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Environmental Noise & Vibration Assessment

Walsh-Bowers Data Center

Santa Clara, California

BAC Job # 2022-089

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Introduction

The proposed Walsh-Bowers Data Center (project) is located at 2805 Bowers Avenue in Santa Clara, California (APN: 216-28-063). Existing land uses in the immediate project vicinity include light industrial in all directions. The project site location with aerial imagery is shown in Figure 1. The proposed building roof and ground level plans are presented in Figures 2 and 3, respectively.

The site is currently developed with an approximately 55,000 ft^2 two-story office building and associated paved surface parking. The project proposes the demolition of the existing office building and construction of a four-story 244,068 ft^2 data center building, utility substation, generator equipment yard, surface parking and landscaping, and utility pipeline connections.

Bollard Acoustical Consultants, Inc. (BAC) was retained by the project applicant to prepare this noise and vibration assessment. Specifically, the purposes of this assessment are to quantify noise levels associated with the proposed rooftop mechanical equipment (air-cooled chillers), ground level backup power emergency generators, and noise and vibration levels associated with project construction/demolition activities, and to compare those levels against the applicable City of Santa Clara noise and vibration exposure criteria.

Noise Fundamentals and Terminology

Noise

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are designated as sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or Hertz (Hz). Definitions of acoustical terminology are provided in Appendix A.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure) as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness. Noise levels associated with common noise sources are provided in Figure 4.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable and can be approximated by filtering the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels.

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 (L_{eq}). The L_{eq} is the foundation of the day-night average noise descriptor, DNL (or L_{dn}), and shows very good correlation with community response to noise. DNL is based on the average noise level over a 24-hour day, with a +10-decibel weighting applied to noise occurring during nighttime (10:00 PM to 7:00 AM) hours. The nighttime penalty is based on the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because DNL represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

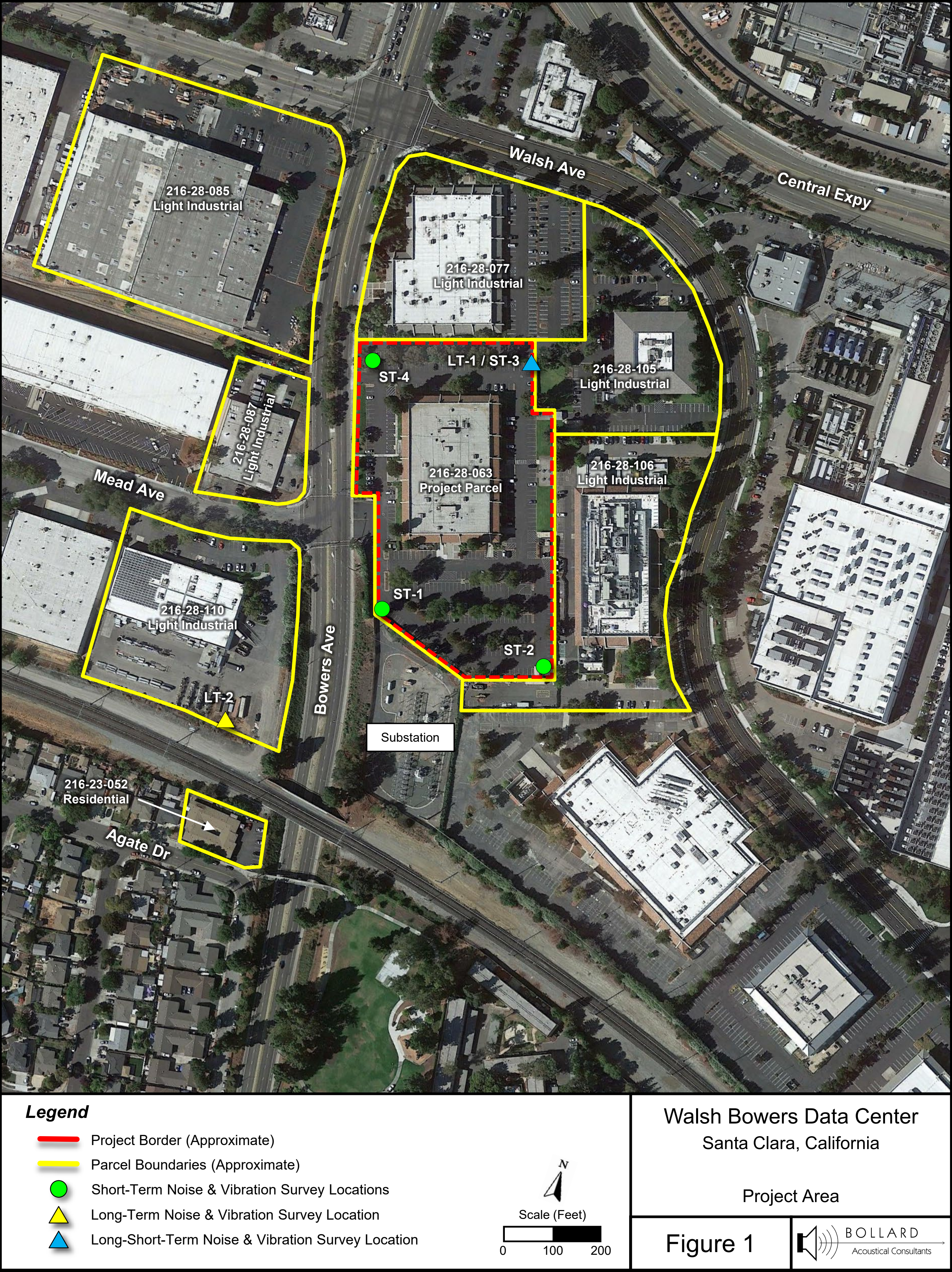
Vibration

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through the ground or structures. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration in terms of velocity in inches per second peak particle velocity (IPS, PPV) or root-mean-square (VdB, RMS). Standards pertaining to perception as well as damage to structures have been developed for vibration in terms of peak particle velocity as well as RMS velocities.

As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. Human response to vibration is difficult to quantify. Vibration can be felt or heard well below the levels that produce any damage to structures. The duration of the event has an effect on human response, as does frequency. Generally, as the duration and vibration frequency increase, the potential for adverse human response increases.

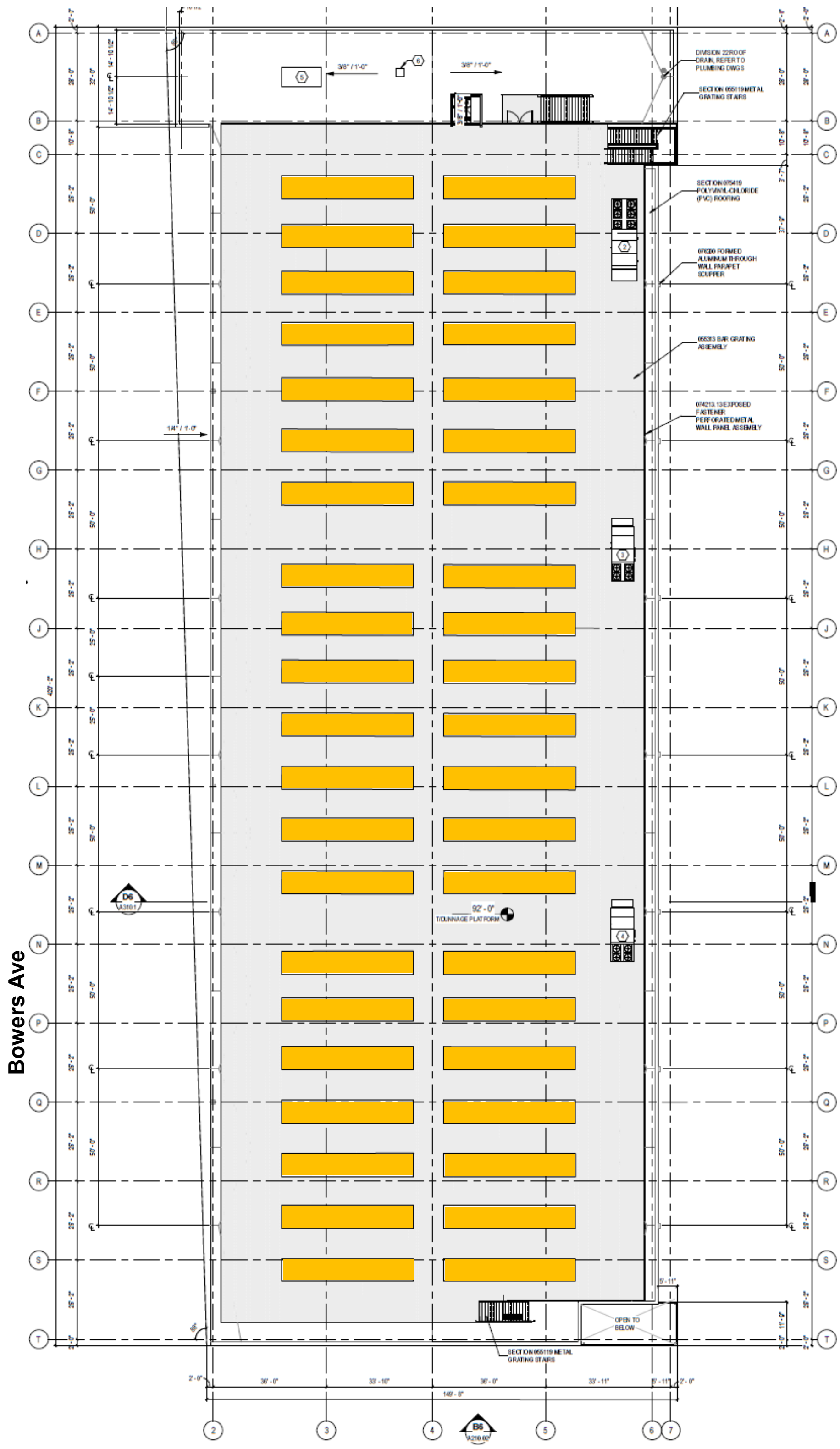
According to the Transportation and Construction-Induced Vibration Guidance Manual (Caltrans, April 2020), operation of construction equipment and construction techniques generate ground vibration. Traffic traveling on roadways can also be a source of such vibration. At high enough amplitudes, ground vibration has the potential to damage structures and/or cause cosmetic damage.



Walsh Bowers Data Center
Santa Clara, California

Project Area

Figure 1



Legend

Rooftop Cooling Equipment (Air-Cooled Chillers)

N

Scale (Feet)

0 25 50

Walsh Bowers Data Center

Santa Clara, California

Building Roof Plan

Figure 2

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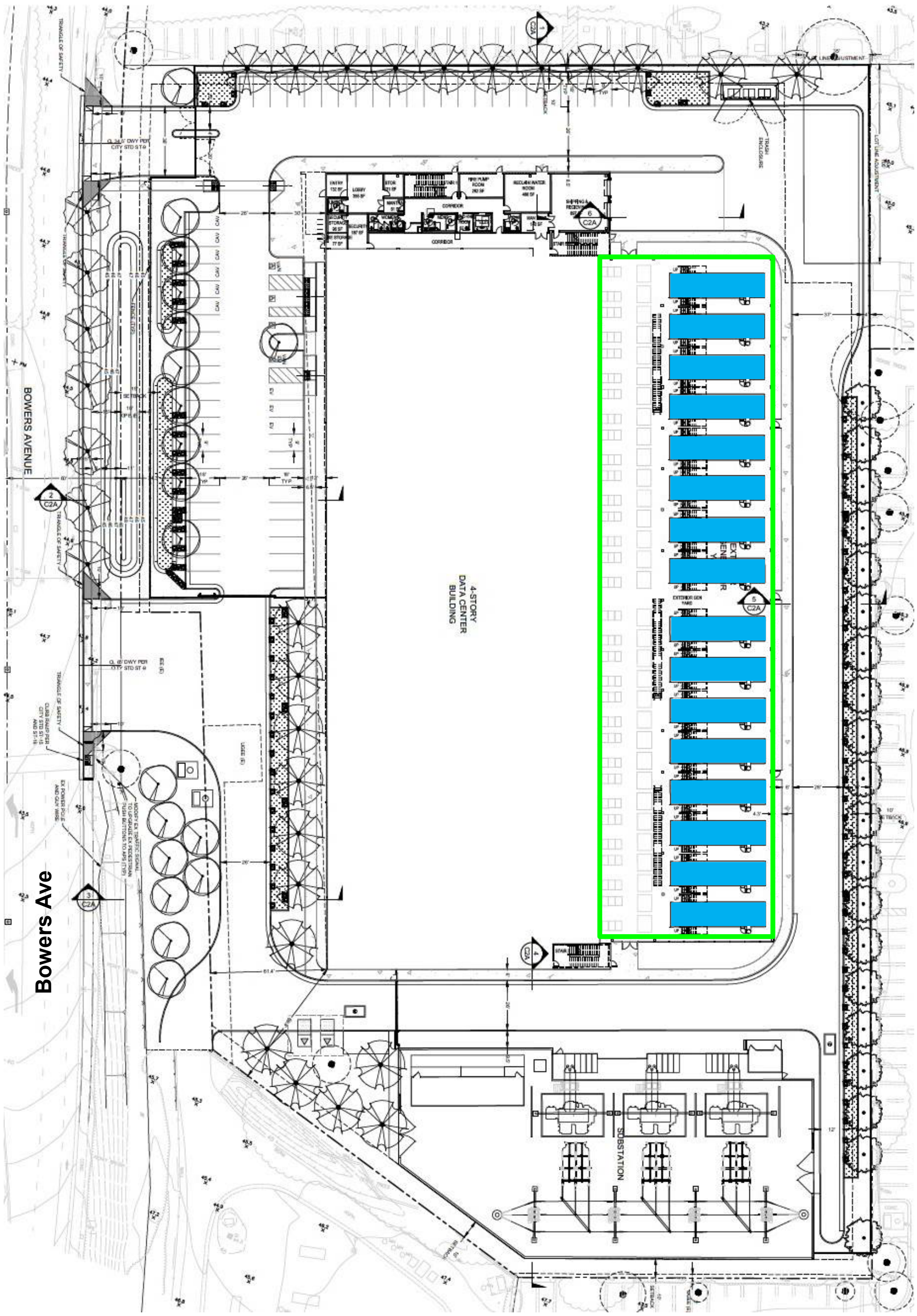

Legend

Outdoor Generator Yard Perimeter

Generators (Double-Stacked)

N

Scale (Feet)

0 40 80

Walsh Bowers Data Center

Santa Clara, California

Ground Level Site Plan

Figure 3

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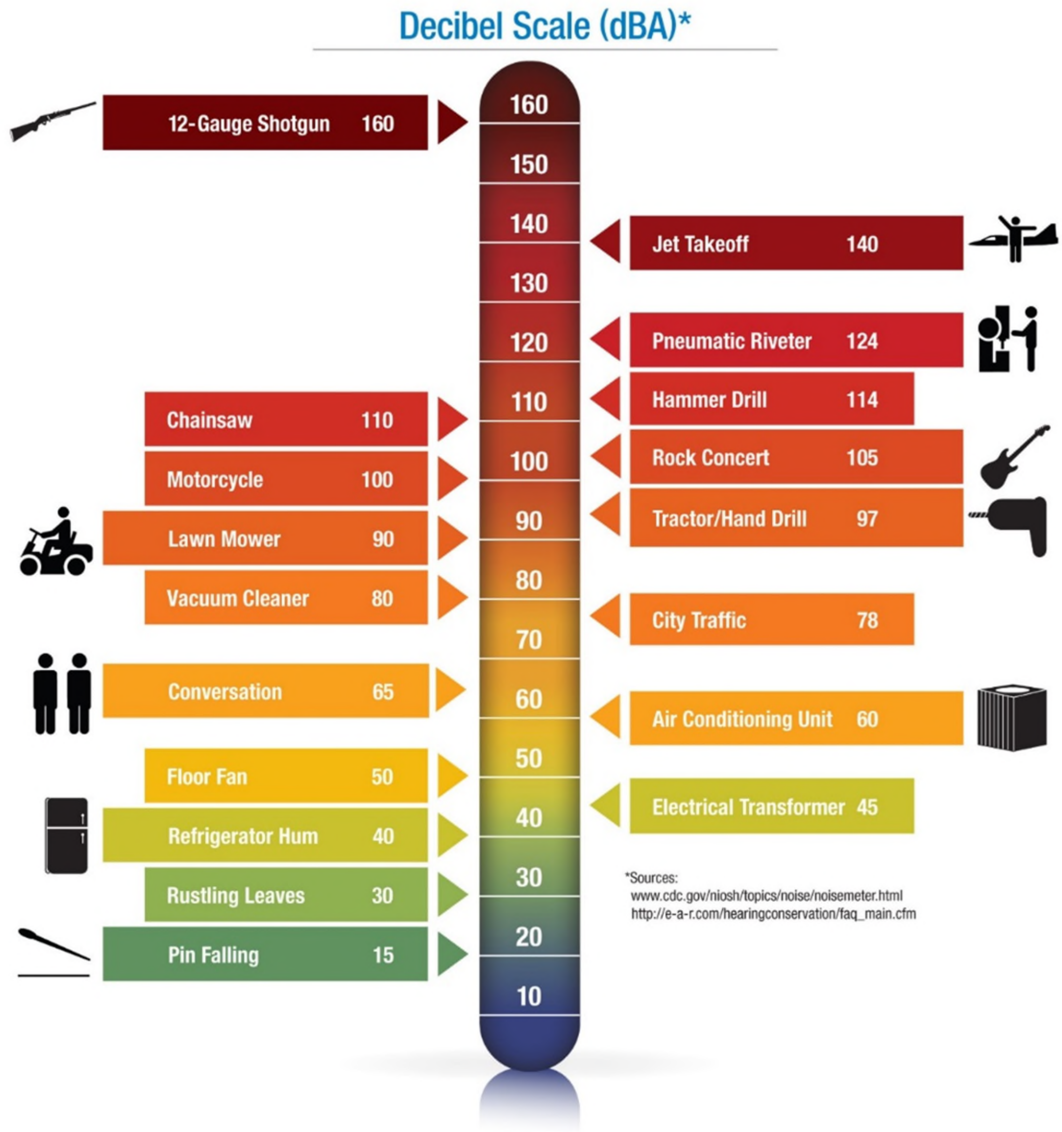
Figure 4
Typical A-Weighted Sound Levels of Common Noise Sources



Criteria for Acceptable Noise & Vibration Exposure

Noise

City of Santa Clara Municipal Code

The City of Santa Clara Municipal Code establishes noise level performance standards for non-transportation (stationary) noise sources, such as those that would occur on the project site. Specifically, Section 9.10.040 of the Municipal Code limits noise levels at residential uses to 55 dB during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dB during nighttime hours (10:00 p.m. to 7:00 a.m.). Section 9.10.040 also establishes noise level limits at light industrial uses to 70 dB (anytime). However, if the measured ambient noise level at any given location differs from those levels indicated above, the allowable noise level standard shall be adjusted in five (5) dB increments as appropriate to encompass or reflect the ambient noise level.

It should be noted that the Municipal Code does not define the acoustical time descriptor such as L_{eq} (average noise level) or L_{max} (maximum instantaneous noise level) that is associated with the established limits. For the purposes of this assessment, the City's noise level limits were reasonably interpretated to be an average noise level (L_{eq}).

Finally, Municipal Code Section 9.10.070 contains exceptions to the noise level limits established in Section 9.10.040 that would be applicable to the project. Specifically, Section 9.10.070 states that the Municipal Code noise limits are not applicable to the performance of emergency work, including the operation of emergency generators, and construction activities occurring within allowable hours. Municipal Code Section 9.10.203 states that construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction activities are permitted on Sundays or holidays.

Federal Transit Administration (FTA)

The City of Santa Clara Municipal Code does not currently have established noise limits for construction activities. Rather, the City controls noise impacts from construction by restricting allowable hours of construction (Municipal Code Section 9.10.230). As a result, this assessment applies construction noise impact criteria developed by the U.S. Federal Transit Administration (FTA) to assess project construction noise level exposure. For construction restricted to daytime hours (7:00 a.m. and 10:00 p.m.), FTA guidance suggests that construction sound levels at or below the levels identified in Table 1.

Table 1
FTA Construction Noise Impact Criteria

Land Use	Daytime 8-Hour Leq (dB)
Residential	80
Commercial	85
Industrial	90

Source: U.S. Federal Transit Administration (FTA). Transit Noise and Vibration Impact Assessment Manual, Table 7-3. 2018.

Vibration

California Department of Transportation (Caltrans)

Section 9.10.050 of the City of Santa Clara Municipal Code prohibits vibration from a fixed source from exceeding vibration levels above the perception threshold of an individual. However, the Municipal Code does not define the term "perceptible". As a result, the vibration impact criteria developed by the California Department of Transportation (Caltrans) was applied to project construction activities. The Caltrans guidelines to assess the potential for annoyance and potential damage to structures is presented in Table 2.

Table 2
Reaction of People and Damage to Buildings, PPV (in/sec)

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006-0.019	Threshold of perception, possibility of intrusion	Vibrations unlikely to cause damage of any type
0.08	Vibration readily perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.10	Level at which continuous vibration begins to annoy people	Virtually no risk of architectural damage to normal buildings
0.20	Vibration annoying to people in buildings	Threshold at which this is a risk of architectural damage to normal dwelling – houses with plaster walls/ceilings
0.4-0.6	Vibration considered unpleasant by people subjected to continuous vibration and unacceptable to some people walking on bridges	Vibration at a greater level than normally expected from traffic but would cause architectural damage and possibly minor structural damage to buildings built of reinforced concrete, steel or timber.

Source: California Department of Transportation (Caltrans). 2020. Transportation and Construction Vibration Guidance Manual.

For the purposes of this assessment, the Caltrans vibration criterion of 0.08 PPV (in/sec) was utilized as the "perception threshold" for an individual on a nearby sensitive property. In addition, the Caltrans vibration criterion of 0.20 PPV (in/sec) was utilized as performance standard in the analysis of structural damage at nearby structures.

It should be noted that there are no known notable sources of groundborne vibration associated with operation of the proposed facility, and adverse reaction to normal facility operations vibration is not expected. Therefore, an analysis of facility operations vibration exposure was not included in this assessment.

Existing Ambient Noise & Vibration Environment in the Project Vicinity

Long-Term Ambient Noise Survey

The existing ambient noise environment in the project vicinity is defined primarily by traffic on Bowers Avenue and Walsh Avenue, and by activities at adjacent light industrial uses. To quantify the existing ambient noise level environment in the project vicinity, BAC conducted long-term (48-hour) noise level measurements June 29th-30th, 2022, at the locations shown on Figure 1 (sites LT-1 and LT-2). Long-term noise measurement site LT-1 was specifically selected to be representative of the existing ambient noise level environment at the project site. Long-term noise measurements obtained at site LT-2 are believed to be acoustically equivalent to the existing ambient noise level environment at the nearest residential uses to the project, located south of the project on Agate Drive. Photographs of the long-term noise survey locations are provided in Appendix B.

Larson-Davis Laboratories (LDL) Model LxT precision integrating sound level meters were used to complete the long-term noise level measurement survey. The meters were calibrated before use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy off the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4). The long-term noise level measurement survey results are summarized in Table 3. The detailed results of the long-term ambient noise survey are contained in Appendix C in tabular format and graphically in Appendix D.

Table 3
Summary of Long-Term Noise Survey Measurement Results – June 29th-30th, 2022[1]

			Average Measured Hourly Noise Levels (dB)			
			Daytime[3]		Nighttime[4]	
Site Description[2]	Date	DNL (dB)	L_{eq}	L_{max}	L_{eq}	L_{max}
LT-1: Northeast end of project parcel	6/29/22	65	57	68	59	64
	6/30/22	64	61	72	57	62
LT-2: South of project off Bowers Ave	6/29/22	67	61	83	60	78
	6/30/22	66	60	83	59	80

[1] Detailed summaries of the noise monitoring results are provided in Appendices C and D.
[2] Long-term noise survey locations are identified on Figure 1.
[3] Daytime hours: 7:00 a.m. to 10:00 p.m.
[4] Nighttime hours: 10:00 p.m. to 7:00 a.m.

Source: Bollard Acoustical Consultants, Inc. (BAC). 2022.

As shown in Table 3, measured ambient noise levels were highest at site LT-2. This is believed to be attributed to operations on adjacent Caltrain tracks to the south of the measurement site.

Short-Term Ambient Noise Survey

A short-term (15-minute) ambient noise level survey was also conducted within the project vicinity. The short-term noise survey was conducted on June 28th, 2022, at the four locations shown on Figure 1 (sites ST-1 through ST-4). The short-term noise measurement sites were specifically selected to be representative of the existing ambient noise level environment at adjacent light industrial uses during daytime hours. Photographs of the short-term noise survey locations are provided in Appendix B.

A Larson-Davis Laboratories (LDL) Model 831 precision integrating sound level meter was used to complete the short-term noise level measurement survey. The meter was calibrated before use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy off the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4). The results of the short-term ambient noise level survey are presented in Table 4.

Table 4
Summary of Short-Term Noise Survey Measurement Results – June 28th, 2022

		Measured Noise Levels (dB)	
Site Description[1]	**Time**	**Average, L_{eq}**	**Maximum, L_{max}**
ST-1: Southwest end of project parcel	11:00 a.m.	59	72
ST-2: Southeast end of project parcel	11:19 a.m.	53	58
ST-3: Northeast end of project parcel	11:41 a.m.	56	66
ST-4: Northwest end of project parcel	12:02 p.m.	58	69

[1] Short-term noise survey locations are shown on Figure 1.

Source: Bollard Acoustical Consultants, Inc. (BAC). 2022.

The Table 4 data indicate that measured ambient noise levels were highest at site ST-1. According to BAC staff, the elevated measured levels at site ST-1 were primarily attributed to traffic on Bowers Avenue and existing mechanical equipment from adjacent industrial uses.

<u>Adjustments to Municipal Code Noise Standards Based on Measured Ambient Conditions</u>

Section 9.10.040 of the Municipal Code limits noise levels at residential uses to 55 dB during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dB during nighttime hours (10:00 p.m. to 7:00 a.m.). Section 9.10.040 also establishes noise level limits at light industrial uses to 70 dB (anytime). However, if the measured ambient noise level at any given location differs from those levels indicated above, the allowable noise level standard shall be adjusted in five (5) dB increments as appropriate to encompass or reflect the ambient noise level.

As mentioned previously, BAC conducted long- and short-term noise level surveys within the project vicinity. Those noise survey locations were specifically selected to be representative of the existing ambient noise level environments at the nearest (adjacent) light industrial uses and closest residential use to the project area. Comparison of the results from the BAC ambient noise level surveys (Tables 3 and 4) with the Municipal Code Section 9.10.040 noise level limits revealed that the City's criteria are being exceeded at one of the measurement sites (site LT-2), representative of the ambient noise level environment at the nearest residential use to the project. Based on the results from the BAC ambient noise survey, and pursuant to the Municipal Code adjustment criteria discussed above, the following exterior noise level standards shown in Table 5 were applied to project noise sources and assessed at the nearest industrial and residential uses.

Table 5
City of Santa Clara Municipal Code Noise Level Standards Applied to the Project

APN	Land Use	Noise Survey Location	Measured Noise Level, L_{eq} (dB)[1]	Unadjusted Noise Standard, L_{eq} (dB)[2]	Adjusted for Ambient?	Applied Noise Standard, L_{eq} (dB)[3]
216-28-077	Industrial	ST-3	56 Day	70 Anytime	No	**70 Anytime**
216-28-105	Industrial	ST-3	56 Day	70 Anytime	No	**70 Anytime**
216-28-106	Industrial	ST-2	53 Day	70 Anytime	No	**70 Anytime**
216-28-110	Industrial	ST-1	59 Day	70 Anytime	No	**70 Anytime**
216-28-087	Industrial	ST-4	58 Day	70 Anytime	No	**70 Anytime**
216-28-085	Industrial	ST-4	58 Day	70 Anytime	No	**70 Anytime**
216-23-052	Residential	LT-2	60 Day / 60 Night	55 Day / 50 Night	Yes / Yes	**60 Day / 60 Night**

[1] Average measured daytime hourly Leq at measurement locations during BAC noise surveys.
[2] Unadjusted Municipal noise level standard applicable to residential uses.
[3] Applied noise standards based on BAC ambient noise survey and General Plan ambient noise adjustment criteria.

Source: Bollard Acoustical Consultants, Inc. (BAC). 2022.

Short-Term Vibration Survey

During BAC staff site visits on June 28th and July 1st, 2022, vibration levels were below the threshold of perception within the project area. Nonetheless, to quantify existing vibration levels at the project site and at nearby land uses, BAC conducted short-term (15-minute) vibration measurements at the five locations identified on Figure 1 on June 28th, 2022. Photographs of the vibration survey equipment and locations are provided in Appendix B.

A Larson-Davis Laboratories Model LxT precision integrating sound level meter equipped with a vibration transducer was used to complete the measurements. The results are summarized in Table 6.

Table 6
Summary of Short-Term Ambient Vibration Survey Results – June 28th, 2022

Survey Location	Time	Measured Maximum Vibration Level, PPV (in/sec)
ST-1: Southwest end of project parcel	11:00 a.m.	0.017
ST-2: Southeast end of project parcel	11:19 a.m.	<0.001
ST-3: Northeast end of project parcel	11:41 a.m.	0.002
ST-4: Northwest end of project parcel	12:02 p.m.	0.020
LT-2: South of project off Bowers Ave	12:58 p.m.	0.029
PPV = Peak Particle Velocity (inches/second)		

Source: Bollard Acoustical Consultants, Inc. (BAC). 2022.

As shown in Table 6, measured maximum vibration levels within the project area ranged from less than 0.001 to 0.029 PPV in/sec. (highest measured levels at sites ST-4 and LT-2). After a comparison of the measurement data with BAC field notes, it was determined that the elevated measured maximum vibration levels at sites ST-4 and LT-2 were attributed to nearby heavy truck movements (ST-4) and Caltrain passbys (LT-2).

Project Noise Generation

As discussed previously, there are two project noise sources which are considered in this evaluation: the rooftop mechanical equipment (air-cooled chillers) and ground level emergency generators. The evaluation of potential noise impacts associated with the operation of each noise source is evaluated as follows:

Rooftop Air-Cooled Chiller Equipment Noise Source & Reference Sound Level

According to the project description, the project proposes the installation of approximately forty-two (42) air-cooled chillers on the rooftop of the data center building. Specifically, it is the understanding of BAC that the project proposes the installation of forty-two (42) 450-ton (nominal capacity) Trane air-cooled chilling units. According to information provided to BAC, the reference sound power levels for the units are 100 dB (unit condenser fan) and 87 dB (unit compressor). The locations of the proposed chilling units are shown in the project roof plan, provided as Figure 2.

Emergency Generator Noise Source & Reference Sound Level

The project proposes the installation of approximately thirty-two (32) emergency generators within a ground level outdoor equipment yard on the east side of the proposed data center building. It is the understanding of BAC that the selected model for the project is the 3,000 kW Cummins emergency generator. The 32 proposed generators will be stacked within the outdoor equipment yard (i.e., 16 generator locations, each with 2 stacked generators). According to information provided to BAC, the reference sound level for the proposed generator (with enclosure) is 80 dB at a distance of 23 feet (1.8 dB sound power level). The locations of the proposed generators and equipment yard are shown in the project ground level plan, provided as Figure 3.

The generators which are proposed at this site would only operate during emergencies (power outages). According to GI Partners an emergency generator testing and maintenance schedule will include operation of the equipment during daytime hours only for the testing scenarios shown in Table 7 below:

Table 7
Emergency Generator Testing Schedule – 2825 Lafayette Street Data Center, Santa Clara, CA

Scenario	Typical Test Time (min)	# of Engines Run Concurrently	Comments	Load
Monthly Readiness Test	15	1	Max of 10 engines tested per day	1%
Quarterly Test	30	1	Max of 10 engines tested per day	1%
Annual Test	60	1	Max of 8 engines tested per day	25, 50, 75 and 100%
Note: The typical load range for tests is 1 to 70%. Engines are not run concurrently for any tests.				

Source: GI Partners.

Equipment Noise Modeling Methodology

SoundPLAN Noise Modeling

SoundPLAN Version 8.2 noise prediction model was utilized to project rooftop chilling equipment and emergency generator noise levels from proposed on-site locations. The SoundPLAN projections were calculated using a standard spherical spreading loss of -6 dB per doubling of distance from a stationary source. To account for shielding provided by intervening topography and structures, elevation data for the entire study area was input to the SoundPLAN model to create a 3-dimensional base map. Using aerial imagery and the project site plans, the SoundPLAN model inputs for both hard surfaces, soft surfaces, and vegetated areas were applied.

Rooftop Chiller Equipment

Because operation of the rooftop chilling equipment would be a component of normal facility operations, the SoundPLAN modeling included consideration of noise exposure associated with all (42) of the proposed chillers in operation concurrently. To assess project chilling equipment noise exposure relative to an hourly average (L_{eq}) noise level descriptor, the SoundPLAN modeling included consideration of all 42 units in operation concurrently for the duration of an hour. Because the proposed chilling equipment could potentially run continuously during both daytime and nighttime hours, the operation of the equipment was assessed relative to the City of Santa Clara Municipal Code daytime and nighttime noise level criteria for residential uses. However, satisfaction of the City's nighttime noise level limit at the closest residential use would ensure compliance with the City's less restrictive daytime noise level criterion at that location. Project chilling equipment noise level exposure was also assessed relative to the City's industrial (anytime) noise level limit at the adjacent industrial uses.

Emergency Generators

It is the understanding of BAC that operation of all 32 of the proposed generators would only occur during emergencies. Aside from emergency use, the provided emergency generator testing and maintenance schedule indicate that worst-case noise exposure from the generators would occur during the Annual Test. Specifically, the Annual Test scenario consists of the operation of 1 generator at a time for the duration of 1 hour during daytime hours only.

Pursuant to Municipal Code Section 9.10.070, operation of the project generators during emergencies would be exempt from Municipal Code noise level criteria. Because the project generators would only be in operation for routine testing and maintenance during daytime hours for no more than 1 hour, and because emergency operation of the generators would be exempt during nighttime hours, project generator noise generation would be subject to the City's daytime noise level criteria only. To assess project emergency generator noise exposure relative to an hourly average (L_{eq}) noise level descriptor, the SoundPLAN modeling included consideration of 1 generator in operation for the duration of an hour for daytime testing of the equipment.

Predicted Project Equipment Noise Levels at Nearest Land Uses

The results from the SoundPLAN model projections at the property lines of the nearest light industrial and residential uses are summarized in Tables 8 and 9 and are shown graphically in Figures 5 and 6 with noise contours.

It should be noted that the provided site plans indicate that an 11' sound attenuating mechanical equipment screen is proposed to be constructed along the perimeter of the building rooftop. The site plans further indicate that an 8' wall is proposed to be constructed around the perimeter of the outdoor ground-level generator yard. For the purposes of this analysis, the proposed 11' rooftop equipment screen and 8' ground level generator yard wall were assumed to perform as effective noise barriers. Based on this assumption, shielding offsets were applied as appropriate in the SoundPLAN modeling of equipment noise levels.

Table 8
Predicted Air-Cooled Chiller Equipment Noise Exposure at Nearby Land Uses

		Predicted Equipment Noise Levels, L_{eq} (dB)[2]		
Receiver[1]	Land Use	No Screen[3]	With Screen[4]	Applied City Noise Standard, L_{eq} (dB)[5]
1	Light Industrial	66	52	**70 Anytime**
2	Light Industrial	65	52	**70 Anytime**
3	Light Industrial	68	54	**70 Anytime**
4	Light Industrial	60	51	**70 Anytime**
5	Light Industrial	62	51	**70 Anytime**
6	Light Industrial	60	52	**70 Anytime**
7	Residential	57	48	**60 Day / 60 Night**

1 Receiver locations (property boundaries) are shown on Figure 5.
2 Predicted noise levels reflect all proposed cooling units (42 total) in operation concurrently.
3 Predicted equipment noise levels without attenuation from 11’ rooftop noise barrier.
4 Predicted equipment noise levels with attenuation from 11’ rooftop noise barrier.
5 Applied noise standards based on results from BAC noise surveys and City adjustment criteria.

Source: Bollard Acoustical Consultants, Inc. (BAC). 2022.

Table 9
Predicted Generator Noise Exposure at Nearby Land Uses

		Predicted Equipment Noise Levels, L_{eq} (dB)[2]		
Receiver[1]	Land Use	No Wall[3]	With Wall[4]	Applied City Noise Standard, L_{eq} (dB)[5]
1	Light Industrial	62	50	**70 Anytime**
2	Light Industrial	73	62	**70 Anytime**
3	Light Industrial	73	63	**70 Anytime**
4	Light Industrial	42	37	**70 Anytime**
5	Light Industrial	38	30	**70 Anytime**
6	Light Industrial	37	29	**70 Anytime**
7	Residential	38	30	**60 Day**

1 Receiver locations (property boundaries) are shown on Figure 6.
2 Predicted noise levels reflect closest generator to a receiver in operation at full-load power for a 1-hour period.
3 Predicted generator noise levels without attenuation from 8’ equipment yard noise barrier.
4 Predicted generator noise levels with attenuation from 8’ equipment yard noise barrier.
5 Applied noise standards based on *results from* BAC noise surveys and City adjustment criteria.

Source: Bollard Acoustical Consultants, Inc. (BAC). 2022.

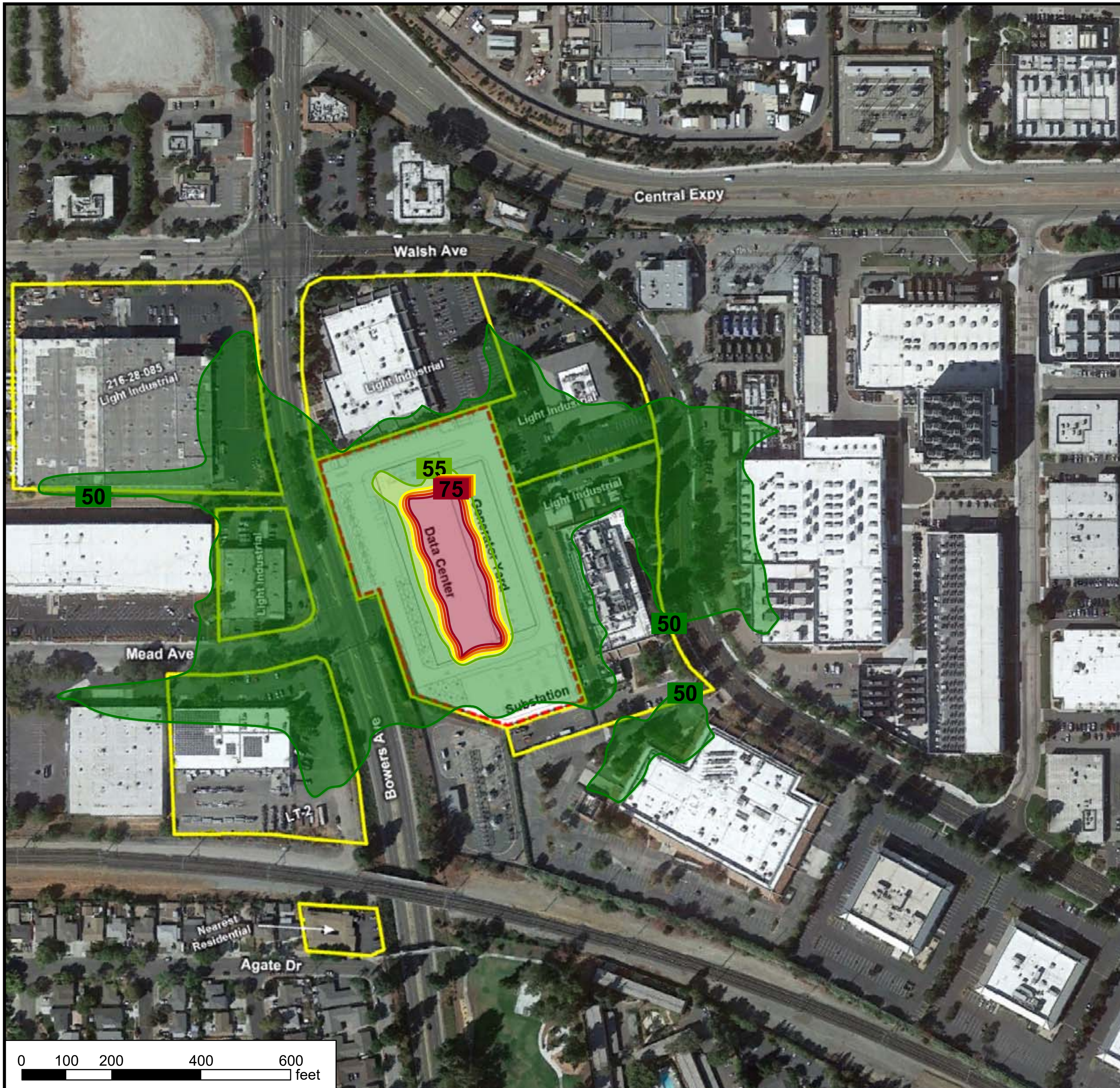


Figure 5
Walsh-Bowers Data Center
Rooftop HVAC Equipment
Noise Contours

Contours reflect all rooftop mechanical equipment operating concurrently.

Leq, dB(A)

>=	75
70 -	75
65 -	70
60 -	65
55 -	60
50 -	55

N

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Figure 6
Walsh-Bowers Data Center
Emergency Generator
Noise Contours

Test conditions with 1 generator operating during daytime hours (contours for generator nearest to southern residences shown)

Leq, dB(A)

>= 70
65 - 70
60 - 65
55 - 60
50 - 55

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Evaluation of Noise Compliance

The SoundPLAN modeling results summarized in Table 8 reflect the combined noise exposure from all 42 rooftop chiller units in operation concurrently for the duration of an hour at each receiver location. As indicated in Table 8, project rooftop chilling equipment noise level exposure is predicted to comply with the applied City of Santa Clara Municipal Code noise level standards at the nearest industrial and residential uses. As a result, no further consideration of rooftop chilling equipment noise mitigation measures would be warranted for the project relative to the City's noise level criteria.

The SoundPLAN modeling results shown in Table 9 reflect the noise exposure associated with the closest generator to each receiver in operation at full-load power for the duration of an hour (for testing and maintenance). As shown in Table 9, project emergency generator noise level exposure is predicted to satisfy the applied City of Santa Clara Municipal Code noise level criteria at the closest industrial and residential uses. The predicted generator noise compliance includes consideration of attenuation that would be provided by the construction of an 8' noise barrier around the perimeter of the outdoor generator yard. Thus, provided that the proposed 8' wall in the outdoor generator yard is constructed such that it performs as an effective noise barrier, no further consideration of generator noise mitigation measures would be warranted for the project relative to the City's noise level criteria.

Evaluation of On-Site Project Construction Equipment Noise

During project construction, heavy equipment would be used for grading excavation, paving, and building construction/structure demolition, which would increase ambient noise levels in the immediate project vicinity when in use. Noise levels would vary depending on the type of equipment used, how it is operated, and how well it is maintained. Noise exposure at any single point outside the project work area would also vary depending upon the proximity of equipment activities to that point.

The adjacent parcels to the project property are industrially zoned. Industrial uses are typically not considered to be noise-sensitive, but rather noise-generating. The nearest existing noise-sensitive use has been identified as residential (APN: 216-23-052) located approximately 500 feet from where construction activities would occur on the project parcel. The location of the nearest residential use is shown on Figure 1.

Table 10 includes the range of maximum noise levels for equipment commonly used in general construction projects at full-power operation at a distance of 50 feet. Not all of these construction activities would be required of this project. The Table 10 data also include predicted maximum (L_{max}) equipment noise levels at the nearest residential use to the project area (500 feet away) which assumes a standard spherical spreading loss of 6 dB per doubling of distance.

Table 10
Reference and Projected Noise Levels for Typical Residential Construction Equipment

Equipment Description	Reference Noise Level at 50 Feet, L_{max} (dB)	Projected Noise Level at 500 Feet, L_{max} (dB)
Air compressor	80	60
Backhoe	80	60
Ballast equalizer	82	62
Ballast tamper	83	63
Compactor	82	62
Concrete mixer	85	65
Concrete pump	82	62
Concrete vibrator	76	56
Crane, mobile	83	63
Dozer	85	65
Excavator	85	65
Generator	82	62
Grader	85	65
Impact wrench	85	65
Loader	80	60
Paver	85	65
Pneumatic tool	85	65
Pump	77	57
Saw	76	56
Scarifier	83	63
Scraper	85	65
Shovel	82	62
Spike driver	77	57
Tie cutter	84	64
Tie handler	80	60
Tie inserter	85	65
Truck	84	64

Source: Federal Transit Administration (FTA). Noise and Vibration Impact Assessment Manual, Table 7-1 (2018) and BAC calculations.

As mentioned previously, Section 9.10.070 of the City of Santa Clara Municipal Code states that construction activities, provided they occur within allowable hours, are exempt from Municipal Code noise level limits. Municipal Code Section 9.10.203 states that construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction activities are permitted on Sundays or holidays. It is reasonably assumed for the purposes of this analysis that all on-site noise-generating project construction equipment and activities would occur pursuant to Municipal Code Section 9.10.070 and 9.10.203 and would thereby be exempt from Municipal Code noise level criteria.

As indicated in Table 10, reference maximum noise levels for typical construction equipment range from 76 to 85 dB L_{max} at a distance of 50 feet. When projected to the nearest residential use located approximately 500 feet away, maximum noise levels from on-site construction equipment are projected to range from 56 to 65 dB L_{max} (Table 10). Hourly average noise levels due to construction activities during busy construction periods typically range from approximately 75 to 88 dB L_{eq} at 50 feet. When projected to a distance of 500 feet (nearest residential use), hourly average noise levels are projected to range from 55 to 68 dB L_{eq}. The worst-case projected construction equipment noise level of 68 dB L_{eq} at the nearest noise-sensitive use would be well below the applied FTA noise impact criterion of 80 dB L_{eq} (8-hr) during daytime hours. Further, it is expected that screening of the project area provided by existing intervening topography and structures would further reduce construction noise levels at those nearest residential uses.

Based on the analysis and results provided above, project construction noise impacts at the nearest noise-sensitive uses (residential) are not expected. Nonetheless, to the reduce the potential for annoyance at nearby land uses, the following measures should be incorporated into project construction operations:

- All on-site noise-generating on-site construction activities shall occur pursuant to Section 9.10.070 and 9.10.203 of the City of Santa Clara Municipal Code.
- All noise-producing project equipment and vehicles using internal-combustion engines shall be equipped with manufacturers-recommended mufflers and be maintained in good working condition.
- All mobile or fixed noise-producing equipment used on the project site that are regulated for noise output by a federal, state, or local agency shall comply with such regulations while in the course of project activity.
- Electrically powered equipment shall be used instead of pneumatic or internal-combustion-powered equipment (where feasible).
- Material stockpiles and mobile equipment staging, parking, and maintenance areas shall be located as far as practicable from noise-sensitive receptors, where feasible.
- Project area and site access road speed limits shall be established and enforced during the construction period.

Evaluation of On-Site Project Construction Equipment Vibration

During project construction, heavy equipment would be used for grading, excavation, paving, and building construction/demolition, which would generate localized vibration in the immediate vicinity of the construction.

As mentioned previously, Section 9.10.050 of the City of Santa Clara Municipal Code prohibits vibration from a fixed source from exceeding vibration levels above the perception threshold of an individual. For the purposes of this analysis, the Caltrans vibration criterion of 0.08 PPV (in/sec) was utilized as the “perception threshold” for an individual on a nearby sensitive property. In addition, the Caltrans vibration criterion of 0.20 PPV (in/sec) was utilized as performance standard in the analysis of structural damage at nearby structures.

The nearest sensitive property has been identified as residential located approximately 500 feet from the project area (APN: 216-23-052). The nearest existing structure to where construction activities would occur on the project parcel is located approximately 75 feet away on an industrially zoned property (APN: 216-28-106). The locations of the nearest residential and industrial properties are shown on Figure 1.

Table 11 includes the range of vibration levels for equipment commonly used in general construction projects at a distance of 25 feet. The Table 11 data also include projected equipment vibration levels at the nearest residential property and industrial structure to the project area.

Table 11
Reference and Projected Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV at 25 Feet (in/sec)[1]	Projected PPV (in/sec)	
		500 Feet	75 Feet
Vibratory roller	0.210	0.002	0.040
Large bulldozer	0.089	0.001	0.017
Caisson drilling	0.089	0.001	0.017
Loaded trucks	0.076	<0.001	0.015
Jackhammer	0.035	<0.001	0.007
Small bulldozer	0.003	<0.001	<0.001

[1] PPV = Peak Particle Velocity

Source: Source: Federal Transit Administration (FTA). Noise and Vibration Impact Assessment Manual, Table 7-4 (2018) and BAC calculations.

The Table 11 data indicate that vibration levels generated from project construction activities are projected to be well below the applied FTA vibration impact criteria of 0.08 and 0.20 PPV (in/sec) at the nearest sensitive (residential) property and industrial structure, respectively. Based on the analysis provided above, vibration associated with on-site project construction/demolition activities are not expected to result in an impact at off-site structures.

Conclusions & Recommendations

Rooftop Chillers and Emergency Generator Noise

Based on the analysis and results presented in this report, noise exposure from project rooftop chilling equipment is predicted to comply with the applied City of Santa Clara Municipal Code noise level criteria at the nearest industrial and residential land uses. In addition, project emergency generator noise exposure is also predicted to comply with the applied Municipal Code noise level criteria at the nearest industrial and residential land uses. However, the predicted generator noise compliance is dependent upon attenuation that would be provided by the construction of an 8' noise barrier at the location identified in the project site plans (proposed as an 8' wall).

Construction Noise

Municipal Code Section 9.10.070 states that construction activities, provided they occur within allowable hours, are exempt from Municipal Code noise level limits. Section 9.10.203 states that construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction activities are permitted on Sundays or holidays. It is reasonably assumed for the purposes of this analysis that all on-site noise-generating project construction equipment and activities would occur pursuant to Section 9.10.070 and 9.10.203 and would thereby be exempt from Municipal Code noise level criteria.

The Municipal Code does not currently have established noise limits for construction activities. As a result, this assessment applied construction noise impact criteria developed by the U.S. Federal Transit Administration (FTA) to assess project construction noise level exposure. Based on the analysis and results presented in this report, worst-case project construction noise exposure is projected to be well below the applied FTA noise impact criterion of 80 dB L_{eq} (8-hr) during daytime hours at the nearest noise-sensitive use (residential).

Construction Vibration

Municipal Code Section 9.10.050 prohibits vibration from a fixed source from exceeding vibration levels above the perception threshold of an individual. For the purposes of this analysis, the Caltrans vibration criterion of 0.08 PPV (in/sec) was utilized as the "perception threshold" for an individual on a nearby sensitive property. In addition, the Caltrans vibration criterion of 0.20 PPV (in/sec) was utilized as performance standard in the analysis of structural damage at nearby structures. Based on the analysis and results presented in this report, vibration levels generated from project construction/demolition activities are projected to be well below the applied FTA vibration impact criteria of 0.08 and 0.20 PPV (in/sec) at the nearest sensitive (residential) property and industrial structure, respectively.

This concludes BAC's environmental noise and vibration assessment for the Walsh-Bowers Data Center in the City of Santa Clara, California. Please contact BAC at (530) 537-2328 or dariog@bacnoise.com with any questions regarding this assessment.

Appendix A
Acoustical Terminology

Acoustics The science of sound.

Ambient Noise The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.

Attenuation The reduction of an acoustic signal.

A-Weighting A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.

Decibel or dB Fundamental unit of sound. A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.

CNEL Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.

Frequency The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.

IIC Impact Insulation Class (IIC): A single-number representation of a floor/ceiling partition's impact generated noise insulation performance. The field-measured version of this number is the FIIC.

L_{dn} Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.

L_{eq} Equivalent or energy-averaged sound level.

L_{max} The highest root-mean-square (RMS) sound level measured over a given period of time.

Loudness A subjective term for the sensation of the magnitude of sound.

Masking The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.

Noise Unwanted sound.

Peak Noise The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the "Maximum" level, which is the highest RMS level.

RT_{60} The time it takes reverberant sound to decay by 60 dB once the source has been removed.

STC Sound Transmission Class (STC): A single-number representation of a partition's noise insulation performance. This number is based on laboratory-measured, 16-band (1/3-octave) transmission loss (TL) data of the subject partition. The field-measured version of this number is the FSTC.

Legend

A: ST-1: Short-term noise and vibration measurement site facing east
B: ST-2: Short-term noise and vibration measurement site facing south
C: ST-3: Short-term noise and vibration measurement site facing east
D: ST-4: Short-term noise and vibration measurement site facing south

Noise monitoring equipment

Walsh Bowers Data Center
Santa Clara, California

Photographs of Noise & Vibration Surveys

Appendix B-1

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Legend

A: LT-1: Long-term noise measurement site facing north
B: LT-2: Long-term noise and vibration measurement site facing south

Noise monitoring equipment

Walsh Bowers Data Center
Santa Clara, California

Photographs of Noise & Vibration Surveys

Appendix B-2

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Appendix C-1
Long-Term Ambient Noise Monitoring Results - Site LT-1
Walsh-Bowers Data Center - Santa Clara, California
Wednesday, June 29, 2022

Hour	Leq	Lmax	L50	L90
12:00 AM	55	60	55	54
1:00 AM	56	59	55	55
2:00 AM	56	58	56	55
3:00 AM	57	59	57	56
4:00 AM	66	95	57	56
5:00 AM	57	61	57	57
6:00 AM	58	64	58	57
7:00 AM	57	65	57	56
8:00 AM	56	65	56	55
9:00 AM	55	67	55	54
10:00 AM	55	69	55	54
11:00 AM	61	75	56	54
12:00 PM	55	73	55	54
1:00 PM	55	62	54	53
2:00 PM	55	67	55	54
3:00 PM	57	69	56	55
4:00 PM	57	74	56	55
5:00 PM	57	68	57	56
6:00 PM	57	65	57	56
7:00 PM	57	67	56	55
8:00 PM	56	63	56	55
9:00 PM	57	74	56	55
10:00 PM	56	60	56	55
11:00 PM	56	62	56	55

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	61	55	57	66	55	59
Lmax (Maximum)	75	62	68	95	58	64
L50 (Median)	57	54	56	58	55	56
L90 (Background)	56	53	55	57	54	55

Computed DNL, dB	65
% Daytime Energy	50%
% Nighttime Energy	50%

GPS Coordinates	37°22'23.12"N 121°58'34.46"W

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Appendix C-2
Long-Term Ambient Noise Monitoring Results - Site LT-1
Walsh-Bowers Data Center - Santa Clara, California
Thursday, June 30, 2022

Hour	Leq	Lmax	L50	L90
12:00 AM	57	62	57	56
1:00 AM	56	59	56	56
2:00 AM	56	58	56	55
3:00 AM	56	60	56	56
4:00 AM	56	59	56	56
5:00 AM	57	62	57	56
6:00 AM	57	63	57	56
7:00 AM	57	68	57	56
8:00 AM	57	68	57	56
9:00 AM	62	85	56	55
10:00 AM	70	91	59	54
11:00 AM	57	79	54	53
12:00 PM	60	77	55	54
1:00 PM	60	78	55	54
2:00 PM	56	70	56	54
3:00 PM	57	72	57	55
4:00 PM	58	68	57	56
5:00 PM	57	63	56	55
6:00 PM	56	71	56	55
7:00 PM	56	62	55	54
8:00 PM	55	71	55	54
9:00 PM	56	61	56	55
10:00 PM	57	74	56	55
11:00 PM	57	61	57	56

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	70	55	61	57	56	57
Lmax (Maximum)	91	61	72	74	58	62
L50 (Median)	59	54	56	57	56	56
L90 (Background)	56	53	55	56	55	56

Computed DNL, dB	64
% Daytime Energy	81%
% Nighttime Energy	19%

GPS Coordinates	37°22'23.12"N 121°58'34.46"W

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Appendix C-3
Long-Term Ambient Noise Monitoring Results - Site LT-2
Walsh-Bowers Data Center - Santa Clara, California
Wednesday, June 29, 2022

Hour	Leq	Lmax	L50	L90
12:00 AM	66	92	48	47
1:00 AM	60	83	47	46
2:00 AM	48	52	48	47
3:00 AM	49	55	48	47
4:00 AM	53	77	48	47
5:00 AM	58	83	51	48
6:00 AM	60	86	52	50
7:00 AM	61	85	53	50
8:00 AM	60	82	52	49
9:00 AM	58	82	51	49
10:00 AM	57	81	52	49
11:00 AM	57	81	51	48
12:00 PM	57	79	51	48
1:00 PM	57	82	51	48
2:00 PM	58	83	51	49
3:00 PM	60	84	53	50
4:00 PM	62	86	54	51
5:00 PM	62	84	55	52
6:00 PM	66	90	55	53
7:00 PM	66	87	54	52
8:00 PM	58	81	53	51
9:00 PM	60	85	53	51
10:00 PM	63	89	51	49
11:00 PM	59	82	50	48

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	66	57	61	66	48	60
Lmax (Maximum)	90	79	83	92	52	78
L50 (Median)	55	51	52	52	47	49
L90 (Background)	53	48	50	50	46	48

Computed DNL, dB	67
% Daytime Energy	67%
% Nighttime Energy	33%

GPS Coordinates	37°22'14.28"N 121°58'38.85"W

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Appendix C-4
Long-Term Ambient Noise Monitoring Results - Site LT-2
Walsh-Bowers Data Center - Santa Clara, California
Thursday, June 30, 2022

Hour	Leq	Lmax	L50	L90
12:00 AM	53	81	49	47
1:00 AM	59	89	47	46
2:00 AM	45	60	44	41
3:00 AM	44	56	44	42
4:00 AM	54	83	44	43
5:00 AM	61	89	50	47
6:00 AM	60	82	50	48
7:00 AM	62	84	53	49
8:00 AM	61	85	50	48
9:00 AM	59	81	50	47
10:00 AM	59	85	50	48
11:00 AM	57	80	51	48
12:00 PM	59	83	53	50
1:00 PM	58	78	53	50
2:00 PM	58	80	53	51
3:00 PM	60	83	55	52
4:00 PM	62	87	55	52
5:00 PM	61	86	55	52
6:00 PM	65	92	54	51
7:00 PM	59	81	53	51
8:00 PM	59	80	53	51
9:00 PM	59	83	52	50
10:00 PM	65	100	50	48
11:00 PM	57	80	52	50

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	65	57	60	65	44	59
Lmax (Maximum)	92	78	83	100	56	80
L50 (Median)	55	50	53	52	44	48
L90 (Background)	52	47	50	50	41	46

Computed DNL, dB	66
% Daytime Energy	69%
% Nighttime Energy	31%

GPS Coordinates	37°22'14.28"N 121°58'38.85"W

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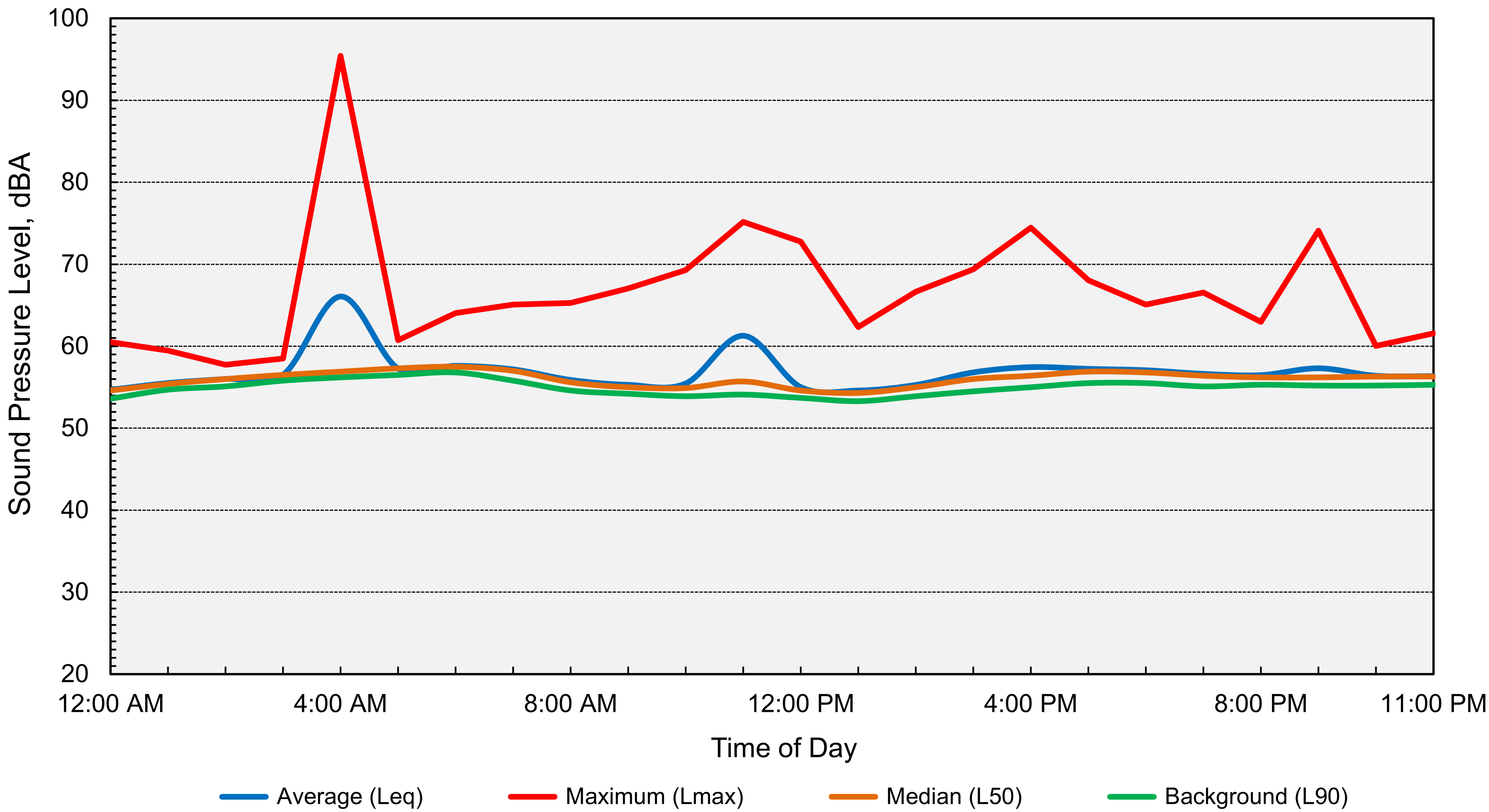
Appendix D-1
Long-Term Ambient Noise Monitoring Results - Site LT-1
Walsh-Bowers Data Center - Santa Clara, California
Wednesday, June 29, 2022



Computed DNL = 65 dB

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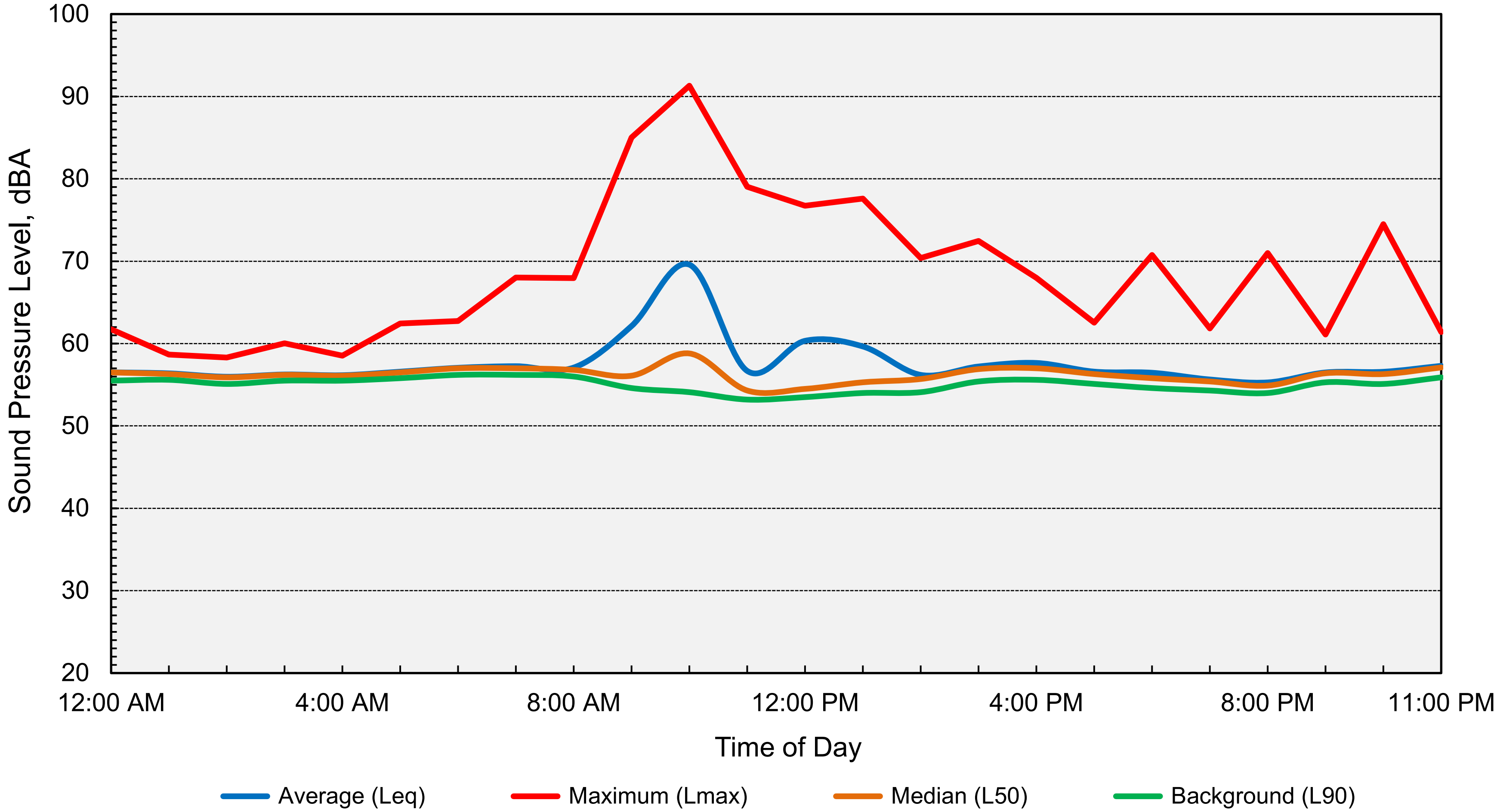
Appendix D-2
Long-Term Ambient Noise Monitoring Results - Site LT-1
Walsh-Bowers Data Center - Santa Clara, California
Thursday, June 30, 2022



Computed DNL = 64 dB

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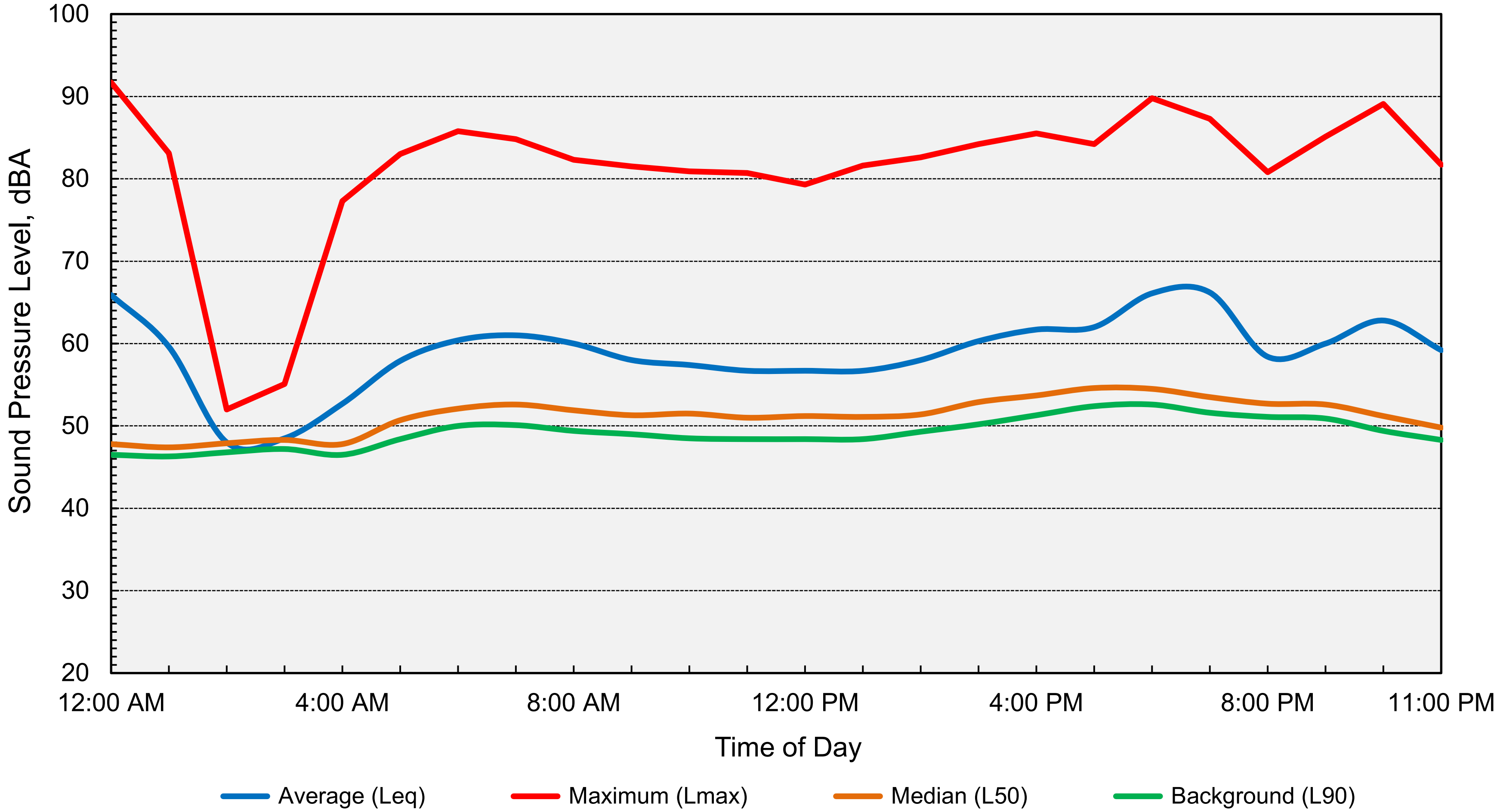
Appendix D-3
Long-Term Ambient Noise Monitoring Results - Site LT-2
Walsh-Bowers Data Center - Santa Clara, California
Wednesday, June 29, 2022



Computed DNL = 67 dB

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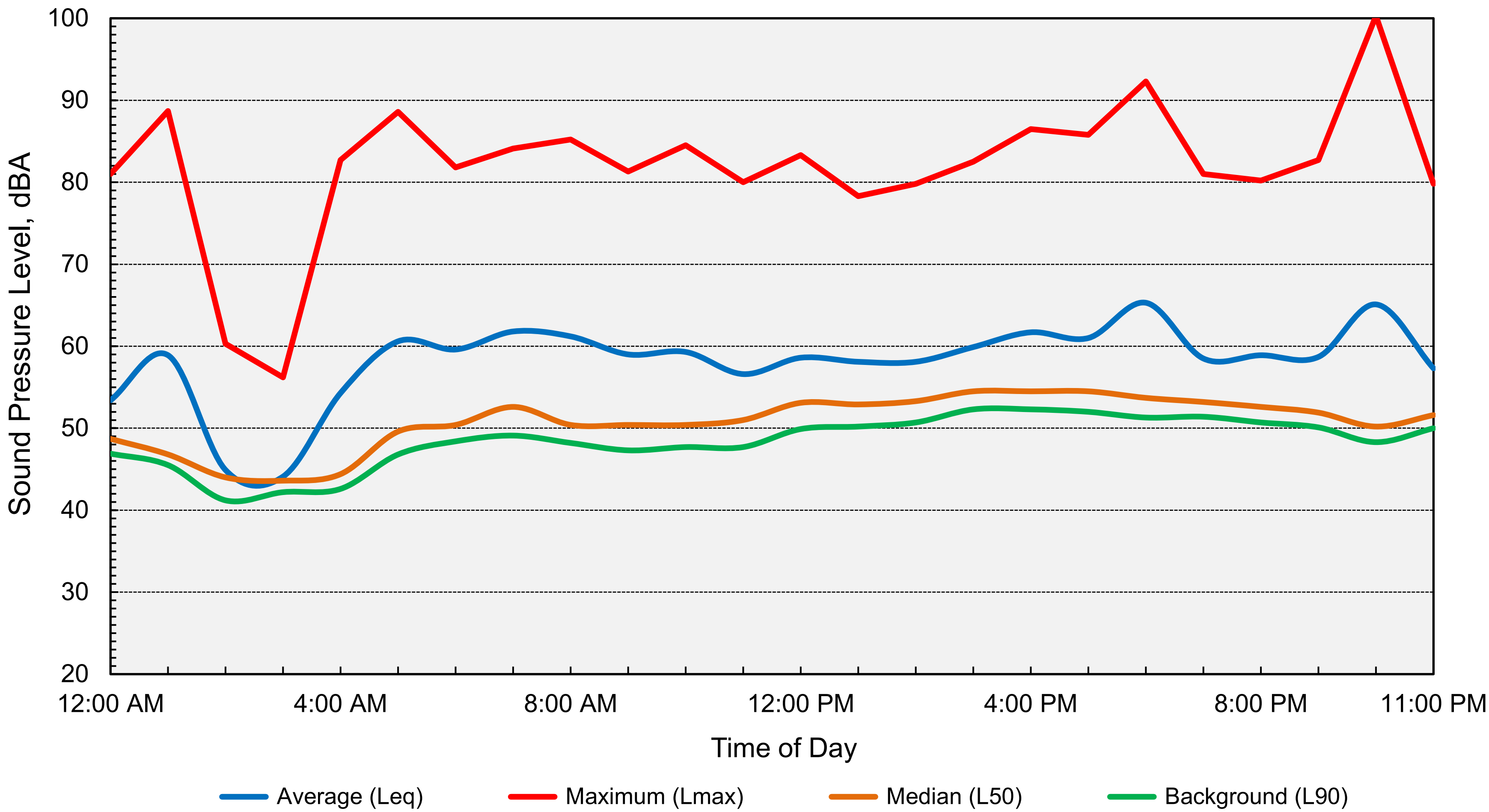
Appendix D-4
Long-Term Ambient Noise Monitoring Results - Site LT-2
Walsh-Bowers Data Center - Santa Clara, California
Thursday, June 30, 2022



Computed DNL = 66 dB

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Memorandum

Date: July 20, 2022

To: Michael Lisenbee, David J. Powers & Associates, Inc.

From: Kai-Ling Kuo

Subject: Transportation Analysis for the Proposed Data Center at 2805 Bowers Avenue

This memorandum presents the transportation analysis for the proposed data center located at 2805 Bowers Avenue in Santa Clara, California. The project would replace the existing 55,000 square-foot (s.f.) office building with a 244,968 s.f. data center. Vehicle access to the data center would be provided via two driveways on Bowers Avenue in the same general areas as the existing driveways: one full-access driveway at the Mead Avenue intersection and the other right-turn only driveway near the northern boundary of the site (see Figure 1).

Because the project would generate a small number of new trips during the peak hours, a local transportation analysis to evaluate the project's traffic effects on intersection operations is not required. The transportation analysis includes trip generation estimates, a vehicle miles traveled (VMT) analysis, evaluation of site access and on-site circulation, and effects on pedestrians, bicycles, and transit facilities.

Per California Senate Bill 743 (SB 743) and CEQA Guidelines, all new developments are required to analyze transportation impacts using the VMT metric and to conform the City's VMT Policy. The City's VMT Policy establishes procedures and VMT thresholds of significance for determining project impacts on VMT. The City's VMT Policy also includes screening criteria that are used to identify projects that would not exceed the VMT thresholds of significance. If a project meets the screening criteria, it is then presumed that the project would result in a less-than- significant VMT impact, and a VMT analysis is not required. The project would not meet all applicable VMT screening criteria. Therefore, a CEQA VMT analysis is required for the project.

Project Trip Estimates

Through empirical research, data have been collected that show trip generation rates for many types of land uses. The research is compiled in the ITE *Trip Generation Manual, 11th Edition*. The magnitude of traffic added to the roadway system by a particular development is estimated by multiplying the applicable trip generation rates by the size of the development. The rates published for "Data Center" (Land Use Code 160) were used to estimate the trips generated by the proposed data center, and the trip rates for "General Office Building" (Land Use Code 710) were used to estimate the trip credits for the existing office building (see Table 1). The existing office space is 29% occupied, and therefore, the existing trip estimates were reduced by 71% to reflect the current occupancy.

Based on the ITE trip generation rates and existing trip credits, it is estimated that the proposed data center would generate 68 new daily trips, with 3 new trips (-6 in and 9 out) occurring during the AM peak hour and 1 less trip (3 in and -4 out) occurring during the PM peak hour.

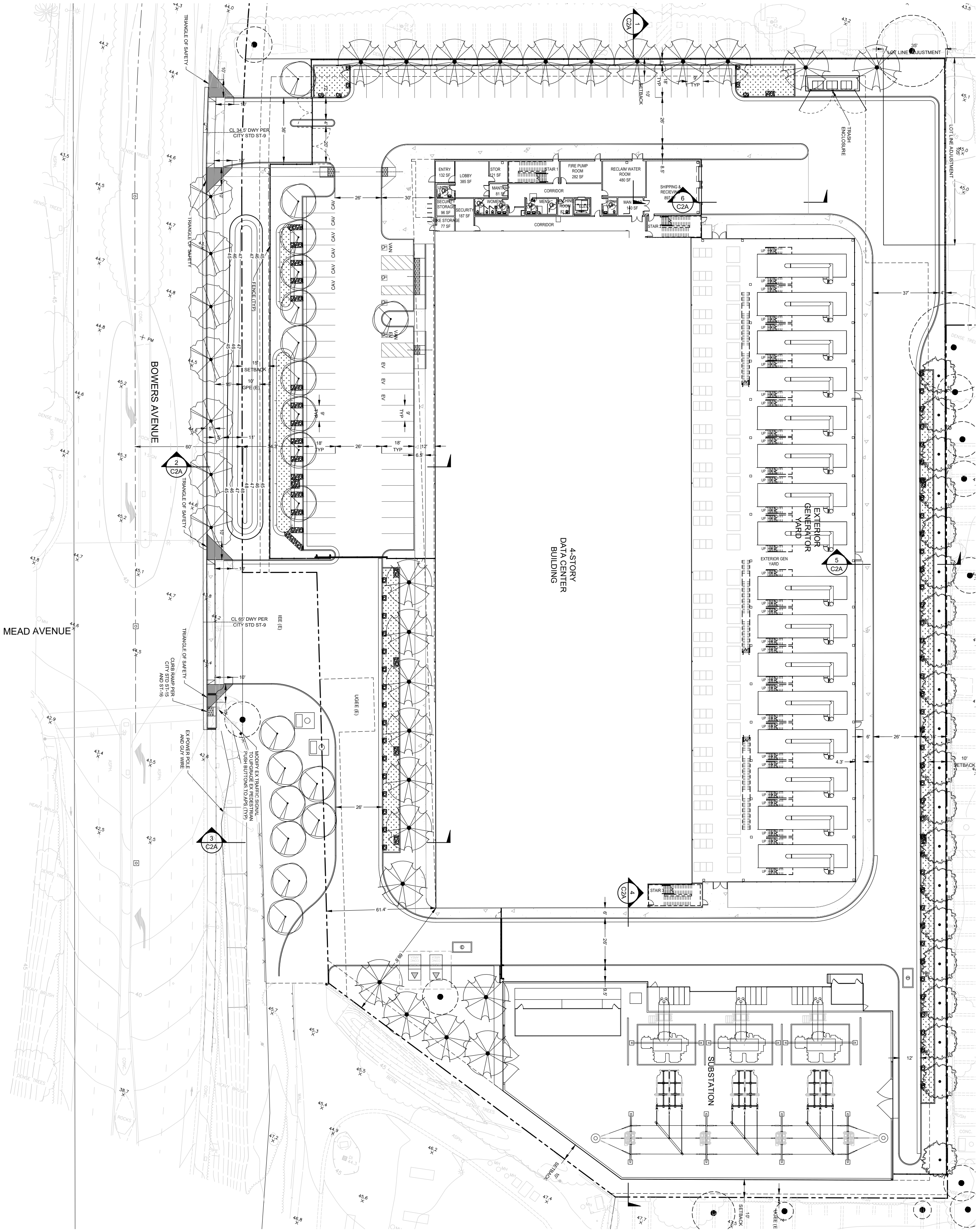


Figure 1
Proposed Site Plan

Table 1
Project Trip Generation

Land Use	Size		Daily Trip Rate	Daily Trips	AM Peak Hour Trip Rate	AM Trips In	AM Trips Out	AM Trips Total	PM Peak Hour Trip Rate	PM Trips In	PM Trips Out	PM Trips Total
Proposed Use												
Data Center[1]	244,068	s.f.	0.99	242	0.11	15	12	27	0.09	7	15	22
Existing Use												
General Office Building[2]	15,950	s.f.	10.84	50	1.52	21	3	24	1.44	4	19	23
Net Project Trips				***192***		***-6***	***9***	***3***		***3***	***-4***	***-1***

Source: ITE *Trip Generation Manual*, 11th Edition.
1. Average trip rates expressed in trips per 1,000 square feet (s.f.) for Data Center (Land Use 160) are used.
2. Average trip rates expressed in trips per 1,000 square feet (s.f.) for General Office Building (Land Use 710) are used. The building size reflects occupied space of the 55,000 s.f. building.

Vehicle Miles Traveled Analysis

VMT Evaluation Methodology

VMT is defined as the total miles of travel by personal motorized vehicles a project is expected to generate in a day. A project's VMT is compared to established thresholds of significance based on the project location and type of development.

Typically, development projects that are farther from other, complementary land uses (such as a business park far from housing) and in areas without transit or active transportation infrastructure (bike lanes, sidewalks, etc.) generate more driving than development near complementary land uses with more robust transportation options. Therefore, developments located in a central business district with high density and diversity of complementary land uses and frequent transit services are expected to internalize trips and generate shorter and fewer vehicle trips than developments located in a suburban area with low density of residential developments and no transit serve in the project vicinity.

When assessing an office or industrial project, the project's VMT is divided by the number of employees and evaluated based on VMT per employee.

<u>VMT Evaluation Tool</u>

To determine whether a project would result in CEQA transportation impacts related to VMT, the Santa Clara Valley Transportation Authority (VTA) has developed a countywide VMT Evaluation Tool to streamline the analysis.

Based on the location of a project, the VMT evaluation tool identifies the existing average VMT per employee for the project area. Based on the project location, type of development, project description, and proposed trip reduction measures, the VMT evaluation tool calculates the project VMT.

Since the VMT evaluation tool does not explicitly include data centers, the proposed data center cannot be evaluated directly using the VMT evaluation tool. Therefore, to complete the VMT evaluation, the proposed data center space was converted to an equivalent amount of industrial square footage (see Table 2). The project was then evaluated as industrial development in the VMT evaluation tool to obtain project VMT. This is a reasonable approach to the VMT analysis since the trip-making characteristics of a data center would be similar to industrial development.

Table 2
Equivalent Industrial Space

Land Use	ITE Land Use	Size	Daily Trips		
			Trip Rate		Trips
Proposed Land Use					
Data Center	Land Use 160	244,068 s.f.	0.99	per 1000 s.f.	242
Equivalent Land Use					
General Light Industrial	Land Use 110	49,692 s.f.	4.87	per 1000 s.f.	242
All trip rates are from ITE Trip Generation Manual, 11th Edition, 2021					

<u>Threshold of Significance</u>

A project's VMT impact is determined by comparing the project VMT to the appropriate thresholds of significance based on the type of development. In Santa Clara, the VMT thresholds of significance are established based on the existing countywide average VMT levels for residential and employment uses.

For industrial use, the threshold of significance is the countywide average VMT per employee minus 15 percent, which calculates to 14.14 daily miles per employee.

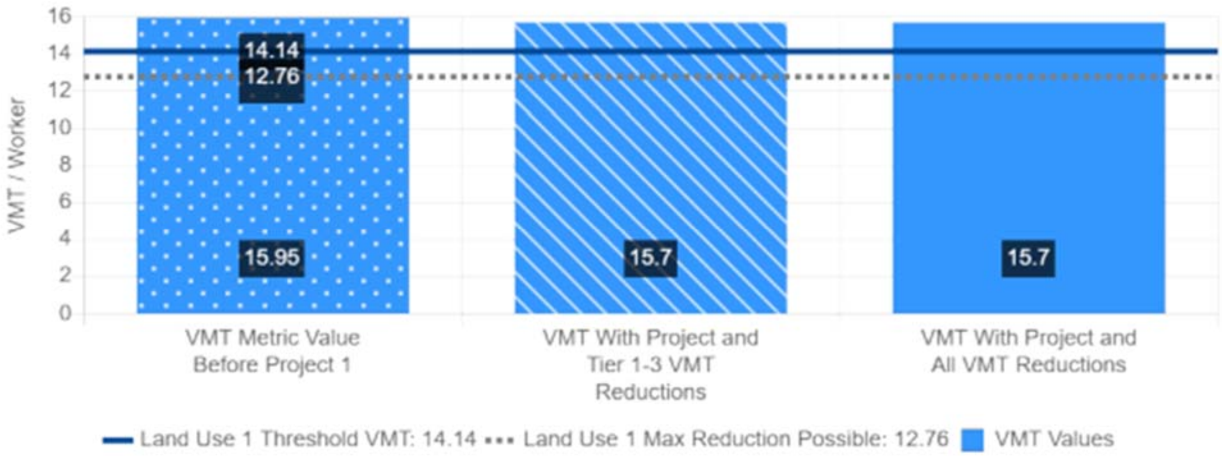
VMT of Existing Land Uses

The results of the VMT evaluation, using the VMT evaluation tool, indicate that the existing VMT for industrial employment uses in the project vicinity is 15.95 per employee. This is higher than the significance threshold of 14.14 daily miles per employee (see Figure 2).

Project-Level VMT Impact Analysis

The project-level VMT estimated by the VMT evaluation tool is 15.7 per employee, which is lower than the existing area VMT for industrial uses in the project vicinity (see Figure 2). This is because the project would provide secured on-site bicycle parking, which would encourage employees to commute using bicycles and reduce VMT. However, the VMT is above the threshold of 14.14 VMT per employee. Therefore, the project would result in a significant impact on the transportation system based on the City's VMT impact criteria.

Figure 2
VMT Analysis without Mitigations



Mitigation Measures

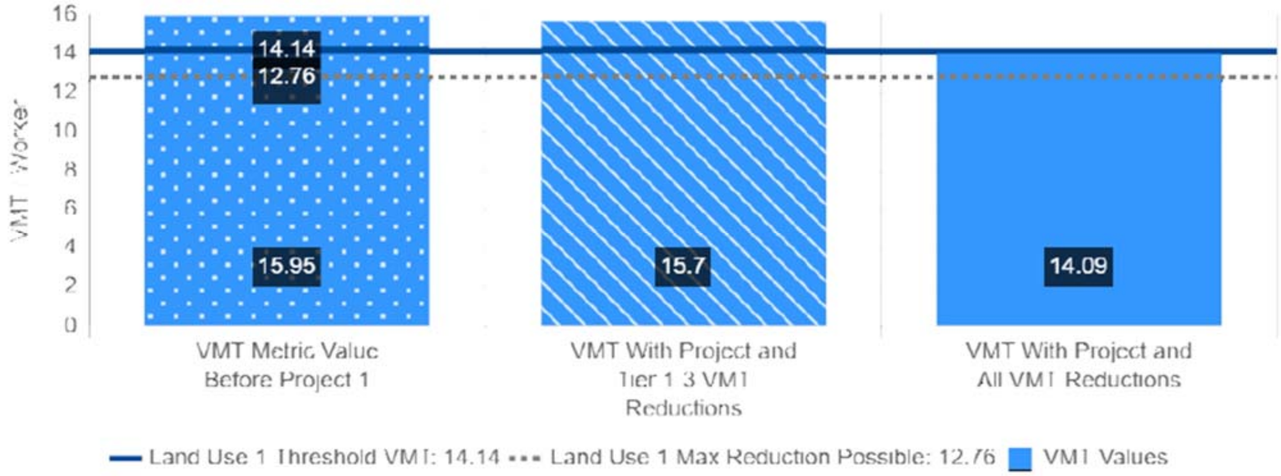
Projects located in areas where the existing VMT is greater than the established threshold of significance are required to include a set of VMT reduction measures that would reduce the project VMT to the greatest extent possible. The VMT evaluation tool evaluates a list of selected VMT reduction measures that can be applied to a project to reduce the project VMT. There are four strategy tiers whose effects on VMT can be calculated with the VMT evaluation tool:

1. Project characteristics (e.g. density, diversity of uses, design, and affordability of housing) that encourage walking, biking, and transit uses;
2. Multimodal infrastructure improvements that increase accessibility for transit users, bicyclists, and pedestrians;
3. Parking measures that discourage personal motorized vehicle-trips; and
4. Transportation demand management (TDM) programs that provide incentives and services to encourage alternatives to personal motorized vehicle-trips.

The first three strategies – land use characteristics, multimodal infrastructure improvements, and parking – are physical design strategies that can be incorporated into the project design. TDM includes programmatic measures that aim to reduce VMT by decreasing personal motorized vehicle mode share and by encouraging more walking, biking, and riding transit. TDM measures should be enforced through annual trip monitoring to assess the project's status in meeting the VMT reduction goals.

Based on the list of selected VMT reduction measures included in the VMT evaluation tool, it is recommended the project implement the TDM measures described below. Figure 3 shows the VMT level generated by the VMT evaluation tool with the mitigation measures. Appendix A presents the VMT evaluation tool summary reports for the project scenarios without and with the mitigation measures.

Figure 3
VMT Analysis with Mitigations



- Commute Trip Reduction Marketing and Education. This would educate and encourage employees to use transit, shared rides, and active modes, therefore lowering the number of single occupancy vehicle trips.
- Alternative Transportation Benefits. The project would be required to provide general commute benefits to employees, which would include financial subsidies or pre-tax deductions for transit, carpooling, and vanpooling activities. This strategy would encourage employees to use alternative transportation modes.
- Ride-Sharing Program. This would encourage employees to carpool with other employees and/or through ridematching services, which help employees find other commuters traveling in the same direction.

The combination of the TDM measures would reduce the project VMT to 14.09 per employee, which would make the project impact less than significant. The VMT estimate assumes that 100% of the employees would participate in the commute trip reduction/education program, 10% of the employees would be eligible for alternative transportation benefits, and 4% of the employees would participate in the ride-sharing program. Therefore, the project would be required to implement a TDM plan with these TDM measures to reduce the project VMT.

The TDM plan is required to have annual monitoring and reporting to ensure these mitigation measures are implemented and effective in reducing the project VMT. It is recommended that the property manager consult with City staff to ensure the monitoring and reporting meets the City's expectations.

Site Access and Circulation

A review of the project site plan was performed to determine if adequate site access and on-site circulation would be provided and to identify any access or circulation issues that should be improved. This review is based on the site plan, dated March 11, 2022 (see Figure 1) and in accordance with generally accepted traffic engineering standards.

Site Access

Vehicle access to the data center would be provided via two driveways on Bowers Avenue in the same general areas as the existing driveways: one right-turn only driveway near the northern boundary of the site (northern driveway) and a full-access driveway at the signalized Bowers Avenue/Mead Avenue intersection (main driveway). The project would widen the northern driveway to 34.5 feet and narrow the main driveway to 65 feet wide. The two driveways would be approximately 275 feet apart.

Driveway Design

According to the City of Santa Clara Municipal Code, Chapter 18.74 (Parking Regulations), two-way driveways providing access to all properties other than residential should be at least 22 feet wide. The City's Standard Details ST-9 (Commercial Driveway with Attached Sidewalk) shows two-way driveways providing access to industrial developments should be no more than 50 feet wide. The northern driveway meets the driveway width requirement, but the main driveway would exceed the maximum width of 50 feet. The project should narrow the main driveway at the Bowers Avenue/Mead Avenue intersection to 50 feet wide, which matches the width of Mead Avenue opposite the driveway.

The site plan shows that the site would be gated with two gates near the main driveway and one gate at the northern driveway. The gates near the main driveway would be located at the drive aisle to the ground parking lot and at the drive aisle to the back side of the building. Both gates are set back from the driveway. Therefore, the inbound vehicle queues at the gates are not expected to block the sidewalk or extend to the street. The gate for the northern driveway would be located approximately 50 feet from the sidewalk, which would provide room for two inbound vehicles. Due to the low volume of project trips, the probability of two or more inbound vehicles entering the site via the driveway at the same time would be low. Therefore, the inbound vehicle queue is not expected to block the sidewalk or extend to the street.

Sight Distance at Project Driveways

The project driveways should be free and clear of any obstructions to provide adequate sight distance, thereby ensuring that exiting vehicles can see pedestrians on the sidewalk and vehicles and bicycles traveling on Bowers Avenue. Any landscaping and signage within the sight triangles at the project driveways should be no taller than 3 feet and located in such a way to ensure an unobstructed view for exiting drivers. Providing the appropriate sight distance reduces the likelihood of a collision at a driveway and provides drivers with the ability to locate sufficient gaps in traffic and exit a driveway.

The minimum acceptable sight distance at the driveways is calculated according to the Caltrans recommended stopping sight distance. Sight distance requirements vary depending on roadway speeds. The speed limit on Bowers Avenue is 35 mph, and the recommended Caltrans stopping sight distance for 35 mph roadways is 300 feet. Thus, a driver must be able to see 300 feet looking left out of the driveways to locate a sufficient gap to turn out of the driveways. Bowers Avenue is slightly curved along the project frontage, but the curves would not obstruct the view for exiting vehicles. The site plan shows the landscaping along the project frontage would not obstruct the view of drivers exiting the project driveways. Bowers Avenue does not allow on-street parking, so sight distance would be adequate at the driveways.

Traffic Operations at Project Driveways

The project trips that are estimated to occur at the driveways are 15 inbound trips and 12 outbound trips in the AM peak hour and 7 inbound trips and 15 outbound trips during the PM peak hour.

Due to the relatively low number of project-generated trips at the driveways, operational issues related to vehicle queueing and/or vehicle delay are not expected to occur at the driveway. It should be noted that the trip generation of the proposed data center would be much less than the existing office building on the site when it was fully occupied.

On-Site Circulation

The project would provide 90-degree standard parking stalls (9 feet wide and 18 feet long) in the parking areas to the north and west sides of the building with a 26-foot two-way drive aisle circulating the site. According to the City of Santa Clara Municipal Code, Chapter 18.74, the standard parking stall should measure 9 feet wide and 18 feet long. For parking facilities with 90-degree standard parking stalls, the minimum drive aisle width should be 25 feet. Therefore, the proposed parking stalls would meet the requirement. The proposed drive aisle width, in combination with the parking dimensions, would provide sufficient room for vehicles to back out of the 90-degree parking stalls.

The project would provide adequate on-site circulation because a two-way drive aisle would circulate the site and provide access to the parking stalls with no dead-end drive aisle. The drive aisle could be accessed via both driveways.

Emergency Vehicle and Truck Access and Circulation

Bowers Avenue and the drive aisle within the site would provide emergency vehicle access to all sides of the project building. Vehicles would enter the site through either driveway, turn into the drive aisle closest to the building, and then circulate the site to exit using either driveway.

The project would provide a trash enclosure in the northeast corner of the site. Trash collection would occur on-site with garbage trucks entering the site through either driveway and then circulating the site to exit using either driveway.

The site plan shows a truck loading area along the northeast edge of the building. Truck access was reviewed for the truck types WB-40 and SU-30, which represent small semi-trailer trucks, emergency vehicles, garbage trucks, and small to medium delivery vehicles. It is expected that larger trucks would enter the site via the northern driveway, back into the loading area, and exit using the main driveway. Large trucks accessing the driveways might encroach into the inner northbound lane on Bowers Avenue. However, because large trucks would typically be infrequent and would access the site during off-peak hours, they are not expected to cause disruption to traffic flow on Bowers Avenue.

Effects on Pedestrians, Bicycles, and Transit Facilities

The following describes the existing transit, pedestrian and bicycle facilities that serve the site and evaluates whether appropriate bicycle and pedestrian access and transit service are provided between the site and nearby destinations.

Pedestrian Facilities

Pedestrian facilities in the study area consist of sidewalks and crosswalks. A continuous network of sidewalks is present along all of the surrounding streets. Crosswalks with pedestrian signal heads are located at all of the signalized intersections in the area. At the Bowers Avenue/Mead Avenue intersection, crosswalks are available on the west and south legs of the intersection.

The project would construct new 9-foot-wide sidewalks along the project frontage on Bowers Avenue and improve the curb ramp at the southeast corner of the Bowers Avenue/Mead Avenue intersection to meet ADA standards. The sidewalks and ADA curb ramp would facilitate pedestrian movements between the project site and surrounding points of interest, such as bus stops.

Within the site, a pedestrian walkway would be provided between the sidewalks on Bowers Avenue, the surface parking lot, and the proposed building entrances. Sidewalks would also be provided around the building and substation. Therefore, pedestrian access to all proposed facilities within the project site would be provided.

Bicycle Facilities

There are bike lanes on Bowers Avenue north of Chromite Drive and bike routes on Bowers Avenue south of Chromite Drive that connect cyclists from the project site to the surrounding areas. According to the *Santa Clara Bicycle Master Plan Update 2018*, Class II bike lanes are planned on Bowers Avenue south of Chromite Drive, and Class IV separated bikeways are planned on Kifer Road.

The project would provide secure bicycle storage in a bike room in the northwest edge of the building near the building entrance. The bike room would be accessed using the pedestrian walkway from Bowers Avenue. The project would also provide bike racks next to the building entrance facing Bowers Avenue.

It is expected that the project would generate some bicycle trips, which could utilize the existing bike lanes on surrounding streets to get to nearby destinations. According to the *Bicycle Master Plan Update 2018*, the proportion of Santa Clara residents that bicycle to work is about two percent, which equates to one new bicycle trip during the AM and PM peak hours for the project.

Transit Services

A bus stop for the VTA Frequent Route 57 is located 450 feet from the project site on Bowers Avenue. The VTA's ACE yellow shuttle also has a stop located on Bowers Avenue within 2,000 feet of the project site. Due to the proximity of Route 57 to the project site, it is assumed that some employees of the project would utilize the existing transit services. Assuming a commute hour transit mode share of two percent (as recommended by VTA guidelines), the project would generate one new transit rider during the peak hours. Therefore, it is anticipated that the new ridership could be accommodated by the existing transit services.

Conclusions

The VMT generated by project (15.7 daily VMT per employee) would exceed the threshold of 14.14 VMT per employee. Therefore, the project would result in a significant impact on VMT, and mitigation measures are required to reduce the VMT impact. Based on the list of selected VMT reduction measures included in the VMT evaluation tool, the project would be required to implement a TDM plan with TDM measures, including the commute trip reduction/education program, alternative transportation benefits, and ride-sharing program, to reduce the project VMT. The combination of these TDM measures would reduce the project VMT to 14.09 per employee, which would make the project impact less than significant.

The site plan shows adequate site access and on-site circulation, and no significant on-site circulation issues are expected to occur as a result of the project. The project would not have an adverse effect on the existing pedestrian, bicycle, or transit facilities in the study area.

Hexagon has the following recommendation resulting from the site access and circulation evaluation.

- The project should narrow the main driveway at the Bowers Avenue/Mead Avenue intersection to 50 feet wide.

Appendix A

VMT Evaluation Tool Results

Project Details

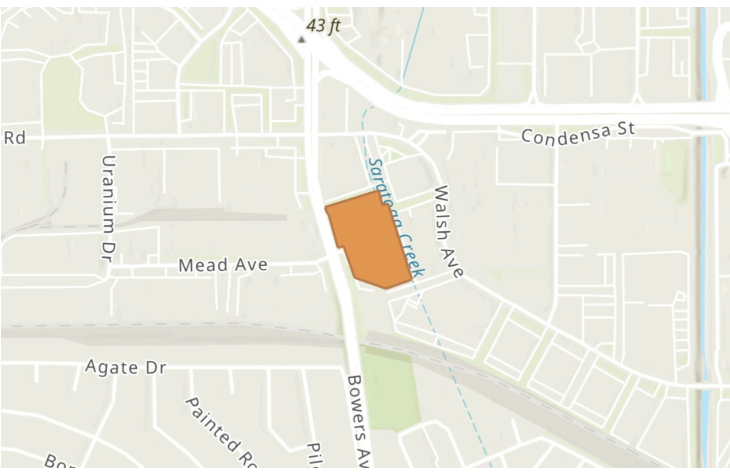
Timestamp of Analysis	July 19, 2022, 06:09:15 PM
Project Name	2805 Bowers Ave Data Center
Project Description	A 244, 968 s.f. data center.

Project Location Map

Jurisdiction:

Santa Clara

APN	TAZ
21628063	1227



Analysis Details

Data Version	VTA Countywide Model December 2019
Analysis Methodology	Parcel Buffer Method
Baseline Year	2015

Project Land Use

Residential:

Single Family DU:	
Multifamily DU:	
Total DUs:	0

Non-Residential:

Office KSF:	
Local Serving Retail KSF:	
Industrial KSF:	49

Residential Affordability (percent of all units):

Extremely Low Income:	0 %
Very Low Income:	0 %
Low Income:	0 %

Parking:

Motor Vehicle Parking:	62
Bicycle Parking:	10

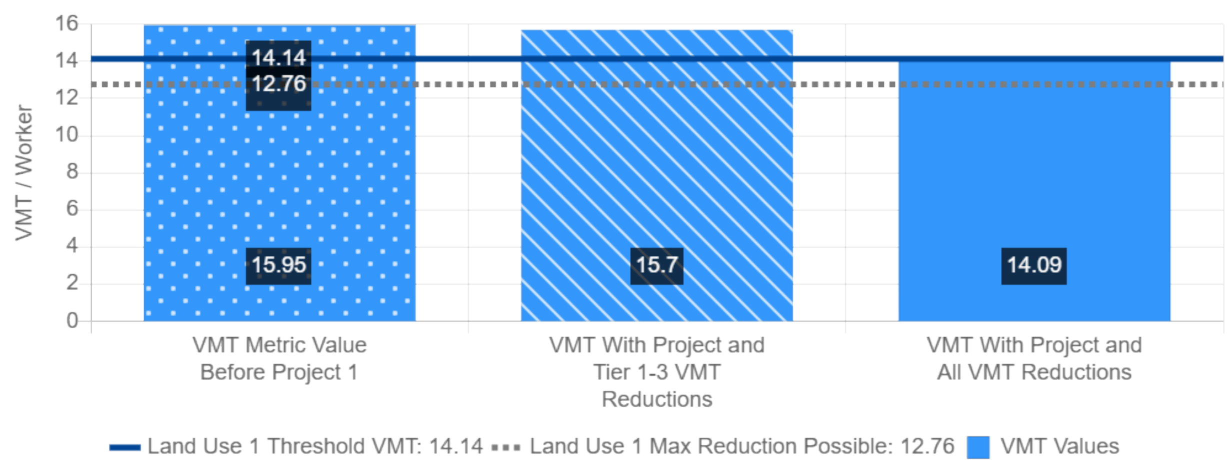
Proximity to Transit Screening

Inside a transit priority area?	Yes (Pass)

Industrial Vehicle Miles Traveled (VMT) Screening Results

Land Use Type 1:	Industrial
VMT Metric 1:	Home-based Work VMT per Worker
VMT Baseline Description 1:	County Average
VMT Baseline Value 1:	16.64
VMT Threshold Description 1 / Threshold Value 1:	-15% / 14.14
Land Use 1 has been Pre-Screened by the Local Jurisdiction:	N/A

	Without Project	With Project & Tier 1-3 VMT Reductions	With Project & All VMT Reductions
Project Generated Vehicle Miles Traveled (VMT) Rate	15.95	15.7	14.09
Low VMT Screening Analysis	No (Fail)	No (Fail)	Yes (Pass)



Tier 1 Project Characteristics

PC01 Increase Residential Density

Existing Residential Density:	9.25
With Project Residential Density:	9.25

PC02 Increase Residential Diversity

Existing Residential Diversity Index:	0.83
With Project Residential Diversity Index:	0.83

PC03 Affordable Housing

PC04 Increase Employment Density

Existing Employment Density:	38.72
With Project Employment Density:	38.93

Tier 3 Parking

PK02 Provide Bike Facilities

Bicycle Parking:	10
Project End-of-trip Bike Facilities:	Yes

Tier 4 TDM Programs

TP04 CTR Marketing and Education

CTR Marketing/Education Percent Expected Participants:	100 %

TP11 Alternative Transportation Benefits

Percent of Employees Eligible for Alternative Transportation Benefits:	10 %

TP13 Ride-Sharing Programs

Expected Percent of Ride-Sharing Participants:	4 %