoustical energy.

The loudness of sound perceived by the human ear depends primarily on the overall sound pressure level and frequency content of the sound source. The human ear is not equally sensitive to loudness at all frequencies in the audible spectrum. To better relate overall sound levels and loudness to human perception, frequency-dependent weighting networks were developed. The standard weighting networks are identified as A through E. There is a strong correlation between the way humans perceive sound and A-weighted sound levels (dBA). For this reason, the dBA can be used to predict community response to noise from the environment, including noise from transportation and stationary sources. Sound levels expressed as dB in this section are A-weighted sound levels, unless noted otherwise.

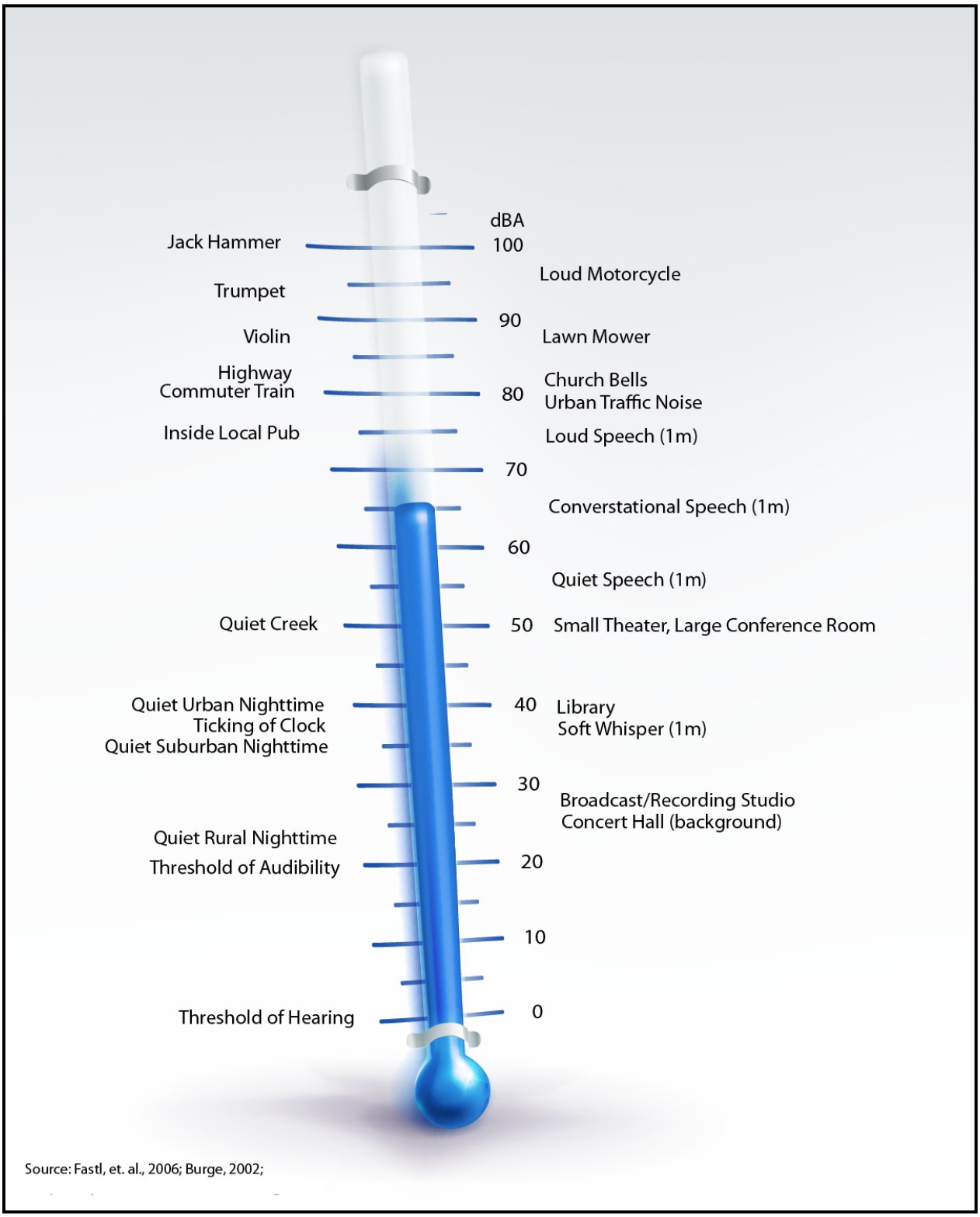

Figure A-1 -Common Noise Sources and Levels.

Noise can be generated by a number of sources, including mobile sources (transportation noise) such as automobiles, trucks, and airplanes and stationary sources (non-transportation noise) such as construction sites, machinery, and commercial and industrial operations. As acoustic energy spreads through the atmosphere from the source to the receiver, noise levels attenuate (decrease) depending on ground absorption characteristics, atmospheric conditions, and the presence of physical barriers (e.g., walls, building façades, berms). Noise generated from mobile sources generally attenuate at a rate of 3dBA (typical for hard surfaces, such as asphalt) to 4.5 dBA (typical for soft surfaces, such as grasslands) per doubling of distance, depending on the intervening ground type. Stationary noise sources spread with more spherical dispersion patterns that attenuate at a rate of 6 to 7.5 dBA per doubling of distance for hard and soft sites, respectively.

Atmospheric conditions such as wind speed, turbulence, temperature gradients, and humidity may additionally alter the propagation of noise and affect levels at a receiver. Furthermore, the presence of a large object (e.g., barrier, topographic features, and intervening building façades) between the source and the receptor can provide significant attenuation of noise levels at the receiver. The amount of noise level reduction or "shielding" provided by a barrier primarily depends on the size of the barrier, the location of the barrier in relation to the source and receivers, and the frequency spectra of the noise. Natural barriers such as berms, hills, or dense woods as well as man-made features such as buildings, berms and walls may be effective barriers for the reduction of source noise levels.

Noise Level Descriptors

The intensity of environmental noise levels can fluctuate greatly over time and as such, several different descriptors of time-averaged noise levels may be used to provide the most effective means of expressing the noise levels. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of both the noise source and the environment near the receptor(s). Noise descriptors most often used to describe environmental noise are defined below.

Lmin (Minimum Noise Level): The minimum noise level during a specific period of time, while accounting for the appropriate weighting curve and response setting (i.e., A-weighted, slow).

Lmax (Maximum Noise Level): The maximum instantaneous noise level during a specific period of time, while accounting for the appropriate weighting curve and response setting (i.e., A-weighted, slow).

SEL (Sound Exposure Level): The cumulative exposure to sound energy over a stated period of time.

Ln (Statistical Descriptor): The noise level exceeded "n"% of a specific period of time. For example, L50 is the median noise level, or level exceeded 50% of the time (typically equated to the noise level exceeded 30-minutes out of the hour).

Leq (Equivalent Noise Level): The energy-average noise level or exposure, from all noise events that occur in a specified period; such as one-minute, one-hour, 24-hours, etc. Leq can be used to report results of short-term noise measurements, usually ranging between 15 minutes and 1 hour, to supplement longer term measurements.

Ldn (Day-Night Average Noise Level): The 24-hour Leq with a 10-dBA "penalty" for noise events that occur during the noise-sensitive hours between 10 p.m. and 7 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours, and this generates a higher reported noise level when determining compliance with noise standards. The Ldn attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

CNEL (Community Noise Equivalent Level): The CNEL is similar to the Ldn described above, but with an additional 5-dBA "penalty" added to noise events that occur during the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. When the same 24-hour noise data are used, it is typical for the reported CNEL to be approximately 0.5 dBA higher than the Ldn.

Community noise is commonly described in terms of the ambient noise level which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent sound level (Leq)which corresponds to the steady-state A-weighted sound level containing the same total energy as the time-varying signal over a given time period (usually one hour). The Leq is the foundation of the composite noise descriptors such as Ldn and CNEL, as defined above, and shows very good correlation with community response to noise. Use of these descriptors along with the maximum noise level occurring during a given time period provides a great deal of information about the ambient noise environment in an area.

Effect of Noise on Humans

Excessive and chronic exposure to elevated noise levels can result in auditory and non-auditory effects on humans. Auditory effects of noise on people are those related to temporary or permanent hearing loss caused by loud noises. Non-auditory effects of exposure to elevated noise levels are those related to behavioral and physiological effects. The non-auditory behavioral effects of noise on humans are associated primarily with the subjective effects of annoyance, nuisance and dissatisfaction, which lead to interference with activities such as communications, sleep and learning. The non-auditory physiological health effects of noise on humans have been the subject of considerable research attempting to discover correlations between exposure to elevated noise levels and health problems, such as hypertension and cardiovascular disease. The mass of research infers that noise-related health issues are predominantly the result of behavioral stressors and not a direct noise-induced response. The extent to which noise contributes to non-auditory health effects remains a subject of considerable research, with no definitive conclusions.

The degree to which noise results in annoyance and interference is highly subjective and may be influenced by several non-acoustic factors. The number and effect of these non-acoustic environmental and physical factors vary depending on individual characteristics of the noise environment such as sensitivity, level of activity, location, time of day, and length of exposure. One key aspect in the prediction of human response to new noise environments is the individual level of adaptation to an existing noise environment. The greater the change in the noise levels that are attributed to a new noise source, relative to the environment an individual has become accustomed to, the less tolerable the new noise source will be to an individual.

With respect to how humans perceive and react to changes in noise levels, a 1 dBA increase is generally imperceptible outside of a laboratory environment, a 3 dBA increase is barely perceptible, a 6 dBA increase is clearly noticeable, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). These subjective reactions to changes in noise levels was developed on the basis of test subjects' reactions to changes in the levels of steady-state, pure tones or broad-band noise and to changes in levels of a given noise source. Perception and reaction to changes in noise levels in this manner is thought to be most applicable in the range of 50 to 70 dBA, as this is the usual range of voice and interior noise levels.

Vibration Fundamentals

Vibration is similar to noise in that it is a pressure wave traveling through an elastic medium involving a periodic oscillation relative to a reference point. Vibration is most commonly described in respect to the excitation of a structure or surface, such as in buildings or the ground. Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Sources of vibration include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and those introduced by human activity (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, (e.g., operating factory machinery) or transient in nature (e.g., explosions, impacts). Vibration levels can be depicted in terms of amplitude and frequency; relative to displacement, velocity, or acceleration.

Vibration amplitudes are commonly expressed in peak particle velocity (PPV) or root-mean-square (RMS) vibration velocity. PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal, or the quantity of displacement measured from peak to trough of the vibration wave. Root-mean-square is defined as the positive and negative statistical measure of the magnitude of a varying quantity. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a period of one second. PPV is typically used in the monitoring of transient and impact vibration and has been found to correlate well to the stresses experienced by buildings (Federal Transit Administration [FTA] 2006, California Department of Transportation [Caltrans] 2004). PPV and RMS vibration velocity are nominally described in terms of inches per second (in/sec). However, as with airborne sound, vibration velocity can also be expressed using decibel notation as vibration decibels (VdB). The logarithmic nature of the decibel serves to compress the broad range of numbers required to describe vibration and allow for the presentation of vibration levels in familiar terms.

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. Human response to vibration has been found to correlate well to average vibration amplitude; therefore, vibration impacts on humans are evaluated in terms of RMS vibration velocity.

Typical outdoor sources of perceptible groundborne vibration include construction equipment, steel-wheeled trains, and traffic on rough roads. Although the effects of vibration may be imperceptible at low levels, effects may result in detectable vibrations and slight damage to nearby structures at moderate and high levels, respectively. At the elevated levels of vibration, damage to structures is primarily architectural (e.g., loosening and cracking of plaster or stucco coatings) and rarely results in damage to structural components. The range of vibration relevant to this analysis occurs from approximately 60 VdB, which is the typical background vibration-velocity level; to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings (FTA 2006).

APPENDIX B

Traffic Noise Modeling Calculations

Appendix B

Traffic Noise Modeling Calculations - Summary

Project: 11244 - Santa Cruz MOB

Number	Name	Segment Description and Location From	To	Existing	Existing + Project	Δ Existing – Existing + Project	Near-Term	Near-Term + Project	Δ Near-Term – Near-Term + Project
Summary of Net Changes									
1	17th Ave	South of Soquel Ave		58.2	58.7	0.4	58.5	58.9	0.4
2	40th Ave	South of Gross Ave		37.9	39.3	1.4	39.3	39.3	0.0
3	41st Ave	Gross Rd	Clares St	64.8	65.0	0.2	65.2	65.3	0.1
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	64.6	64.7	0.1	64.8	64.9	0.1
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	63.2	63.3	0.1	63.4	63.5	0.1
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	65.8	65.9	0.1	66.0	66.1	0.1
7	Auto Plaza Dr	East of 41st		51.0	51.0	0.0	51.1	51.1	0.0
8	Chanticleer Ave	South of Soquel Ave		53.8	54.8	1.0	53.8	54.8	1.0
9	Existing Driveway	South of Soquel Ave		40.7	54.2	13.5	40.7	54.2	13.5
10	Gross Rd	40th Ave	41st Ave	57.2	57.9	0.7	57.4	58.1	0.7
11	Gross Rd	Existing Driveway	40th Ave	51.8	51.9	0.1	51.8	51.9	0.1
12	Hwy 1 NB Off-Ramp			59.4	59.5	0.1	59.4	59.5	0.1
13	Hwy 1 NB On-Ramp			49.6	49.6	0.0	50.4	50.4	0.0
14	Hwy 1 SB Off-Ramp			56.4	56.4	0.0	56.7	56.7	0.0
15	Hwy 1 SB On-Ramp			56.8	56.9	0.1	56.9	57.1	0.1
16	Paul Sweet Dr	North of Soquel Dr		54.1	54.1	0.0	54.3	54.3	0.0
17	Soquel Ave	17th Ave	Chanticleer Ave	59.7	61.0	1.3	59.4	61.0	1.6
18	Soquel Ave	Chanticleer Ave	Existing Driveway	59.2	61.3	2.1	59.5	61.3	1.8
19	Soquel Ave	Existing Driveway	40th Ave	59.5	60.4	0.9	59.5	60.4	0.9
20	Soquel Ave	North/west of Gross Rd		59.0	60.0	1.0	59.2	60.2	1.0
21	Soquel Ave	SB On/Off Ramps	17th Ave	62.4	62.9	0.5	62.5	63.0	0.5
22	Soquel Ave	West of SB On/Off Ramps		63.3	63.6	0.3	63.4	63.7	0.3
23	Soquel Dr	East of Paul Sweet Dr		64.2	64.2	0.0	64.3	64.3	0.0
24	Soquel Dr / Hwy 1 NB On-Ramp			62.5	62.6	0.1	62.6	62.7	0.1
25	Hwy 1			78.8	78.9	0.0			

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Modeling Calculations - Summary

Project: 11244 - Santa Cruz MOB

Number	Name	Segment Description and Location From	To	Cumulative	Cumulative + Project	Δ Cumulative – Cumulative + Project	
	Summary of Net Changes						
1	17th Ave	South of Soquel Ave		59.2	59.6	0.3	
2	40th Ave	South of Gross Ave		39.3	39.3	0.0	
3	41st Ave	Gross Rd	Clares St	66.4	66.5	0.1	
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	65.9	66.0	0.1	
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	64.5	64.6	0.0	
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	66.9	67.0	0.1	
7	Auto Plaza Dr	East of 41st		51.5	51.5	0.0	
8	Chanticleer Ave	South of Soquel Ave		53.8	54.8	1.0	
9	Existing Driveway	South of Soquel Ave		40.7	54.2	13.5	
10	Gross Rd	40th Ave	41st Ave	57.5	58.1	0.6	
11	Gross Rd	Existing Driveway	40th Ave	51.8	51.9	0.1	
12	Hwy 1 NB Off-Ramp			59.9	59.9	0.1	
13	Hwy 1 NB On-Ramp			53.6	53.6	0.0	
14	Hwy 1 SB Off-Ramp			58.6	58.6	0.0	
15	Hwy 1 SB On-Ramp			57.6	57.7	0.1	
16	Paul Sweet Dr	North of Soquel Dr		55.4	55.4	0.0	
17	Soquel Ave	17th Ave	Chanticleer Ave	59.8	61.0	1.2	
18	Soquel Ave	Chanticleer Ave	Existing Driveway	59.5	61.3	1.8	
19	Soquel Ave	Existing Driveway	40th Ave	59.5	60.6	1.2	
20	Soquel Ave	North/west of Gross Rd		59.0	60.0	1.0	
21	Soquel Ave	SB On/Off Ramps	17th Ave	62.9	63.4	0.4	
22	Soquel Ave	West of SB On/Off Ramps		63.9	64.2	0.2	
23	Soquel Dr	East of Paul Sweet Dr		64.7	64.7	0.0	
24	Soquel Dr / Hwy 1 NB On-Ramp			63.2	63.3	0.1	

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Model Calculations

Project: 11244 - Santa Cruz MOB

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 5

	Segment Description and Location			Input										Output				
						Distance to Directional Centerline, $(feet)_4$		Traffic Distribution Characteristics						Ldn,	Distance to Contour, $(feet)_3$			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Med	% Hvy	% Day	% Eve	% Night	$(dBA)_{5,6,7}$	70 dBA	65 dBA	60 dBA	55 dBA
Existing Conditions																		
1	17th Ave	South of Soquel Ave		7,860	30	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.2	16	35	76	165
2	40th Ave	South of Gross Ave		105	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	37.9	1	2	3	7
3	41st Ave	Gross Rd	Clares St	24,445	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.8	45	98	210	453
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	23,325	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.6	44	95	204	439
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	16,900	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.2	35	76	164	354
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	30,355	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	65.8	52	113	243	523
7	Auto Plaza Dr	East of 41st		2,155	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.0	5	12	25	54
8	Chanticleer Ave	South of Soquel Ave		4,110	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	53.8	8	18	39	83
9	Existing Driveway	South of Soquel Ave		250	10	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	40.7	1	2	5	11
10	Gross Rd	40th Ave	41st Ave	8,995	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.2	14	30	65	140
11	Gross Rd	Existing Driveway	40th Ave	2,580	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.8	6	13	28	61
12	Hwy 1 NB Off-Ramp			14,870	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.4	20	42	91	196
13	Hwy 1 NB On-Ramp			1,570	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	49.6	4	9	20	44
14	Hwy 1 SB Off-Ramp			7,425	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.4	12	27	57	123
15	Hwy 1 SB On-Ramp			8,230	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.8	13	28	61	132
16	Paul Sweet Dr	North of Soquel Dr		4,455	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.1	9	19	41	88
17	Soquel Ave	17th Ave	Chanticleer Ave	7,555	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.7	21	45	96	207
18	Soquel Ave	Chanticleer Ave	Existing Driveway	6,645	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.2	19	41	88	190
19	Soquel Ave	Existing Driveway	40th Ave	7,095	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	92	199
20	Soquel Ave	North/west of Gross Rd		6,325	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.0	18	40	85	184
21	Soquel Ave	SB On/Off Ramps	17th Ave	13,800	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.4	31	67	144	309
22	Soquel Ave	West of SB On/Off Ramps		17,235	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.3	36	77	167	359
23	Soquel Dr	East of Paul Sweet Dr		21,150	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.2	41	89	191	411
24	Soquel Dr / Hwy 1 NB On-Ramp			30,685	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.5	32	68	147	317
25	Hwy 1			94,000	65	100	100	95.0%	3.2%	1.8%	80.0%		20.0%	78.8	389	838	1805	3889

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Model Calculations

Project: 11244 - Santa Cruz MOB

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 5

	Segment Description and Location			Input										Output				
						Distance to Directional Centerline, $(feet)_4$		Traffic Distribution Characteristics						Ldn,	Distance to Contour, $(feet)_3$			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Med	% Hvy	% Day	% Eve	% Night	$(dBA)_{5,6,7}$	70 dBA	65 dBA	60 dBA	55 dBA
Existing + Project Conditions																		
1	17th Ave	South of Soquel Ave		8,640	30	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.7	18	38	81	175
2	40th Ave	South of Gross Ave		145	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	39.3	1	2	4	9
3	41st Ave	Gross Rd	Clares St	25,620	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	65.0	47	101	217	467
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	23,885	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.7	45	96	207	446
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	17,110	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.3	36	77	166	357
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	31,110	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	65.9	53	115	247	532
7	Auto Plaza Dr	East of 41st		2,155	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.0	5	12	25	54
8	Chanticleer Ave	South of Soquel Ave		5,165	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.8	10	21	45	97
9	Existing Driveway	South of Soquel Ave		5,575	10	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.2	9	19	41	88
10	Gross Rd	40th Ave	41st Ave	10,625	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.9	16	34	73	156
11	Gross Rd	Existing Driveway	40th Ave	2,650	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.9	6	13	29	62
12	Hwy 1 NB Off-Ramp			15,155	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	92	198
13	Hwy 1 NB On-Ramp			1,570	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	49.6	4	9	20	44
14	Hwy 1 SB Off-Ramp			7,425	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.4	12	27	57	123
15	Hwy 1 SB On-Ramp			8,475	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.9	13	29	62	135
16	Paul Sweet Dr	North of Soquel Dr		4,455	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.1	9	19	41	88
17	Soquel Ave	17th Ave	Chanticleer Ave	10,130	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	61.0	25	54	117	252
18	Soquel Ave	Chanticleer Ave	Existing Driveway	10,765	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	61.3	26	56	122	262
19	Soquel Ave	Existing Driveway	40th Ave	8,800	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	60.4	23	49	106	229
20	Soquel Ave	North/west of Gross Rd		8,035	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	60.0	22	46	100	216
21	Soquel Ave	SB On/Off Ramps	17th Ave	15,555	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.9	34	72	156	335
22	Soquel Ave	West of SB On/Off Ramps		18,425	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.6	38	81	174	375
23	Soquel Dr	East of Paul Sweet Dr		21,200	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.2	41	89	191	412
24	Soquel Dr / Hwy 1 NB On-Ramp			31,145	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.6	32	69	149	320
25	Hwy 1			94,530	65	100	100	95.0%	3.2%	1.8%	80.0%		20.0%	78.9	390	841	1812	3904

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Model Calculations

Project: 11244 - Santa Cruz MOB

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 5

	Segment Description and Location			Input										Output				
						Distance to Directional Centerline, $(feet)_4$		Traffic Distribution Characteristics						Ldn,	Distance to Contour, $(feet)_3$			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Med	% Hvy	% Day	% Eve	% Night	$(dBA)_{5,6,7}$	70 dBA	65 dBA	60 dBA	55 dBA
Near-Term Conditions																		
1	17th Ave	South of Soquel Ave		8,310	30	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.5	17	37	79	171
2	40th Ave	South of Gross Ave		145	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	39.3	1	2	4	9
3	41st Ave	Gross Rd	Clares St	26,310	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	65.2	48	103	221	476
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	24,425	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.8	45	98	210	453
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	17,695	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.4	37	79	170	365
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	31,805	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	66.0	54	116	251	540
7	Auto Plaza Dr	East of 41st		2,195	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.1	5	12	25	55
8	Chanticleer Ave	South of Soquel Ave		4,110	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	53.8	8	18	39	83
9	Existing Driveway	South of Soquel Ave		250	10	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	40.7	1	2	5	11
10	Gross Rd	40th Ave	41st Ave	9,400	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.4	14	31	67	144
11	Gross Rd	Existing Driveway	40th Ave	2,580	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.8	6	13	28	61
12	Hwy 1 NB Off-Ramp			15,095	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.4	20	43	92	198
13	Hwy 1 NB On-Ramp			1,895	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	50.4	5	11	23	50
14	Hwy 1 SB Off-Ramp			8,110	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.7	13	28	61	131
15	Hwy 1 SB On-Ramp			8,465	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.9	13	29	62	134
16	Paul Sweet Dr	North of Soquel Dr		4,660	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.3	9	19	42	90
17	Soquel Ave	17th Ave	Chanticleer Ave	7,055	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.4	20	43	92	198
18	Soquel Ave	Chanticleer Ave	Existing Driveway	7,145	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	93	200
19	Soquel Ave	Existing Driveway	40th Ave	7,095	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	92	199
20	Soquel Ave	North/west of Gross Rd		6,655	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.2	19	41	88	190
21	Soquel Ave	SB On/Off Ramps	17th Ave	14,235	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.5	32	68	147	316
22	Soquel Ave	West of SB On/Off Ramps		17,575	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.4	36	78	169	364
23	Soquel Dr	East of Paul Sweet Dr		21,505	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.3	42	90	193	416
24	Soquel Dr / Hwy 1 NB On-Ramp			31,425	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.6	32	69	150	322

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Model Calculations

Project: 11244 - Santa Cruz MOB

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 5

	Segment Description and Location			Input										Output				
						Distance to Directional Centerline, $(feet)_4$		Traffic Distribution Characteristics							Distance to Contour, $(feet)_3$			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Med	% Hvy	% Day	% Eve	% Night	Ldn, $(dBA)_{5,6,7}$	70 dBA	65 dBA	60 dBA	55 dBA
Near-Term + Project Conditions																		
1	17th Ave	South of Soquel Ave		9,135	30	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.9	18	39	84	182
2	40th Ave	South of Gross Ave		145	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	39.3	1	2	4	9
3	41st Ave	Gross Rd	Clares St	27,195	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	65.3	49	105	226	486
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	24,935	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.9	46	99	213	459
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	17,905	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.5	37	79	171	368
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	32,560	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	66.1	55	118	255	548
7	Auto Plaza Dr	East of 41st		2,195	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.1	5	12	25	55
8	Chanticleer Ave	South of Soquel Ave		5,165	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.8	10	21	45	97
9	Existing Driveway	South of Soquel Ave		5,575	10	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.2	9	19	41	88
10	Gross Rd	40th Ave	41st Ave	11,040	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.1	16	35	74	160
11	Gross Rd	Existing Driveway	40th Ave	2,650	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.9	6	13	29	62
12	Hwy 1 NB Off-Ramp			15,395	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	93	200
13	Hwy 1 NB On-Ramp			1,895	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	50.4	5	11	23	50
14	Hwy 1 SB Off-Ramp			8,110	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	56.7	13	28	61	131
15	Hwy 1 SB On-Ramp			8,710	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.1	14	30	64	137
16	Paul Sweet Dr	North of Soquel Dr		4,660	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.3	9	19	42	90
17	Soquel Ave	17th Ave	Chanticleer Ave	10,130	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	61.0	25	54	117	252
18	Soquel Ave	Chanticleer Ave	Existing Driveway	10,765	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	61.3	26	56	122	262
19	Soquel Ave	Existing Driveway	40th Ave	8,800	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	60.4	23	49	106	229
20	Soquel Ave	North/west of Gross Rd		8,365	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	60.2	22	48	103	222
21	Soquel Ave	SB On/Off Ramps	17th Ave	15,990	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.0	34	74	158	341
22	Soquel Ave	West of SB On/Off Ramps		18,765	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.7	38	82	176	380
23	Soquel Dr	East of Paul Sweet Dr		21,555	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.3	42	90	193	417
24	Soquel Dr / Hwy 1 NB On-Ramp			31,945	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.7	33	70	151	326

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Model Calculations

Project: 11244 - Santa Cruz MOB

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 5

		Segment Description and Location		Input										Output				
						Distance to Directional Centerline, $(feet)_4$		Traffic Distribution Characteristics						Ldn,	Distance to Contour, $(feet)_3$			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Med	% Hvy	% Day	% Eve	% Night	$(dBA)_{5,6,7}$	70 dBA	65 dBA	60 dBA	55 dBA
Cumulative Conditions																		
1	17th Ave	South of Soquel Ave		9,895	30	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.2	19	41	89	192
2	40th Ave	South of Gross Ave		145	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	39.3	1	2	4	9
3	41st Ave	Gross Rd	Clares St	35,300	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	66.4	58	125	269	579
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	31,085	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	65.9	53	115	247	532
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	22,725	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.5	43	93	200	432
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	39,485	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	66.9	62	134	289	624
7	Auto Plaza Dr	East of 41st		2,435	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.5	6	13	27	59
8	Chanticleer Ave	South of Soquel Ave		4,110	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	53.8	8	18	39	83
9	Existing Driveway	South of Soquel Ave		250	10	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	40.7	1	2	5	11
10	Gross Rd	40th Ave	41st Ave	9,550	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.5	15	31	68	146
11	Gross Rd	Existing Driveway	40th Ave	2,610	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.8	6	13	28	61
12	Hwy 1 NB Off-Ramp			16,620	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.9	21	45	98	211
13	Hwy 1 NB On-Ramp			3,950	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	53.6	8	17	38	81
14	Hwy 1 SB Off-Ramp			12,445	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.6	17	37	81	174
15	Hwy 1 SB On-Ramp			9,970	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.6	15	32	70	150
16	Paul Sweet Dr	North of Soquel Dr		5,940	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	55.4	11	23	49	106
17	Soquel Ave	17th Ave	Chanticleer Ave	7,605	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.8	21	45	97	208
18	Soquel Ave	Chanticleer Ave	Existing Driveway	7,145	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	93	200
19	Soquel Ave	Existing Driveway	40th Ave	7,095	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.5	20	43	92	199
20	Soquel Ave	North/west of Gross Rd		6,355	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.0	18	40	86	185
21	Soquel Ave	SB On/Off Ramps	17th Ave	15,740	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	62.9	34	73	157	338
22	Soquel Ave	West of SB On/Off Ramps		19,710	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.9	39	85	182	392
23	Soquel Dr	East of Paul Sweet Dr		23,770	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.7	44	96	206	445
24	Soquel Dr / Hwy 1 NB On-Ramp			36,160	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.2	35	76	164	354

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Model Calculations

Project: 11244 - Santa Cruz MOB

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 5

	Segment Description and Location			Input										Output				
						Distance to Directional Centerline, $(feet)_4$		Traffic Distribution Characteristics						Ldn,	Distance to Contour, $(feet)_3$			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Med	% Hvy	% Day	% Eve	% Night	$(dBA)_{5,6,7}$	70 dBA	65 dBA	60 dBA	55 dBA
Cumulative + Project Conditions																		
1	17th Ave	South of Soquel Ave		10,710	30	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.6	20	44	94	202
2	40th Ave	South of Gross Ave		145	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	39.3	1	2	4	9
3	41st Ave	Gross Rd	Clares St	36,005	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	66.5	59	126	272	586
4	41st Ave	Hwy 1 NB On/Off Ramps	Hwy 1 SB On/Off Ramps	32,070	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	66.0	54	117	252	543
5	41st Ave	Hwy 1 NB On/Off Ramps	Soquel Dr	22,920	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.6	43	94	201	434
6	41st Ave	Hwy 1 SB On/Off Ramps	Gross Rd	40,205	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	67.0	63	136	293	631
7	Auto Plaza Dr	East of 41st		2,435	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.5	6	13	27	59
8	Chanticleer Ave	South of Soquel Ave		5,130	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.8	10	21	45	96
9	Existing Driveway	South of Soquel Ave		5,575	10	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	54.2	9	19	41	88
10	Gross Rd	40th Ave	41st Ave	11,090	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.1	16	35	75	161
11	Gross Rd	Existing Driveway	40th Ave	2,685	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	51.9	6	13	29	63
12	Hwy 1 NB Off-Ramp			16,910	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	59.9	21	46	99	213
13	Hwy 1 NB On-Ramp			3,950	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	53.6	8	17	38	81
14	Hwy 1 SB Off-Ramp			12,445	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	58.6	17	37	81	174
15	Hwy 1 SB On-Ramp			10,205	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	57.7	15	33	71	152
16	Paul Sweet Dr	North of Soquel Dr		5,940	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	55.4	11	23	49	106
17	Soquel Ave	17th Ave	Chanticleer Ave	10,080	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	61.0	25	54	116	251
18	Soquel Ave	Chanticleer Ave	Existing Driveway	10,765	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	61.3	26	56	122	262
19	Soquel Ave	Existing Driveway	40th Ave	9,300	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	60.6	24	51	110	238
20	Soquel Ave	North/west of Gross Rd		7,970	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	60.0	21	46	100	215
21	Soquel Ave	SB On/Off Ramps	17th Ave	17,450	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.4	36	78	168	362
22	Soquel Ave	West of SB On/Off Ramps		20,865	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.2	41	88	189	408
23	Soquel Dr	East of Paul Sweet Dr		23,830	35	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	64.7	45	96	207	445
24	Soquel Dr / Hwy 1 NB On-Ramp			36,675	25	100	100	97.0%	2.0%	1.0%	80.0%		20.0%	63.3	36	77	166	357

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Appendix B

Traffic Noise Modeling Calculations - References

Citation	Reference
1	Caltrans Technical Noise Supplement. 2009 (November). Table (5-11), Pg 5-60.
2	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-26), Pg 5-60.
3	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-16), Pg 2-32.
4	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-11), Pg 5-47, 48.
5	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-26), Pg 2-55, 56.
6	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-27), Pg 2-57.
7	Caltrans Technical Noise Supplement. 2009 (November). Pg 2-53.
8	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-7), Pg 5-45.
9	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-8), Pg 5-45.
10	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-9), Pg 5-45.
11	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-13), Pg 5-49.
12	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-14), Pg 5-49.
13	Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (16), Pg 67
14	Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (20), Pg 69
15	Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (18), Pg 69

APPENDIX C

Mechanical Specifications

AIR HANDLING UNIT SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	AREA SERVED	SUPPLY AIRFLOW [CFM]	RETURN AIRFLOW [CFM]	MIN. OUTSIDE AIRFLOW [CFM]	SUPPLY FAN TOTAL S.P. [IN W.C.]	SUPPLY FAN EXT S.P. [IN W.C.]	SUPPLY FAN FAN QTY.	SUPPLY FAN FAN SPEED [RPM]	SUPPLY FAN MOTOR DATA BHP [EACH]	SUPPLY FAN MOTOR DATA HP [EACH]	SUPPLY FAN MOTOR DATA TOTAL HP	SUPPLY FAN WHEEL DIA. [IN.]	SUPPLY FAN VFD	RETURN/EXHAUST FAN TOTAL S.P. [IN W.C.]	RETURN/EXHAUST FAN EXT S.P. [IN W.C.]	RETURN/EXHAUST FAN FAN QTY.	RETURN/EXHAUST FAN FAN SPEED [RPM]	RETURN/EXHAUST FAN MOTOR DATA BHP [EACH]	RETURN/EXHAUST FAN MOTOR DATA HP [EACH]	RETURN/EXHAUST FAN MOTOR DATA TOTAL HP	RETURN/EXHAUST FAN WHEEL DIA. [IN]	RETURN/EXHAUST FAN VFD	DX COOLING COIL REFRIG TYPE	DX COOLING COIL REFRIG CHARGE [LBS]	DX COOLING COIL COIL PERFORMANCE AHRI EER	T24 MIN. EER	DX COOLING COIL TOTAL CAP [TON]	COIL PERFORMANCE TOTAL CAP [MBH]	COIL PERFORMANCE SENS CAP [BTU]	COIL PERFORMANCE SENS CAP [MBH]	SUPPLY AIR MAX VEL [FPM]	SUPPLY AIR MAX P.D. [IN W.C.]	SUPPLY AIR ENT DB [°F]	SUPPLY AIR ENT WB [°F]	SUPPLY AIR LVG DB [°F]	SUPPLY AIR LVG WB [°F]	COMPRESSORS QTY
AHU	1	AAON	EVAP COOLED RL134	ROOF	L2 WEST	33,300	0	33300	7.05	4.00	4	1495	25.2	30	120	33.5	Y	0.00	0.00	0	0	0.0	0	0	0.0	-	R-410A	419.00	13.2	11.5	119.9	1438.8	1322030.0	1322.0	500	0.50	84.4	63.0	47.6	47.4	4
AHU	1E	HUNTAIR	CUSTOM	ROOF	L2 WEST	0	33300	0	0.00	0.00	0	0	0.0	0	0	0.0	-	5.20	3.00	8	2355	4.8	5	40	18.0	Y		0.00	0	0	0	0.0	0.0	0.0	0	0.00	0.0	0.0	0.0	0.0	0
AHU	2	AAON	EVAP COOLED RL170	ROOF	L1 & L3 WEST	46,400	32480	13920	5.70	2.00	4	1471	16.2	20	80	30.4	Y	1.10	0.85	2	586	5.0	10	20	42.5	Y	R-410A	347.00	13.1	11.5	152.4	1828.8	1540780.0	1540.8	500	0.50	81.3	64.0	49.8	49.5	6
AHU	3	AAON	EVAP COOLED RL155	ROOF	CENTRAL WEST	42,500	32600	12750	5.50	2.00	4	1433	14.7	20	80	30.4	Y	1.10	0.85	2	587	5.0	10	20	42.5	Y	R-410A	502.00	13.1	11.5	137.7	1652.4	1444840.0	1444.8	500	0.50	82.6	64.3	50.3	50.1	6
AHU	4	AAON	EVAP COOLED RL125	ROOF	CENTRAL EAST	35,000	27800	10500	5.50	2.00	3	1442	15.3	20	60	30.4	Y	1.30	1.00	2	904	5.5	8	15	33.5	Y	R-410A	282.00	13	11.5	117.2	1406.4	1184880.0	1184.9	500	0.50	81.9	64.2	49.8	49.4	6
AHU	5	AAON	EVAP COOLED RL190	ROOF	EAST	48,800	37900	14640	5.80	2.00	4	1352	20.5	30	120	33.5	Y	1.30	1.00	2	667	7.2	15	30	42.5	Y	R-410A	480.00	12.7	11.5	168.9	2026.8	1702470.0	1702.5	500	0.50	82.2	64.2	49.1	49.0	8
AHU	6	HUNTAIR	CUSTOM	ROOF	CHEMO PHARMACY	3,900	0	3900	6.30	3.00	2	3611	2.8	3	6	12.0	Y	0.00	0.00	0	0	0.0	0	0	0.0	-	R-410A	45.80	0	11	6.6	79.2	78600.0	78.6	500	0.50	99.0	67.8	50.2	50.0	0

AIR HANDLING UNIT CONT.

ITEM TYPE	ITEM NO.	HEATING COIL CAPACITY [BTU]	AIR MAX VEL [FPM]	AIR MAX P.D. [IN W.C.]	AIR ENT DB [°F]	AIR LVG TEMP [°F]	HOT WATER HHW FLOW [GPM]	HOT WATER ENT TEMP [°F]	HOT WATER LVG TEMP [°F]	HOT WATER MAX P.D. [FT W.C.]	ENERGY RECOVERY TYPE	FACE AREA [SF]	WINTER CONDITION FLUID FLOW RATE [GPM]	FLUID PRESSURE DROP [FT W.C.]	FLUID ENT TEMP [°F]	FLUID LVG TEMP [°F]	AIR PRESSURE DROP [IN W.C.]	AIR ENT DB TEMP [°F]	AIR LVG DB TEMP [°F]	ELECTRICAL V	PH	HZ	COMPRESSOR FLA [AMPS]	FAN FLA [AMPS]	EMERGENCY/ STANDBY POWER	EMERGENCY LOAD	PRE-FILTER % EFFICIENCY	FINAL FILTER % EFFICIENCY	VIBRATION ISOLATION TYPE	MIN. STATIC DEFL.	OPERATING WEIGHT [LBS]	NOTES
AHU	1	730000.0	600	0.50	26.5	55.0	37	140	100	5.00	RUN AROUND COIL	69.3	68	15.7	60.1	33.8	0.98	26.5	50.9	460	3	60	337	0	YES	284.1 kVA	30%	90%	NP	1/4"	33500	1-20
AHU	1E	0.0	0	0.00	0.0	0.0	0	0	0	0.00	RUN AROUND COIL	75.52	68	16.3	33.8	60.1	0.66	68	42.3	460	3	60	0	64	YES	37.9 kVA	30%		NP	1/4"	17000	1-21
AHU	2	334300.0	600	0.50	49.8	62.6	20	140	106	5.00		0	0	0	0	0	0	0	0	460	3	60	232	137	YES	95.2 kVA	30%	60%	NP	1/4"	42000	1-20
AHU	3	377000.0	600	0.50	44.4	60.0	25	140	109	5.00		0	0	0	0	0	0	0	0	460	3	60	215	137	NO	0 kVA	30%	60%	NP	1/4"	38500	1-20
AHU	4	266400.0	600	0.50	47.3	60.8	10	140	100	5.00		0	0	0	0	0	0	0	0	460	3	60	190	103	YES	64.7 kVA	30%	60%	NP	1/4"	28600	1-20
AHU	5	281800.0	600	0.50	55.1	65.5	16	140	104	5.00		0	0	0	0	0	0	0	0	460	3	60	270	202	NO	0 kVA	30%	60%	NP	1/4"	43100	1-20
AHU	6	120000.0	450	0.50	26.5	55.0	6	140	100	3.00		0	0	0	0	0	0	0	0	460	3	60	11	0	YES	16.9 kVA	30%	99.97%	NP	1/4"	6000	1-20

1. AIR HANDLING UNIT SIZES AND COMPONENTS SHALL BE SIZED ON MAXIMUM UNIT PERFORMANCE INDICATED FOR CABINET SIZE CFM. AHU AIRFLOWS INCLUDE 4% LEAKAGE FACTOR AND 6% SPARE CAPACITY.
2. PROVIDE INTEGRATED FILTERS, FRAMING, FILTER CARTRIDGES AND MAGNEHELIC GAUGES.
3. AHU-1 TO AHU-5 HAVE INTERGAL INDIRECTIVE EVAPORATIVE CONDENSING SECTION. PROVIDE INTEGRAL WATER TREATMENT.
4. AHU-6 HAS SEPARATE AIR-COOLED CONDENSING UNIT. REFER TO DX UNIT SCHEDULE.
5. AHU-1 AND AHU-6 ARE 100% OUTSIDE AIR SUPPLY UNITS.
6. AHU-1E IS EXHAUST ONLY.
7. AHU-6: PROVIDE STAINLESS STEEL DISCHARGE PLENUM AT DOWNSTREAM OF THE HEPA FILTER.
8. AHU-1 AND AHU-1E: PROVIDE INTERGAL HEAT RECOVERY RUNAROUND COILWITH MINIMUM 50% EFFICIENCY WITH SUPPLEMENTAL HEATING HOT WATER PIPING CONNECTIONS.
9. ALL CONTROLS ARE ON EMERGENCY POWER.
10. PROVIDE PREMIUM EFFICIENCY MOTORS.
11. PROVIDE THRUST RESTRAINERS ON ALL FANS.
12. PROVIDE INDIVIDUAL VFD FOR EACH FAN FOR ALL UNITS, EXCEPT AHU-1E. AHU-1E TO HAVE TWO (2) 40 HP VFDS IN RUNNING/STANDBY.
13. ALL UNITS ARE IN DRAW THROUGH COOLING COILS POSITION. SUPPLY AIR TEMPERATURES ARE LEAVING COIL TEMPERATURES.
14. PROVIDE FACTORY INSTALLED INSULATION ON INTERNAL PIPING.
15. PROVIDE FACTORY DESIGNED PIPING SUPPORTS INSIDE CABINET.
16. ALL UNITS SHALL HAVE FAN ARRAYS WITH N+1 FAN REDUNDANCY. PROVIDE MANUAL INSERT BLANKOFF FOR FAILED FAN.
17. AIR HANDLING UNIT AIR INTAKE SHALL BE MIN 18" ABOVE ROOF CURB OR ABOVE HOUSEKEEPING PAD.
18. PROVIDE FLEXIBLE DUCTWORK CONNECTIONS.
19. PROVIDE TWO ELECTRICAL POWER CONNECTIONS FOR AHU-2 TO AHU-5, ONE FOR FANS AND THE OTHER FOR ALL OTHER COMPONENTS. PROVIDE SEPARATE 120V POWER CONNECTIONS FOR CONTROLS AND UNIT LIGHTINGS.
20. PROVIDE DUCT SMOKE DETECTOR AT NEAR SUPPLY AIR OUTLET.
21. PROVIDE FACTORY VESTIBULE FOR FIELD INSTALLATION AND PIPING OF THE SKID.

VIBRATION ISOLATION SUPPORT SYSTEM LEGEND (TYPICAL):

- USM - UNHOSED SPRING MOUNTS- SEISMIC SNUBBER
- RSM - RESTRAINED SPRING MOUNTS
- SSM - SEISMIC SPRING MOUNTS
- SH - SPRING HANGER
- SF - STRUCTURAL STEEL INTEGRAL FRAME
- IB - INERTIA BASE
- NM - NEOPRENE MOUNTED

FAN SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	AREA SERVED	ROOM AIR FLOW [CFM]	ADDITIONAL AIRFLOW [CFM]	TOTAL AIR FLOW [CFM]	EMERGENCY MODE AIR FLOW [CFM]	EFFECTIVE PLUME HEIGHT [FT.]	MIN. FAN NOZZLE DISCHARGE VELOCITY [FPM]	E.S.P. [IN W.C.]	FAN [RPM]	MOTOR DATA BHP	EMERGENCY MODE BHP	HP	V	PH	HZ	SPEED CONTROL	VIBRATION ISOLATION MOUNT TYPE	MIN. STATIC DEFL. [IN]	OPERATING WEIGHT [LBS]	NOTES
EF	1-A	GREENHECK	VEKTOR-H-10-6	ROOF	HOT LAB 1122 - HOFU212	455	230	685	685	17.4	3500	3	3446	1.2	1.2	1.5	460	3	60	VFD	NM	2"	838	1-4, 6-10, 14-16
EF	1-B	GREENHECK	VEKTOR-H-10-6	ROOF	HOT LAB 1122 - HOFU212	455	230	685	685	17.4	3500	3	3446	1.2	1.2	1.5	460	3	60	VFD	NM	2"	838	1-4, 6-10, 14-16
EF	2-A	GREENHECK	VEKTOR-H-9	ROOF	PATHOLOGY LAB 2216	600	350	950	950	18.7	3500	2	3463	1.3	1.3	1.5	460	3	60	VFD	NM	2"	811	1-4, 6-11, 16
EF	2-B	GREENHECK	VEKTOR-H-9	ROOF	PATHOLOGY LAB 2216	600	350	950	950	18.7	3500	2	3463	1.3	1.3	1.5	460	3	60	VFD	NM	2"	811	1-4, 6-11, 16
EF	3-A	GREENHECK	VEKTOR-H-10	ROOF	BLOCK CUTTING 1658 - HOFU222	605	400	1,005	1005	18.4	3500	2.5	3442	1.4	1.4	2	460	3	60	VFD	NM	2"	1100	1-4, 6-11, 16
EF	3-B	GREENHECK	VEKTOR-H-10	ROOF	BLOCK CUTTING 1658 - HOFU222	605	400	1,005	1005	18.4	3500	2.5	3442	1.4	1.4	2	460	3	60	VFD	NM	2"	1100	1-4, 6-11, 16
EF	4	GREENHECK	29-IPA	ROOF	GENERAL EXHAUST	14,500	0	14,500	9425	0.0	0	2	474	8.6	2.4	10	460	3	60	VFD	USM	2"	2460	1-4, 10
EF	5	GREENHECK	21-IPA	ROOF	GENERAL EXHAUST	7,200	0	7,200	2760	0.0	0	2	642	4.1	0.2	5	460	3	60	VFD	USM	2"	1165	1-4, 10
EF	6	GREENHECK	23-IPA	ROOF	GENERAL EXHAUST	9,900	0	9,900	3560	0.0	0	2	622	6.2	0.3	7.5	460	3	60	VFD	USM	2"	1485	1-4, 10
EF	7	GREENHECK	29-IPA	ROOF	GENERAL EXHAUST, LINAC	13,900	0	13,900	0	0.0	0	2	466	8.0	0	10	460	3	60	VFD	USM	2"	2460	1-4
EF	8	GREENHECK	SQ-160-VG	TER	TER	3,600	0	3,600	3600	0.0	0	0.3	0	0.3	0.3	2	208	1	60	VFD	USM	2"	400	1-4, 10
EF	9-A	GREENHECK	VEKTOR-CS-18-10-II	ROOF	ONCOLOGY PHARMACY 2614A - HOBI221	4,000	0	4,000	4000	22.5	3500	5.5	2478	4.1	4.1	7.5	460	3	60	VFD	USM	2"	2100	1-4, 7-13, 16
EF	9-B	GREENHECK	VEKTOR-CS-18-10-II	ROOF	ONCOLOGY PHARMACY 2614A - HOBI221	4,000	0	4,000	4000	22.5	3500	5.5	2478	4.1	4.1	7.5	460	3	60	VFD	USM	2"	2100	1-4, 7-13, 16
EF	10-A	GREENHECK	VEKTOR-CH-12-10-II	ROOF	ISOLATION ROOM 1253	500	1,000	1,500	1500	20.2	3500	3	2697	1.5	1.5	2	460	3	60	VFD	USM	2"	1300	1-6, 10, 16
EF	10-B	GREENHECK	VEKTOR-CH-12-10-II	ROOF	ISOLATION ROOM 1253	500	1,000	1,500	1500	20.2	3500	3	2697	1.5	1.5	2	460	3	60	VFD	USM	2"	1300	1-6, 10, 16
EF	11-A	GREENHECK	VEKTOR-CH-15-10-II-10	ROOF	SCOPE WASH - 2362	1,500	1,500	3,000	3000	30.5	5560	4	2791	4.2	4.2	5	460	3	60	VFD	USM	2"	1600	1-4, 6, 7, 10, 16
EF	11-B	GREENHECK	VEKTOR-CH-15-10-II-10	ROOF	SCOPE WASH - 2362	1,500	1,500	3,000	3000	30.5	5560	4	2791	4.2	4.2	5	460	3	60	VFD	USM	2"	1600	1-4, 6, 7, 10, 16

1. PROVIDE OSHA BELTGUARD/WEATHER COVER AND ADJUSTABLE BELT DRIVE
2. PROVIDE TEFC MOTOR, PREMIUM EFFICIENCY
3. SEISMIC SNUBBERS SHALL BE ADJUSTED AFTER FANS ARE OPERATED AND ADUSTMENT OF SPRING HAS ACCOMODATED LATERAL MOVEMENT AND THRUST
4. ALL EXHAUST STACKS SHALL BE SELF-DRAIN TYPE, PROVIDE SCROLL DRAINS ON ALL UTILITY FANS.
5. LABEL FAN “HAZARDOUS EXHAUST - NEGATIVE ISOLATION ROOMS. CALL CLINIC STAFF PRIOR TO SHUT DOWN”. PROVIDE WEATHER PROOF LABELS ON DUCT, PLENUMS, FANS AND DISCHARGE STACK.
6. FANS ARE IN RUN AND STANDBY FAN ARRANGEMENT.
7. FAN SERVING STERILIZING DEPARTMENT AND FUME HOODS SHALL HAVE CORROSION RESISTANT POLYESTER POWDER COAT FINISH.
8. FANS SERVING HOODS SHALL HAVE AMCA-A SPARK RESISTANT CONSTRUCTION.
9. FANS SERVING HOODS SHALL HAVE SHAFT SEAL, FLANGED DISCHARGE CONNECITON, PHENOLIC EPOXY POWDER COAT FINISH W/UV PROTECTION.
10. PROVIDE EMERGENCY POWER.
11. LABEL FAN “HAZARDOUS EXHAUST”. PROVIDE WEATHER PROOF LABELS ON DUCT, PLENUMS, FANS AND DISCHARGE STACK.
12. EF-9A AND EF-9B RUN IN PARALLEL AT 50% AIRFLOW IN NORMAL OPERATION. FAN RAMPS UP TO 100% WHEN THE OTHER FAN FAILS. REFER TO CONTROL DIAGRAMS.
13. PROVIDE VARIABLE VOLUME EXHAUST OUTLET AND FACTORY AIRFLOW SENSOR AT FAN INLET FOR EF-9A AND EF-9B.
14. LABEL FAN “HAZARDOUS EXHAUST - RADIOACTIVE. CALL CLINIC STAFF PRIOR TO SHUT DOWN”. PROVIDE WEATHER PROOF LABELS ON DUCT, PLENUMS, FANS AND DISCHARGE STACK.
15. PROVIDE BAG-IN BAG-OUT MERV 8 PREFILTERS AND HEPA FINAL FILTERS IN DUTY/STANDBY ARRANGEMENT WITH BUBBLE-TIGHT ISOLATION DAMPERS.
16. PROVIDE DIRECT DRIVE FAN FOR EF-1A/1B, EF-2A/2B, EF-3A/3B, EF-9A/9B, EF-10A/10B, EF-11A/11B.

EXHAUST FAN FILTER

ASSOCIATED FAN	MANUFACTURER & MODEL NO.	PRE FILTER EFFICIENCY	FINAL FILTER EFFICIENCY	CLEAN FILTER PRESSURE DROP [IN W.C.]	DIRTY FILTER PRESSURE DROP [IN W.C.]	MAX FACE VELOCITY [FPM]
EF-1A/B	CAMFIL CF-1/2X1-212P-3GB-SS W/ CF-BTFB-8-M-SS	MERV 8	MERV 18	0.65	1.95	200

COMPUTER ROOM UNIT SCHEDULE (DX CONDENSING UNIT)

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	AREA SERVED	REFRIGERANT TYPE	COOLING DATA CAP [BTU]	CONDENSER FAN QTY	HP EA	AIR FLOW [CFM]	ELECTRICAL DATA V	PH	HZ	FLA [AMPS]	MCA [AMPS]	VIBRATION ISOLATION MOUNT TYPE	MIN STATIC DEFL. [IN]	OPERATING WEIGHT [LBS]	NOTES
CRC	1-A	DATA AIRE	DARC-1134	ROOF	TER	R-410A	120000.0	2	0.75	10400	460	3	60	3.6	4	RSM	2"	600	1-9
CRC	1-B	DATA AIRE	DARC-1134	ROOF	TER	R-410A	120000.0	2	0.75	10400	460	3	60	3.6	4	RSM	2"	600	1-9

COMPUTER ROOM UNIT SCHEDULE (DX EVAPORATOR)

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	AREA SERVED	CONFIGURATION	SUPPLY FAN AIRFLOW [CFM]	ECONOMIZER OUTSIDE AIR FLOW [CFM]	EXT S.P. [IN WC]	MOTOR DATA HP	V	PH	HZ	COOLING COIL TOTAL CAP [BTU]	SENS CAP [BTU]	FAN POWER (W/KBTU.h)	AIR ENT DB [°F]	AIR ENT WB [°F]	AIR LVG DB [°F]	AIR LVG WB [°F]	COND. DRAIN [IN]	CONDENSATE PUMP Y/N
CRU	1-A	DATA AIRE	DALA-1034-CO-D	CAFE	TER	CEILING SUSPENDED DUCTED	3700	3700	0.50	3	460	3	60	116600	90500	24.7	78	65	55	54	3/4"	Yes
CRU	1-B	DATA AIRE	DALA-1034-CO-D	CAFE	TER	CEILING SUSPENDED DUCTED	3700	3700	0.50	3	460	3	60	116600	90500	24.7	78	65	55	54	3/4"	Yes

ITEM TYPE	ITEM NO.	ELECTRICAL DATA V	PH	HZ	MCA [AMPS]	FULL LOAD CURRENT	FILTERS MERV	INLET SOUND POWER LEVEL dB re 10E-12 Watts 63	125	250	500	1k	2k	4k	8k	OUTLET SOUND POWER LEVEL dB re 10E-12 Watts 63	125	250	500	1k	2k	4k	8k	RADIATED SOUND POWER LEVEL dB re 10E-12 Watts 63	125	250	500	1k	2k	4k	8k	OPERATING WEIGHT [LBS]	NOTES
CRU	1-A	460	3	60	26	23.6	8	70	74	80	77	72	72	73	64	73	76	82	82	83	79	77	68	72	75	81	80	80	78	76	67	990	1-9
CRU	1-B	460	3	60	26	23.6	8	70	74	80	77	72	72	73	64	73	76	82	82	83	79	77	68	72	75	81	80	80	78	76	67	990	1-9

1. COMPUTER ROOM UNITS ARE IN RUNNING/STANDBY CONFIGURATION.
2. PROVIDE AIR SIDE ECONOMIZER CONTROLS.
3. PROVIDE MICROPROCESSOR CONTROLLER FOR EACH UNIT.
4. PROVIDE INTEGRAL REFRIGERANT CONTROL.
5. CRC-1-A AND CRC-1-B ARE CEILING MOUNTED UNITS.
6. FILTERS SHALL BE FACTORY MOUNTED, 65% EFFICIENCY, DISPOSABLE TYPE.
7. MANUFACTURER TO PROVIDE INTERCONNECTING WIRING, PIPING, CONDUIT FOR EXTERNAL MOUNTED DEVICES SUCH AS CONTROL VALVES AND OTHER SPECIFIED ACCESSORIES.
8. PROVIDE REFRIGERANT LEAKAGE DETECTION.
9. PROVIDE EMERGENCY POWER.

Plot Date: 5/18/2018 3:38:53 PM
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PERMIT 3
INCREMENT 1

ISSUED FOR	REV	DATE
ASI-037	46	05/18/2018
ASI-022	27	10/31/2017
ADDENDUM 4, ISSUED FOR PERMIT	6	04/17/2017
ADDENDUM 3		03/10/2017
ADDENDUM 3	4	02/21/2017
ADDENDUM 3, ISSUED FOR PERMIT		01/27/2017
ADDENDUM 1	2	08/24/2016

SEALS AND SIGNATURES

REGISTERED PROFESSIONAL ENGINEER
R. DASWANI
M31875
MECHANICAL
STATE OF CALIFORNIA

DRAWING TITLE
HVAC SCHEDULES

SCALE
12" = 1'-0"

20681.000
PROJECT NUMBER

CD
M0.02
DRAWING NUMBER

CHILLER SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	AREA SERVED	TYPE	REFRIG TYPE	COOLING CAPACITY [TONS]	EVAPORATOR DESIGN FLOW [GPM]	EVAPORATOR ENT WATER TEMP [°F]	EVAPORATOR LVG WATER TEMP [°F]	CONDENSER DESIGN AMBIENT OA TEMP [°F]	ELECTRICAL FLA [AMPS]	ELECTRICAL V	ELECTRICAL PH	ELECTRICAL HZ	ELECTRICAL EMERGENCY/ STANDBY POWER	VIBRATION ISOLATION MOUNT TYPE	VIBRATION ISOLATION MIN STATIC DEFL. [IN]	OPERATING WEIGHT [LB]	NOTES
CH	1	DIMPLEX THERMAL SOLUTIONS	DTSWO2250MR60	ROOF	MRI	PACKAGED AIR COOLED	R-407C	17.0	34.4	53	43	99	67	460	3	60	NO	RSM	2"	4050	1, 4, 5
CH	2	DIMPLEX THERMAL SOLUTIONS	DTSWO2250MR60	ROOF	MRI	PACKAGED AIR COOLED	R-407C	17.0	34.4	53	43	99	67	460	3	60	NO	RSM	2"	4050	1, 4, 5
CH	3	VARIAN	CAVCS0754-M	ROOF	LINAC	PACKAGED AIR COOLED	R-407C	7.5	4.0	108	65	99	21.9	460	3	60	NO	RSM	2"	1610	2-5
CH	4	VARIAN	CAVCS0754-M	ROOF	LINAC	PACKAGED AIR COOLED	R-407C	7.5	4.0	108	65	99	21.9	460	3	60	NO	RSM	2"	1610	2-5
CH	5	VARIAN	CAVCS0754-M	ROOF	LINAC	PACKAGED AIR COOLED	R-407C	7.5	4.0	108	65	99	21.9	460	3	60	NO	RSM	2"	1610	2-5
CH	6	VARIAN	CAVCS0754-M	ROOF	LINAC	PACKAGED AIR COOLED	R-407C	7.5	4.0	108	65	99	21.9	460	3	60	NO	RSM	2"	1610	2-5

2

1. MRI CHILLERS (CH-1 AND CH-2) ARE TO BE OFCI.
2. LINAC CHILLERS (CH-3 TO CH-6) TO HAVE INTEGRAL PUMP, TANK, AIR SEPARATOR, AND ACCESSORIES.
3. PROVIDE CHILLER CONTROLS PER MEDICAL EQUIPMENT MANUFACTURER REQUIREMENTS.
4. PROVIDE ALARM OUTPUTS TO BMS.
5. PROVIDE AUTOMATIC DOMESTIC WATER SWITCH OVER PANEL FOR EMERGENCY BACKUP. SWITCH OVER PANEL TO BE LOCATED AS CLOSE TO THE IMAGING EQUIPMENT AS POSSIBLE.

VRF INDOOR UNIT SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	FAN DATA SUPPLY AIRFLOW [CFM]	COOLING COIL AIRSIDE ENT TEMP DB [°F]	ENT TEMP WB [°F]	TOTAL CAPACITY [BTU]	SENSIBLE CAPACITY [BTU]	ELECTRICAL MCA [A]	MOTOR DATA V	PH	HZ	VIBRATION ISOLATION MOUNT TYPE	MIN. STATIC DEFL. [IN]	OPERATING WEIGHT [LBS]	NOTES
FCU	A-1	DAIKIN	FXAQ12PVJU	EMERGENCY SWITCHGEAR ROOM	1220	86	75	12000	8900	0.4	208	1	60	SH	1"	26	
FCU	A-2	DAIKIN	FXAQ12PVJU	MAIN ELECTRICAL ROOM	1220	86	75	12000	8900	0.4	208	1	60	SH	1"	26	
FCU	B-1	DAIKIN	FXFQ48TVJU	MECHANICAL ROOM	290	86	75	48000	35300	1.8	208	1	60	NH	1/2"	55	
FCU	B-2	DAIKIN	FXFQ48TVJU	MECHANICAL ROOM	290	86	75	48000	35300	1.8	208	1	60	NH	1/2"	55	
FCU	C-1	DAIKIN	FTXS36LVJU	ELEVATOR MACHINE ROOMS (TYP.)	770	85	74	36000	22390	19.5	208	1	60	SH	1"	45	TYPICAL OF 6. SEE ROOF PLANS.

VRF OUTDOOR UNIT SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	ASSOCIATED EVAP UNIT	LOCATION	REFRIGERANT TYPE	REFRIGERANT CHARGE [LBS]	COOLING DATA HIGH AMBIENT OUTDOOR TEMP [°F]	COOLING DATA CAP [BTU]	COOLING DATA EFFICIENCY [EER]	MIN EER	COOLING DATA INTEGRATED EFFICIENCY [IEER]	MIN IEER	ELECTRICAL V	ELECTRICAL PH	ELECTRICAL HZ	ELECTRICAL MCA [AMPS]	VIBRATION ISOLATION MOUNT TYPE	VIBRATION ISOLATION MIN STATIC DEFL. [IN]	OBERATING WEIGHT [LBS]	NOTES
DXC	1	DAIKIN	RXYQ12OTYDN	FCU-A-1, A-2, B-1, B-2	ROOF	R-410A	22.9	99	114000	13.2	11	23.5	12.9	460	3	60	21	USM	1"	600	
DXC	2	DAIKIN	RXYQ24OTYDN	AHU-6	ROOF	R-410A	45.8	99	228000	11.5	10.6	20.8	12.3	460	3	60	42	USM	1"	1200	1-2
DXC	3	DAIKIN	RXS36LVJU	FCU-C1	ROOF	R-410A	6.2	99	36000	8.37	11.7	0	0	460	3	60	20	USM	1"	200	

2

1. DXC-2 HAS TWO(2) INDIVIDUAL CONNECTIONS WITH 11.7 RLA EACH. PROVIDE FIELD DISCONNECTS.
2. PROVIDE 208V POWER TO ELECTRONIC EXPANSION VALVE CONTROLLER FOR DXC-2.

ELECTRIC STEAM HUMIDIFIER

ITEM	MANUFACTURER & MODEL NO.	QTY.	AREA SERVED	CONTROL VALVE ELECTRICAL DATA	MAX. STEAM PRESSURE PSIG	MAX. STEAM OUTPUT LB/HR	STEAM SUPPLY CONNECTION IN.	ELECTRICAL V/PHASE/AMP	ELECTRICAL Power kW	MAX. OPER. WT. LB	NOTES
H-1	DRI-STEEM VLC 48-3	1	L2 PACU AREA	0-10 V; 4-20 MA	15	136	1 1/2	480/ 3 / 57.7	48	563	1-10
H-2	DRI-STEEM VLC 64-4	1	ONCOLOGY PHARMACY	0-10 V; 4-20 MA	15	182	1 1/2	480/ 3 / 77	77	1190	1-10, 12
H-3	DRI-STEEM VLC 21-1	6	OPERATING ROOMS	0-10 V; 4-20 MA	15	60	1 1/2	480/ 3 / 25.3	21	212	1-11

2

NOTES:
1. PROVIDE INJECTION TUBE AND FLEXIBLE HOSE.
2. PROVIDE FACTORY INSULATION.
3. HI-LOW LIMIT SWITCH AND AIR FLOW SENSOR INTEGRAL WITH HUMIDIFIER.
4. CONTRACTOR SHALL COORDINATE WITH EQUIPMENT TO PROVIDE DUCT TRANSITIONS AT EACH HUMIDIFIER AS NECESSARY FOR PROPER INSTALLATION
5. PROVIDE STAINLESS STEEL STRAIGHT DUCTWORK DOWN STREAM OF HUMIDIFIER 10 FT. MIN.
6. PROVIDE 1-1/4" CONDENSATE LINES.
7. PROVIDE EMERGENCY POWER.
8. PROVIDE AFTER COOLER.
9. PROVIDE FACTORY CONTROLLER WITH BMS COMMUNICATION CAPABILITY.
10. PROVIDE DRAIN PAN 25% LARGER THAN HUMIDIFIER WITH LEAK DETECTION AND CONNECT TO BMS.
11. PROVIDE ONE H-3 PER OPERATING ROOM.
12. PROVIDE FACTORY OUTDOOR ENCLOSURE.

ACOUSTIC DATA

ITEM	INLET SOUND POWER 63	125	250	500	1K	2K	4K	8K	LWA	DBA	OUTLET SOUND POWER 63	125	250	500	1K	2K	4K	8K	LWA	DBA	RADIATED SOUND POWER 63	125	250	500	1K	2K	4K	8K	LWA	DBA	NOTES
AHU-1	82	84	88	80	81	67	35	23	-	-	99	97	99	97	93	92	95	92	-	-	-	-	-	-	-	-	-	-	-	-	
AHU-1E	80	83	82	78	79	62	23	7	-	-	98	96	96	97	95	92	87	81	-	-	-	-	-	-	-	-	-	-	-	-	
AHU-2	86	88	86	82	83	75	70	66	-	-	99	97	98	98	97	93	89	83	-	-	-	-	-	-	-	-	-	-	-	-	
AHU-3	86	88	85	81	83	75	70	66	-	-	98	97	97	97	96	92	88	82	-	-	-	-	-	-	-	-	-	-	-	-	
AHU-4	85	87	85	82	84	80	78	76	-	-	100	96	97	97	95	92	87	81	-	-	-	-	-	-	-	-	-	-	-	-	
AHU-5	83	86	86	80	82	78	74	70	-	-	99	98	99	98	94	93	94	91	-	-	-	-	-	-	-	-	-	-	-	-	
AHU-6	78	77	82	80	72	71	66	63	-	-	84	83	85	86	81	78	73	68	-	-	88	88	84	81	79	74	67	60	-	-	
EF-1-A	98	91	89	89	85	77	74	67	90	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
EF-1-B	98	91	89	89	85	77	74	67	90	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
EF-2-A	87	85	82	89	79	77	71	65	88	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
EF-2-B	87	85	82	89	79	77	71	65	88	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
EF-3-A	88	86	85	85	80	76	72	68	86	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
EF-3-B	88	86	85	85	80	76	72	68	86	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
EF-4	98	88	79	75	73	67	62	57	79	68	106	96	87	80	75	69	63	59	86	75	-	-	-	-	-	-	-	-	-	-	
EF-5	93	89	79	74	70	66	60	55	78	67	102	97	88	80	74	68	62	57	85	74	-	-	-	-	-	-	-	-	-	-	
EF-6	98	92	81	76	73	69	63	59	81	70	106	100	89	82	77	71	65	60	88	77	-	-	-	-	-	-	-	-	-	-	
EF-7	97	87	78	74	72	66	61	55	78	67	105	95	86	79	74	69	62	57	55	74	-	-	-	-	-	-	-	-	-	-	
EF-8	74	76	81	80	72	69	65	61	80	69	-	-	-	-	-	-	-	-	-	-	77	77	77	74	64	54	47	45	74	63	
EF-9-A	96	94	90	90	83	80	75	72	90	79	96	90	93	89	85	81	75	70	91	79	-	-	-	-	-	-	-	-	-	-	1
EF-9-B	96	94	90	90	83	80	75	72	90	79	96	90	93	89	85	81	75	70	91	79	-	-	-	-	-	-	-	-	-	-	1
EF-10-A	85	84	84	85	77	73	70	64	85	73	86	84	81	83	75	73	68	63	83	72	-	-	-	-	-	-	-	-	-	-	
EF-10-B	85	84	84	85	77	73	70	64	85	73	86	84	81	83	75	73	68	63	83	72	-	-	-	-	-	-	-	-	-	-	
EF-11-A	95	94	89	91	83	80	76	72	91	79	90	92	88	92	84	81	75	71	91	80	-	-	-	-	-	-	-	-	-	-	
EF-11-B	95	94	89	91	83	80	76	72	91	79	90	92	88	92	84	81	75	71	91	80	-	-	-	-	-	-	-	-	-	-	
CRU-1-A	70	74	80	77	72	72	73	64	-	-	73	76	82	82	83	79	77	68	-	-	72	75	81	80	80	78	76	67	-	-	
CRU-1-B	70	74	80	77	72	72	73	64	-	-	73	76	82	82	83	79	77	68	-	-	72	75	81	80	80	78	76	67	-	-	
FCU-A-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32	31	38	36	34	30	21	14	-	38	
FCU-A-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32	31	38	36	34	30	21	14	-	38	
FCU-B-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	46	46	44	40	35	25	18	-	45	
FCU-B-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	46	46	44	40	35	25	18	-	45	

NOTES:
1. FAN AT FULL SPEED

PUMP SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	SYSTEM SERVED	FLOW [GPM]	PUMP HEAD [FT WC]	MOTOR DATA BHP	HP	V	PH	HZ	SPEED CONTROL	VIBRATION ISOLATION MOUNT TYPE	MIN. STATIC DEFL. (IN)	OPERATING WEIGHT (LBS)	NOTES
HHWP	1	BELL & GOSSETT	E-1510-2BD	L1 PLANT ROOM	HHW	150	70	3.6	5	460	3	60	VFD	USM	1"	300	1, 3-5
HHWP	2	BELL & GOSSETT	E-1510-2BD	L1 PLANT ROOM	HHW	150	70	3.6	5	460	3	60	VFD	USM	1"	300	1, 3-5
HRP	1	BELL & GOSSETT	4BC	AHU-1E	HEAT RECOVERY	68	60	2.3	3	460	3	60	VFD	USM	1"	200	2-5

2 2

1. HHWP MAY SERVE EITHER BOILER.
2. HRP-1 TO BE PROVIDED AS PUMP SKID INSIDE AND PART OF AHU-1E. HRP-1 TO BE INTERNALLY ISOLATED.
3. PROVIDE VARIABLE SPEED DRIVES.
4. OPERATING WEIGHTS DO NOT INCLUDE CONCRETE INERTIA BASES IF REQUIRED.
5. PROVIDE PREMIUM EFFICIENCY TEFC MOTORS

BOILER SCHEDULE

ITEM TYPE	ITEM NO.	MANUFACTURER	MODEL NO.	LOCATION	SERVICE	TYPE	CAPACITY MIN OUTPUT [MBH]	CAPACITY MIN. EFF. %	MIN.THERMAL EFFICIENCY %	HOT WATER MAX [GPM]	HOT WATER MIN [GPM]	HOT WATER ENT TEMP [°F]	HOT WATER LVG TEMP [°F]	FLUE COLLAR DIA [IN]	ELECTRICAL DATA V	ELECTRICAL DATA PH	ELECTRICAL DATA HZ	ELECTRICAL DATA FLA [AMPS]	VIBRATION ISOLATION MOUNT TYPE	VIBRATION ISOLATION MIN STATIC DEFL. [IN]	OBERATING WEIGHT [LBS]	NOTES
B	01	RAYPAK	XTHERM 1505A	L1 PLANT ROOM	HEATING HOT WATER	CONDENSING GAS-FIRED	1440	96	80	150	25	100	140	8"	460	3	60	12	NP	1/4"	1500	1-2
B	02	RAYPAK	XTHERM 1505A	L1 PLANT ROOM	HEATING HOT WATER	CONDENSING GAS-FIRED	1440	96	80	150	25	100	140	8"	460	3	60	12	NP	1/4"	1500	1-2

2

1. BOILERS ARE SIZED AT 68% OF BUILDING PEAK LOAD.
2. PROVIDE CONDENSATE NEUTRAILZER.

KAISER PERMANENTE®

DUBLIN CA
HUB & CANCER CENTER
3200 DUBLIN BLVD
DUBLIN, CA 94568

SMITHGROUP JJR

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REVIEWED
FOR CODE COMPLIANCE
CITY OF DUBLIN
BUILDING & SAFETY DIVISION

PERMIT 3
INCREMENT 1

ISSUED FOR	REV	DATE
ADDENDUM 1	2	08/24/2016
REISSUED FOR PERMIT	1	07/22/2016
ISSUED FOR PERMIT 3 INCREMENT 1		05/24/2016

SEALS AND SIGNATURES

REGISTERED PROFESSIONAL ENGINEER R. DASWANI M31875 MECHANICAL STATE OF CALIFORNIA

DRAWING TITLE
HVAC SCHEDULES

SCALE 12" = 1'-0"

PROJECT NUMBER 20681.000

DRAWING NUMBER CD M0.04

Author

Plot Date: 11/4/2016 8:03:36 AM