APPENDIX B
ENVIRONMENTAL NOISE ASSESSMENT

SAXELBY ACOUSTICS
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Environmental Noise Assessment

Osage Warehouse

City of Sacramento, California

May 9, 2022

Project #210802

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INTRODUCTION

The Osage Warehouse project includes the construction of a single 115,468 sqft. warehouse on a previously vacant parcel. The project is located at the northeast corner of the intersection of South Watt Avenue and Osage Avenue in the City of Sacramento, California. The project will include 116 auto parking stalls and 18 loading dock spaces. Surrounding land uses include commercial uses to the north and west and single family residential uses to the south and east of the project site. While the project is located within the boundaries of the City of Sacramento, the adjacent sensitive receptors are located outside of the City boundaries but within the County of Sacramento Boundaries.

Figure 1 shows the project site plan. **Figure 2** shows an aerial photo of the project site.

ENVIRONMENTAL SETTING

BACKGROUND INFORMATION ON NOISE

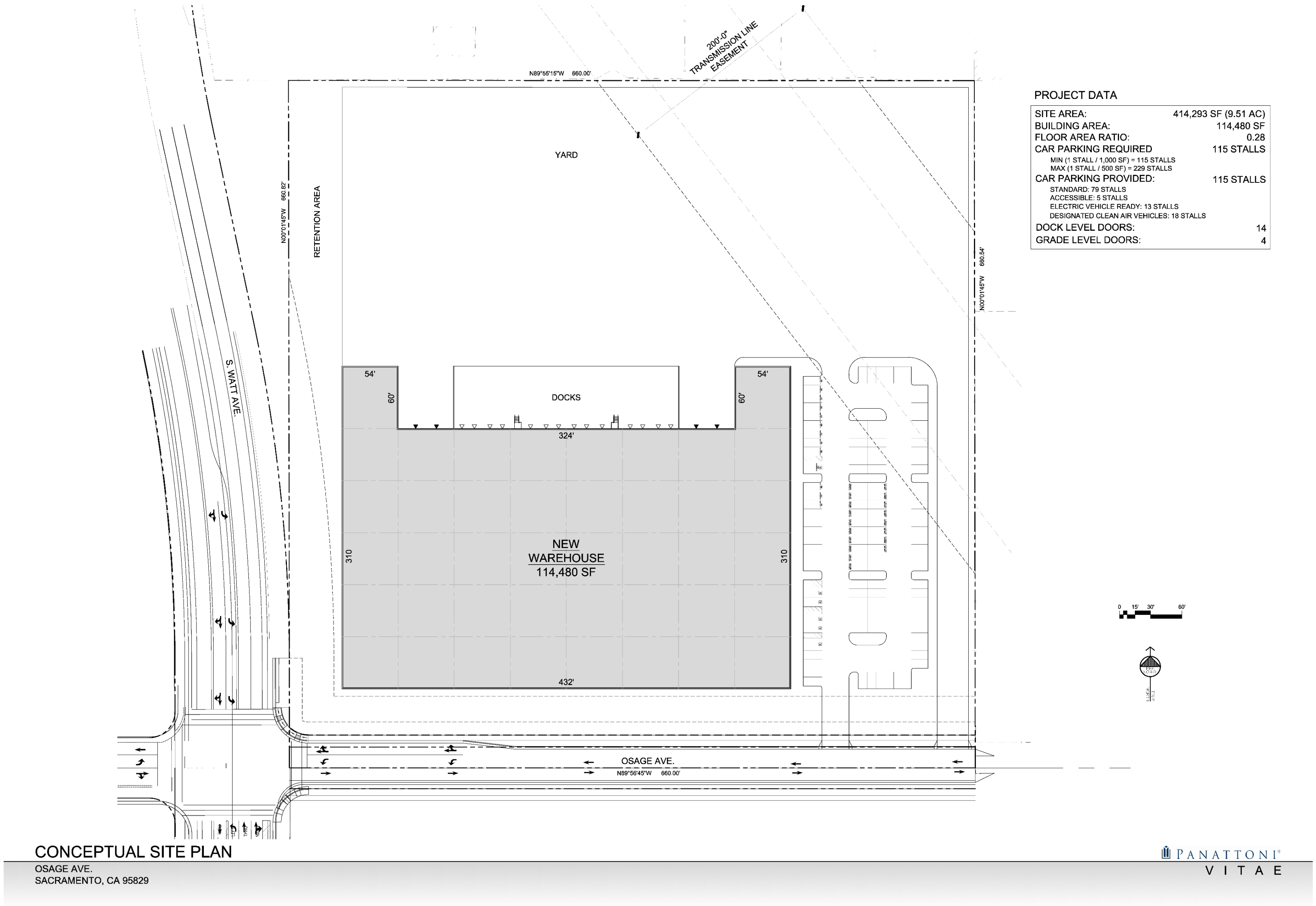
Fundamentals of Acoustics

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

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), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this 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, and changes in levels (dB) correspond closely to human perception of relative loudness.

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 A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment.

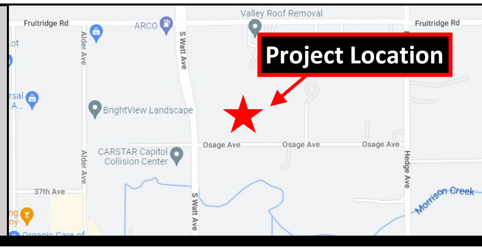


Osage Warehouse

City of Sacramento, California

Figure 1

Project Site Plan



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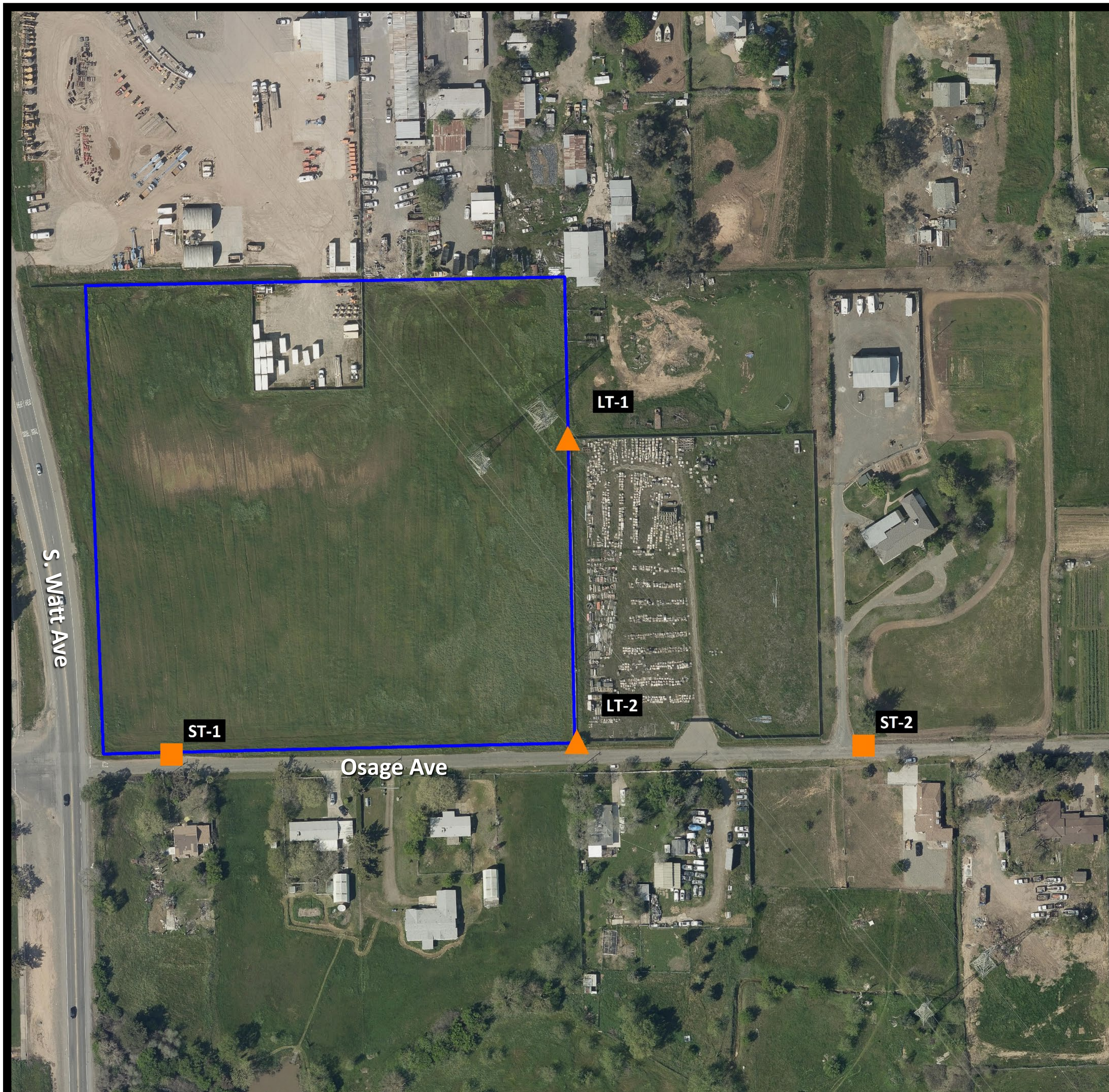

Osage Warehouse

City of Sacramento, California

Figure 2

Noise Measurement Sites

Legend

- Project Site
- Noise Measurement Site - Long Term
- Noise Measurement Site - Short Term

50 ft 150 ft 250 ft 350 ft

Projection: UTM Zone 10 / WGS84 / meters
Rev. Date: 05/09/2022

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The decibel scale is logarithmic, not linear. In other words, two sound levels 10-dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10-dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound, and twice as loud as a 60 dBA sound.

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 environment. A common statistical tool is the average, or equivalent, sound level (L_{eq}), which corresponds to a steady-state A weighted sound level containing the same total energy as a time varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The day/night average level (DNL or L_{dn}) is based upon the average noise level over a 24-hour day, with a +10-decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Table 1 lists several examples of the noise levels associated with common situations. **Appendix A** provides a summary of acoustical terms used in this report.

TABLE 1: TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	--110--	Rock Band
Jet Fly-over at 300 m (1,000 ft.)	--100--	
Gas Lawn Mower at 1 m (3 ft.)	--90--	
Diesel Truck at 15 m (50 ft.), at 80 km/hr. (50 mph)	--80--	Food Blender at 1 m (3 ft.) Garbage Disposal at 1 m (3 ft.)
Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft.)	--70--	Vacuum Cleaner at 3 m (10 ft.)
Commercial Area Heavy Traffic at 90 m (300 ft.)	--60--	Normal Speech at 1 m (3 ft.)
Quiet Urban Daytime	--50--	Large Business Office Dishwasher in Next Room
Quiet Urban Nighttime	--40--	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime	--30--	Library
Quiet Rural Nighttime	--20--	Bedroom at Night, Concert Hall (Background)
	--10--	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing

Source: Caltrans, Technical Noise Supplement, Traffic Noise Analysis Protocol. September, 2013.

Effects of Noise on People

The effects of noise on people can be placed in three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as hearing loss or sudden startling

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- A change in level of at least 5-dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause an adverse response.

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6-dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

EXISTING AND FUTURE NOISE AND VIBRATION ENVIRONMENTS

EXISTING NOISE RECEPTORS

Some land uses are considered more sensitive to noise than others. Land uses often associated with sensitive receptors generally include residences, schools, libraries, hospitals, and passive recreational areas. Sensitive noise receptors may also include threatened or endangered noise sensitive biological species, although many jurisdictions have not adopted noise standards for wildlife areas. Noise sensitive land uses are typically given special attention in order to achieve protection from excessive noise.

Sensitivity is a function of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities involved. In the vicinity of the project site, sensitive land uses include existing single-family residential uses located west and south of the project site.

EXISTING GENERAL AMBIENT NOISE LEVELS

The existing ambient noise environment in the project vicinity is primarily defined by traffic on South Watt Avenue. To quantify the existing ambient noise environment in the project vicinity, Saxelby Acoustics conducted continuous (24-hr.) noise level measurements at two locations on the project site and short-term noise level measurements at two locations. Noise measurement locations are shown on **Figure 2**. A summary of the noise level measurement survey results is provided in **Table 2**. **Appendix B** contains the complete results of the noise monitoring.

The sound level meters were programmed to record the maximum, median, and average noise levels at each site during the survey. The maximum value, denoted L_{max}, represents the highest noise level measured. The average value, denoted L_{eq}, represents the energy average of all of the noise received by the sound level meter microphone during the monitoring period. The median value, denoted L_{50}, represents the sound level exceeded 50 percent of the time during the monitoring period.

Larson Davis Laboratories (LDL) model 820 and 831 precision integrating sound level meters were used for the ambient noise level measurement survey. The meters were calibrated before and after use with a B&K Model 4230 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

TABLE 2: SUMMARY OF EXISTING BACKGROUND NOISE MEASUREMENT DATA

Location	Date	L_{dn}	Daytime L_{eq}	Daytime L_{50}	Daytime L_{max}	Nighttime L_{eq}	Nighttime L_{50}	Nighttime L_{max}
LT-1: 735 ft. to CL of South Watt Ave.	8/19/21	59	53	51	66	53	51	64
LT-2: 690 ft. to CL of South Watt Ave.	8/19/21	59	53	51	66	53	51	64
ST-1: 140 ft. to CL of South Watt Ave.	8/20/21	N/A	62	61	54	N/A	N/A	N/A
ST-2: 1,080 ft. to CL of South Watt Ave.	8/20/21	N/A	50	49	47	N/A	N/A	N/A

Notes:

- *All values shown in dBA*
- *Daytime hours: 7:00 a.m. to 10:00 p.m.*
- *Nighttime Hours: 10:00 p.m. to 7:00 a.m.*
- *Source: Saxelby Acoustics 2022*

FUTURE TRAFFIC NOISE ENVIRONMENT AT OFF-SITE RECEPTORS

Off-Site Traffic Noise Impact Assessment Methodology

To assess noise impacts due to project-related traffic increases on the local roadway network, traffic noise levels are predicted at sensitive receptors for project and no-project conditions.

Existing and Existing Plus Project noise levels due to traffic are calculated using the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108). The model is based upon the Calveno reference noise factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site.

The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions. To predict traffic noise levels in terms of L_{dn}, it is necessary to adjust the input volume to account for the day/night distribution of traffic.

Project trip generation volumes were provided by the project traffic engineer (DKS Associates 2021), truck usage and vehicle speeds on the local area roadways were estimated from field observations. The predicted increases in traffic noise levels on the local roadway network for Existing and Existing Plus Project conditions are provided in terms of L_{dn}.

Traffic noise levels are predicted at the sensitive receptors located at the closest typical setback distance along each project-area roadway segment. In some locations sensitive receptors may not receive full shielding from noise barriers or may be located at distances which vary from the assumed calculation distance.

Table 3 summarizes the modeled traffic noise levels at the nearest sensitive receptors along each roadway segment in the Project area. **Appendix C** provides the complete inputs and results of the FHWA traffic modeling. Based upon the data in **Table 3**, the proposed project is predicted to result in a maximum traffic noise level increase of 1.4 dBA.

TABLE 3: PREDICTED TRAFFIC NOISE LEVEL AND PROJECT-RELATED TRAFFIC NOISE LEVEL INCREASES

Roadway	Segment	Predicted Exterior Noise Level (dBA L_{dn}) at Closest Sensitive Receptors		
		Existing No Project	Existing + Project	Change
Osage Ave.	East of S Watt Ave.	67.4	67.9	0.5
Osage Ave.	West of Project Driveway	62.5	62.5	0.0
Osage Ave.	Project Driveway	60.0	61.4	1.4

EVALUATION OF PROJECT OPERATIONAL NOISE AT RESIDENTIAL RECEPTORS

Loading Dock and Truck Circulation Noise Generation

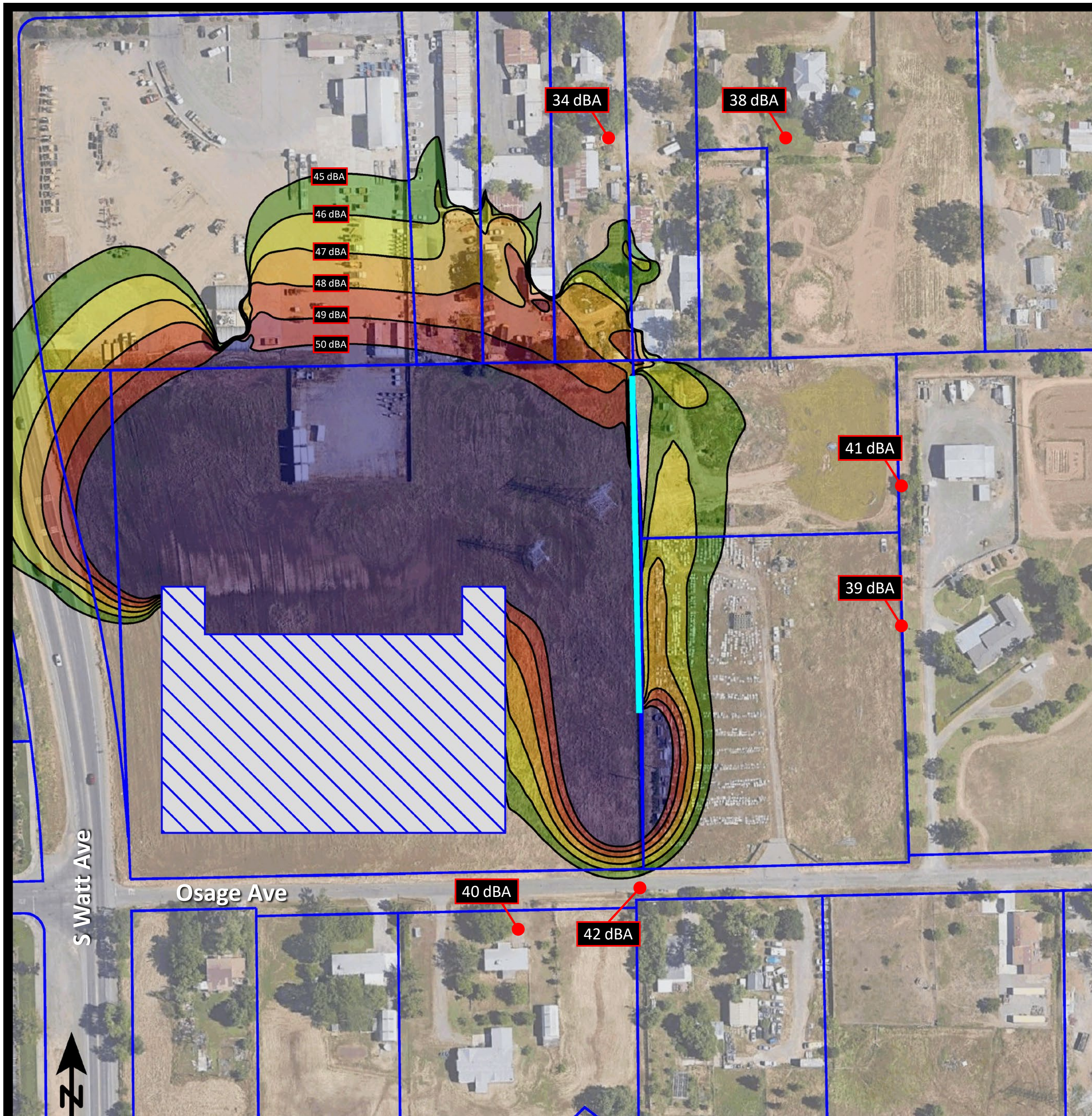
To determine typical loading dock noise levels associated with the proposed loading docks, noise level measurement data from a Restaurant Depot warehouse was used. The noise level measurements were conducted at a distance of 100 feet from the center of the loading dock area. This noise measurement location was located at the boundary of the truck maneuvering lanes. Activities during the peak hour of loading dock activities included truck arrival/departures, truck idling, truck backing, air brake release, and operation of truck-mounted refrigeration units.

The results of the loading dock noise measurements indicate that a busy hour generated an average noise level of 64 dBA L_{50} and 92 dBA L_{max} at the boundary of the truck maneuvering lanes. This analysis conservatively assumes that the proposed loading docks could operate at this level of activity continuously.

Parking Lot Circulation

The proposed project will provide parking stalls for 116 passenger vehicles. Saxelby Acoustics conservatively assumed that in a busy hour every parking stall on site could fill or empty, resulting in a peak hour movement of 116 vehicles on site. Based upon noise measurements conducted of vehicle movements in parking lots, the sound exposure level (SEL) for a single passenger vehicle is 71 dBA at a distance of 50 feet.

Saxelby Acoustics used the SoundPLAN noise model to calculate noise levels at the nearest sensitive receptors. Input data included the loading docks and parking lot noise generation, as discussed above. The project noise level contours for the nighttime (10:00 p.m. to 7:00 a.m.) median (L_{50}) and maximum (L_{max}) are shown in **Figure 3** and **Figure 4**, respectively.



Osage Warehouse

City of Sacramento, California

Figure 3

Nighttime Median Project Noise Contours (dBA L_{50})

Signs and symbols

- Parcel Boundary
- 8-Foot Wall
- Proposed Building

Levels in dB(A)

<= 45
45 - 46
46 - 47
47 - 48
48 - 49
49 - 50
\> 50

1 : 2200

0 10 20 40 60 80 m

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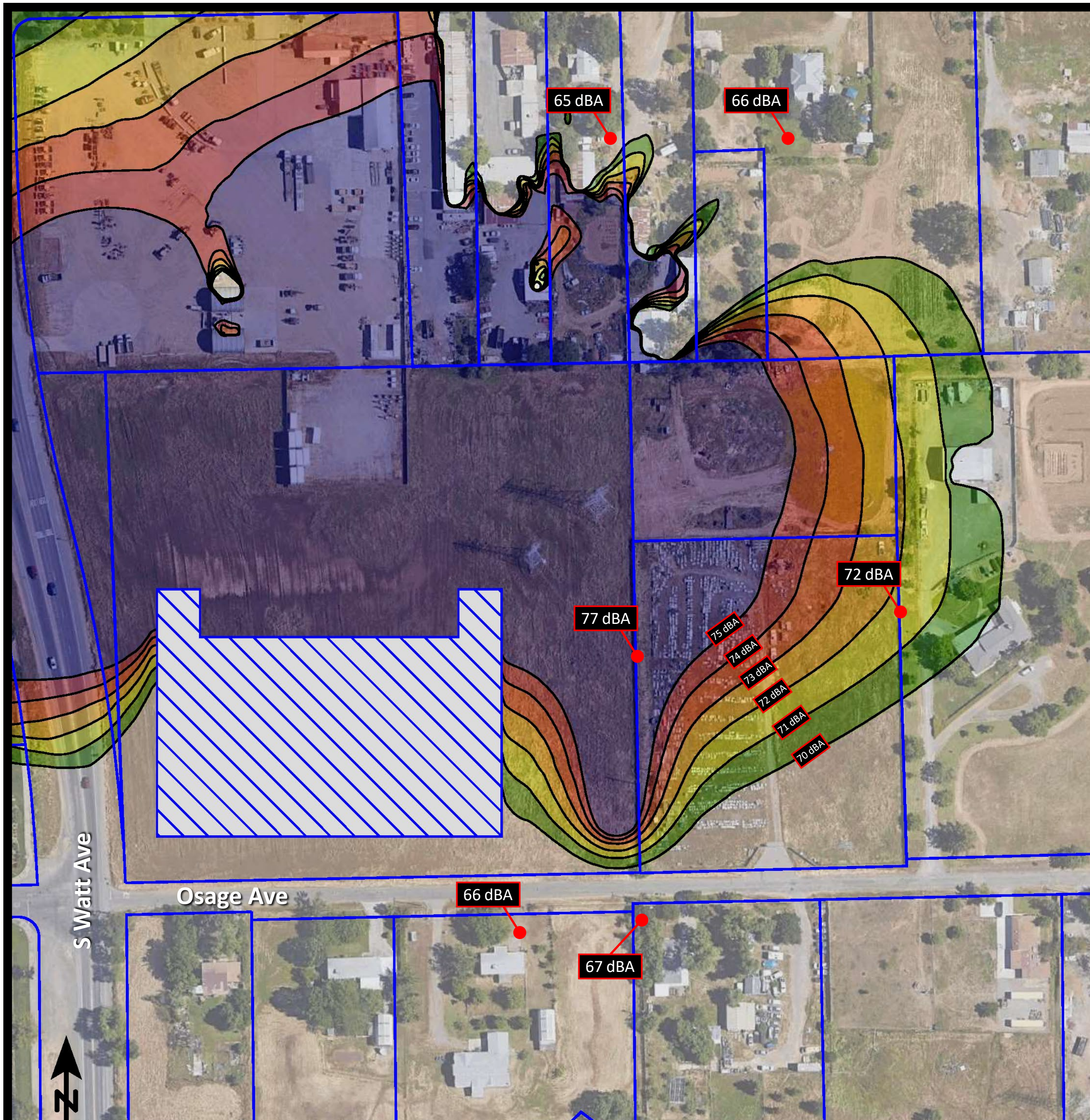
Figure 4

Nighttime Maximum Project Noise Contours (dBA L_{max})



Signs and symbols

Parcel Boundary

Proposed Building

Levels in dB(A)

	<= 70
	70 - 71
	71 - 72
	72 - 73
	73 - 74
	74 - 75
	> 75

1 : 2200

0 10 20 40 60 80 m

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CONSTRUCTION NOISE ENVIRONMENT

During the construction of the proposed project noise from construction activities would temporarily add to the noise environment in the project vicinity. As shown in **Table** Error! Reference source not found.**4**, activities involved in construction would generate maximum noise levels ranging from 76 to 90 dB at a distance of 50 feet.

TABLE 4: CONSTRUCTION EQUIPMENT NOISE

Type of Equipment	Maximum Level, dBA at 50 feet
Auger Drill Rig	84
Backhoe	78
Compactor	83
Compressor (air)	78
Concrete Saw	90
Dozer	82
Dump Truck	76
Excavator	81
Generator	81
Jackhammer	89
Pneumatic Tools	85

Source: Roadway Construction Noise Model User's Guide. Federal Highway Administration. FHWA-HEP-05-054. January 2006.

CONSTRUCTION VIBRATION ENVIRONMENT

The primary vibration-generating activities associated with the proposed project would occur during construction when activities such as grading, utilities placement, and parking lot construction occur. **Table 5** shows the typical vibration levels produced by construction equipment.

TABLE 5: VIBRATION LEVELS FOR VARIOUS CONSTRUCTION EQUIPMENT

Type of Equipment	Peak Particle Velocity at 25 feet (inches/second)	Peak Particle Velocity at 50 feet (inches/second)	Peak Particle Velocity at 100 feet (inches/second)
Large Bulldozer	0.089	0.031	0.011
Loaded Trucks	0.076	0.027	0.010
Small Bulldozer	0.003	0.001	0.000
Auger/drill Rigs	0.089	0.031	0.011
Jackhammer	0.035	0.012	0.004
Vibratory Hammer	0.070	0.025	0.009
Vibratory Compactor/roller	0.210 (Less than 0.20 at 26 feet)	0.074	0.026

Source: Transit Noise and Vibration Impact Assessment Guidelines. Federal Transit Administration. May 2006.

REGULATORY CONTEXT

FEDERAL

There are no federal regulations related to noise that apply to the Proposed Project.

STATE

There are no state regulations related to noise that apply to the Proposed Project.

LOCAL

City of Sacramento General Plan

The Noise Element of the City's General Plan identifies noise and land use compatibility standards for various land uses. The City's goal is to minimize noise impacts on human activity to ensure the health and safety of the community. **Table 6** below shows exterior noise compatibility standards for various land uses.

TABLE 6: CITY OF SACRAMENTO EXTERIOR NOISE COMPATIBILITY STANDARDS FOR VARIOUS LAND USES

Land Use Type	Highest Level of Noise Exposure that is Regarded as "Normally Acceptable"[a] (L_{dn}[b] or CNEL[c])
Residential - Low Density Single Family, Duplex, Mobile Homes	60 dBA[d,e]
Residential – Multi-family	65 dBA
Urban Residential Infill[f] and Mixed-Use Projects[g]	70 dBA
Transient Lodging – Motels, Hotels	65 dBA
Schools, Libraries, Churches, Hospitals, Nursing Homes	70 dBA
Auditoriums, Concert Halls, Amphitheaters	Mitigation based on site-specific study
Sports Arena, Outdoor Spectator Sports	Mitigation based on site-specific study
Playgrounds, Neighborhood Parks	70 dBA
Golf Courses, Riding Stables, Water Recreation, Cemeteries	75 dBA
Office Buildings – Business, Commercial and Professional	70 dBA
Industrial, Manufacturing, Utilities, Agriculture	75 dBA

Source: Governor's Office of Planning and Research, *State of California General Plan Guidelines 2003,* October 2003

a. As defined in the Guidelines, "Normally Acceptable" means that the "specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements."

b. L_{dn} of Day Night Average Level is an average 24-hour noise measurement that factors in day and night noise levels.

c. CNEL or Community Noise Equivalent Level measurements are a weighted average of sound levels gathered throughout a 24-hour period.

d. dBA or A-weighted decibel scale is a measurement of noise levels.

e. The exterior noise standard for the residential area west of McClellan Airport known as McClellan Heights/Parker Homes is 65 dBA.

f. With land use designations of Central business District, Urban Neighborhood (Low, Medium, or High) Urban Center (Low or High), Urban Corridor (Low or High).

g. All mixed-use projects located anywhere in the City of Sacramento.

City of Sacramento Municipal Code

The City of Sacramento Municipal Code, Section 8.68.060 establishes and allowable exterior noise level limit of 55 dBA L_{50} and 75 dBA L_{max} during daytime (7:00 a.m. to 10:00 p.m.) hours and 50 dBA L_{50} and 70 dBA L_{max} during nighttime (10:00 p.m. to 7:00 a.m.) for sources of noise which occur for more than 30 minutes per hour (L_{50}).

If the existing ambient noise level exceeds the 50/55 dBA L_{50} standard the allowable limit is increased in five dBA increments to encompass the ambient noise level. If the existing ambient noise level exceeds the 70/75 dBA L_{max} noise standard, the limit becomes the measured L_{max} existing ambient noise level. For example, if measured existing ambient daytime noise levels are 57 dBA L_{50} and 77 dBA L_{max}, the noise ordinance limits would be 60 dBA L_{50} and 77 dBA L_{max}.

The City of Sacramento Municipal Code standards are summarized in **Table 7** below.

TABLE 7: STATIONARY NOISE SOURCE NOISE STANDARDS

Noise Level Descriptor	Outdoor Activity Areas Daytime (7 a.m. to 10 p.m.)	Outdoor Activity Areas Nighttime (10 p.m. to 7 a.m.)
Hourly equivalent sound level (L_{50}), dB	55	50
Maximum sound level (L_{max}), dB	75	70

Source: City of Sacramento Municipal Code

County of Sacramento General Plan

The County of Sacramento General Plan Noise Element Table 2 (listed in **Table 3** below) establishes an acceptable exterior noise level of 55 dBA L_{50} for daytime (7:00 a.m. to 10:00 p.m.) and 50 dBA L_{50} for nighttime (10:00 p.m. to 7:00 a.m.) for non-transportation noise sources. The standards are reduced by 5 dB for sounds consisting primarily of speech or music, such as a speaker in a drive-thru.

TABLE 8: SACRAMENTO COUNTY GENERAL PLAN NON-TRANSPORTATION NOISE STANDARDS

	Outdoor Area[2]		Interior[3]	
Receiving Land Use	**Daytime**	**Nighttime**	**Interior Day & Night**	**Notes**
All Residential	55 / 75	50 / 70	35 / 55	
Transient Lodging	55 / 75	-----	35 / 55	4
Hospitals & Nursing Home	55 / 75	-----	35 / 55	5, 6
Theaters & Auditoriums	-----	-----	30 / 50	6
Churches, Meeting Halls, Schools, Libraries, etc.	55 / 75	-----	35 / 60	6
Office Buildings	60 / 75	-----	45 / 65	6
Commercial Buildings	-----	-----	45 / 65	6
Playgrounds, Parks, etc.	60 / 75	-----	-----	6
Industry	60 / 80	-----	50 / 70	6

Notes:

1. The Table 2 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table 2, then the noise level standards shall be increased at 5 dB increments to encompass theambient.
2. Sensitive areas are defined acoustic terminology section.
3. Interior noise level standards are applied within noise-sensitive areas of the various land uses, with windows and doors in the closed positions.
4. Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.
5. Hospitals are often noise-generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff orpatients.
6. The outdoor activity areas of these uses (if any), are not typically utilized during nighttime hours.
7. Where median (L50) noise level data is not available for a particular noise source, average (Leq) values may be substituted for the standards of this table provided the noise source in question operates for at least 30 minutes of an hour. If the source in question operates less than 30 minutes per hour, then the maximum noise level standards shown wouldapply.
8.

Source: Sacramento County General Plan Noise Element, 2011. Accessed November, 2019.

County of Sacramento Noise Ordinance

The County of Sacramento Noise Ordinance provides an exterior noise level standard of 55 dBA L_{50} for daytime (7:00 a.m. to 10:00 p.m.) and an exterior noise level standard of 50 dBA L_{50} for nighttime (10:00 p.m. to 7:00 a.m.) for residential areas. These levels are shown in **Table 4**.

If the noise source includes speech, such as from a drive-thru lane, the levels in **Table 4** are to be reduced by 5 dBA. Additionally, if the ambient noise level exceeds the permitted noise level in any of the noise level categories specified in the subdivision, the allowable noise limit shall be increased by 5 dBA increments in each category to encompass the ambient noise level.

TABLE 9: SACRAMENTO COUNTY NOISE ORDINANCE

Cumulative Duration of the Intrusive Noise	Exterior Noise Level, dB	
	Daytime	Nighttime
30 minutes per hour	55	50
15 minutes per hour	60	55
5 minutes per hour	65	60
1 minute per hour	70	65
Level not to exceed for any time per hour	75	70

Source: County of Sacramento Noise Ordinance.

Summary of Relevant Noise Level Criteria

The City of Sacramento and the County of Sacramento General Plan/Noise Ordinance share similar noise level standards for "Stationary" (non-transportation) noise sources. The project, which shall be considered to be a "Stationary" noise source, shall not be permitted to generate noise levels exceeding 55 dBA L_{50} or 75 dBA L_{max} during daytime (7:00 a.m. to 10:00 p.m.) hours and 50 dBA L_{50} or 70 dBA L_{max} during nighttime (10:00 p.m. to 7:00 a.m.) hours at the adjacent residential uses.

Criteria for Acceptable 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 in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of an amplitude and frequency. A person's perception to the vibration will depend on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating.

Vibration can be measured in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities in inches per second. Standards pertaining to perception as well as damage to structures have been developed for vibration levels defined in terms of peak particle velocities.

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. **Table 8**, which was developed by Caltrans, shows the vibration levels which would normally be required to result in damage to structures. The vibration levels are presented in terms of peak particle velocity in inches per second.

TABLE 10: EFFECTS OF VIBRATION ON PEOPLE AND BUILDINGS

Peak Particle Velocity		Human Reaction	Effect on Buildings
mm/second	in/second		
0.15-0.30	0.006-0.019	Threshold of perception; possibility of intrusion	Vibrations unlikely to cause damage of any type
2.0	0.08	Vibrations readily perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
2.5	0.10	Level at which continuous vibrations begin to annoy people	Virtually no risk of “architectural” damage to normal buildings
5.0	0.20	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relative short periods of vibrations)	Threshold at which there is a risk of “architectural” damage to normal dwelling - houses with plastered walls and ceilings. Special types of finish such as lining of walls, flexible ceiling treatment, etc., would minimize “architectural” damage
10-15	0.4-0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause “architectural” dam age and possibly minor structural damage

Source: Transportation Related Earthborne Vibrations. Caltrans. TAV-02-01-R9601. February 20, 2002.

IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

Appendix G of the CEQA Guidelines states that a project would normally be considered to result in significant noise impacts if noise levels conflict with adopted environmental standards or plans or if noise generated by the project would substantially increase existing noise levels at sensitive receivers on a permanent or temporary basis. Significance criteria for noise impacts are drawn from CEQA Guidelines Appendix G (Items XI [a-f]).

Would the project:

a. Generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b. Generate excessive groundborne vibration or groundborne noise levels?

c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Noise Level Increase Criteria for Long-Term Project-Related Noise Level Increases

The City of Sacramento General Plan Noise Element specifies criteria for determination of significant noise impacts in Table EC 2, which is reproduced in **Table 9** below.

TABLE 11: EXTERIOR INCREMENTAL NOISE IMPACT STANDARDS FOR NOISE-SENSITIVE USES (DBA)

Residences and buildings where people normally sleep[a]		Institutional land uses with primarily daytime and evening uses[b]	
Existing L_{dn}	Allowable Noise Increment	Existing Peak Hour L_{eq}	Allowable Noise Increment
45	8	45	12
50	5	50	9
55	3	55	6
60	2	60	5
65	1	65	3
70	1	70	3
75	0	75	1
80	0	80	0

Source: Federal Transit Administration, Transit Noise Impact and Vibration Assessment, May 2006

a. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.

b. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

Based on **Table 9**, an increase in the traffic noise level of 1 dB or more would be significant where the pre-project noise levels are less than 75 dB L_{dn}, or 2 dB or more where existing noise levels are less than 65 dB L_{dn}. Extending this concept to lower noise levels, an increase in the traffic noise level of 3 dB or more may be significant where the pre-project traffic noise level is less than 60 dB L_{dn}. The rationale for the **Table 9** criteria is that as ambient noise levels increase, a smaller increase in noise resulting from a project is sufficient to cause annoyance.

Project-Specific Impacts and Mitigation Measures

Impact 1: Would the project generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Traffic Noise Increases at Off-Site Receptors

The City of Sacramento General Plan Noise Element specifies criteria to determine the significance of traffic noise impacts. An increase in the traffic noise level of 1 dB or more would be significant where the pre-project noise levels are less than 75 dB L_{dn}, or 2 dB or more where existing noise levels are less than 65 dB L_{dn}.

According to **Table 3**, the maximum noise level increase along Osage Avenue is predicted to be 1.4 dBA L_{dn} near the project driveway. For this roadway segment, the existing ambient noise level at the nearest sensitive receptor is 60.0 dBA which is less than the 2 dB significant increase criterion. The highest ambient noise level of 67.4 dBA occurs directly adjacent to South Watt Avenue. The noise level increase along this segment is predicted to be 0.5 dBA which is less than the 1 dB significant increase criterion.

Therefore, impacts resulting from increased traffic noise would be considered ***less-than-significant***.

Operational Noise at Sensitive Receptors

The City of Sacramento and County of Sacramento noise level standards require that new projects in the vicinity of existing sensitive receptors generate noise levels no greater than 55 dBA L_{50} and 75 dBA L_{max} during daytime (7:00 a.m. to 10:00 p.m.) hours and 50 dBA L_{50} and 70 dBA L_{max} during nighttime (10:00 p.m. to 7:00 a.m.) hours.

As shown on **Figure 3,** the proposed project is predicted to comply with the City's daytime and nighttime (10:00 p.m. to 7:00 a.m.) L_{50} noise level standards without any additional noise control measures. However, the project will exceed the City's nighttime L_{max} standard. Therefore, impacts resulting from operational noise would be considered potentially significant and mitigation would be required.

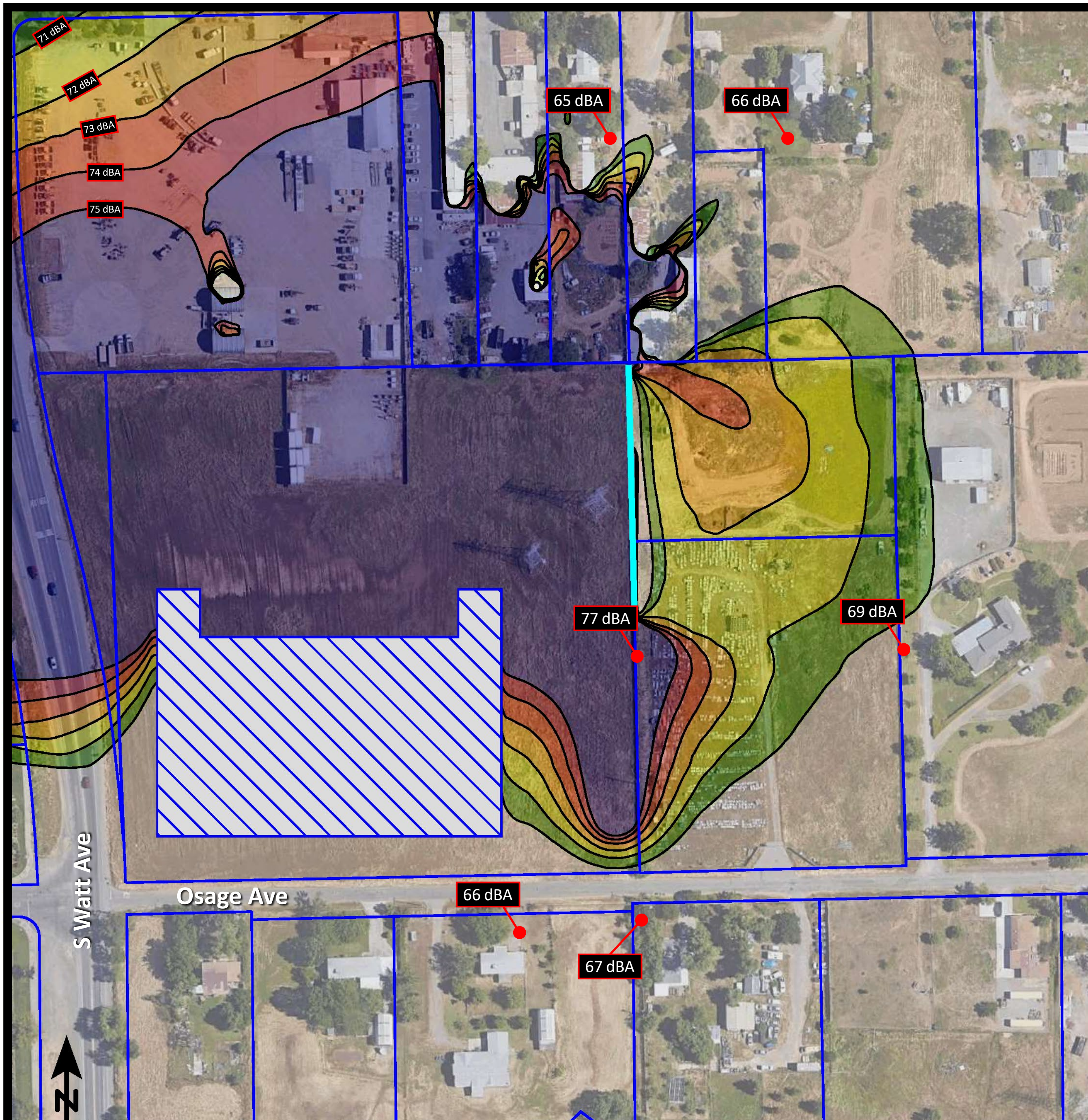
Saxelby Acoustics recommends the construction of an 8-foot-tall sound wall to reduce the maximum noise levels emanating from the project site. The wall location and resulting contours are shown on **Figure 5.** Implementation of this mitigation measure would reduce operational noise impacts to ***less-than-significant.***

Construction Noise

The noise increase during construction would be of short duration, and would likely occur primarily during daytime hours. The City of Sacramento's Noise Ordinance of the Municipal Code exempts construction activities from the noise standards, provided that construction takes place between the hours of 7:00 AM and 6:00 PM Monday through Saturday and 9:00 AM and 6:00 PM Sundays and holidays. Although the construction activities could result in infrequent periods of high noise, the construction noise would not be sustained and would only occur only during the City's permitted construction noise hours. In addition, construction noise was previously addressed in the 2001 IS/MND and the construction of the proposed project would be consistent with the type and intensity of development anticipated for the project site within the 2001 IS/MND. As a result, the proposed project would note result in noise levels during construction beyond what has been anticipated in the 2001 IS/MND, which concluded that noise impacts related to construction would be **less-than-significant**.

This is a **less-than-significant** impact, and no mitigation is required.

MM1: An 8-foot-tall sound wall shall be constructed along the eastern project boundary in order to achieve the City's exterior noise standards. Noise barrier walls shall be constructed of concrete panels, concrete masonry units, earthen berms, or any combination of these materials that achieve the required total height. Wood is not recommended due to eventual warping and degradation of acoustical performance. These requirements shall be included in the improvements plans prior to their approval by the City's Public Works Department. **Figure 5** shows the recommended sound wall location.



Osage Warehouse

City of Sacramento, California

Figure 5

Nighttime Maximum Project Noise Contours – Noise Protection (dBA L_{max})

Signs and symbols

- Parcel Boundary
- 8-Foot Wall
- Proposed Building

Levels in dB(A)

<= 70
70 - 71
71 - 72
72 - 73
73 - 74
74 - 75
> 75

1 : 2200

0 10 20 40 60 80 m

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Impact 2: ***Would the project generate excessive groundborne vibration or groundborne noise levels?***

Construction vibration impacts include human annoyance and building structural damage. Human annoyance occurs when construction vibration rises significantly above the threshold of perception. Building damage can take the form of cosmetic or structural.

The **Table 5** data indicate that construction vibration levels anticipated for the project are less than the 0.2 in/sec threshold at distances of 26 feet. Sensitive receptors which could be impacted by construction related vibrations, especially vibratory compactors/rollers, are located approximately 80 feet, or further, from typical construction activities. At these distances construction vibrations are not predicted to exceed acceptable levels. Additionally, construction activities would be temporary in nature and would likely occur during normal daytime working hours.

This is a **less-than-significant** impact and no mitigation is required.

Impact 3: ***For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?***

There are no projects within 2 miles of the project site. Therefore, this impact is not applicable to the proposed project.

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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.
ASTC	Apparent Sound Transmission Class. Similar to STC but includes sound from flanking paths and correct for room reverberation. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic.
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 +5 dBA and nighttime hours weighted by +10 dBA.
DNL	See definition of Ldn.
IIC	Impact Insulation Class. An integer-number rating of how well a building floor attenuates impact sounds, such as footsteps. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz).
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
L(n)	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L50 is the sound level exceeded 50% of the time during the one-hour period.
Loudness	A subjective term for the sensation of the magnitude of sound.
NIC	Noise Isolation Class. A rating of the noise reduction between two spaces. Similar to STC but includes sound from flanking paths and no correction for room reverberation.
NNIC	Normalized Noise Isolation Class. Similar to NIC but includes a correction for room reverberation.
Noise	Unwanted sound.
NRC	Noise Reduction Coefficient. NRC is a single-number rating of the sound-absorption of a material equal to the arithmetic mean of the sound-absorption coefficients in the 250, 500, 1000, and 2,000 Hz octave frequency bands rounded to the nearest multiple of 0.05. It is a representation of the amount of sound energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption.
RT60	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 Sabin.
SEL	Sound Exposure Level. SEL is a rating, in decibels, of a discrete event, such as an aircraft flyover or train pass by, that compresses the total sound energy into a one-second event.
SPC	Speech Privacy Class. SPC is a method of rating speech privacy in buildings. It is designed to measure the degree of speech privacy provided by a closed room, indicating the degree to which conversations occurring within are kept private from listeners outside the room.
STC	Sound Transmission Class. STC is an integer rating of how well a building partition attenuates airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations. The STC rating is typically used to rate the sound transmission of a specific building element when tested in laboratory conditions where flanking paths around the assembly don't exist. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.
Impulsive	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
Simple Tone	Any sound which can be judged as audible as a single pitch or set of single pitches.

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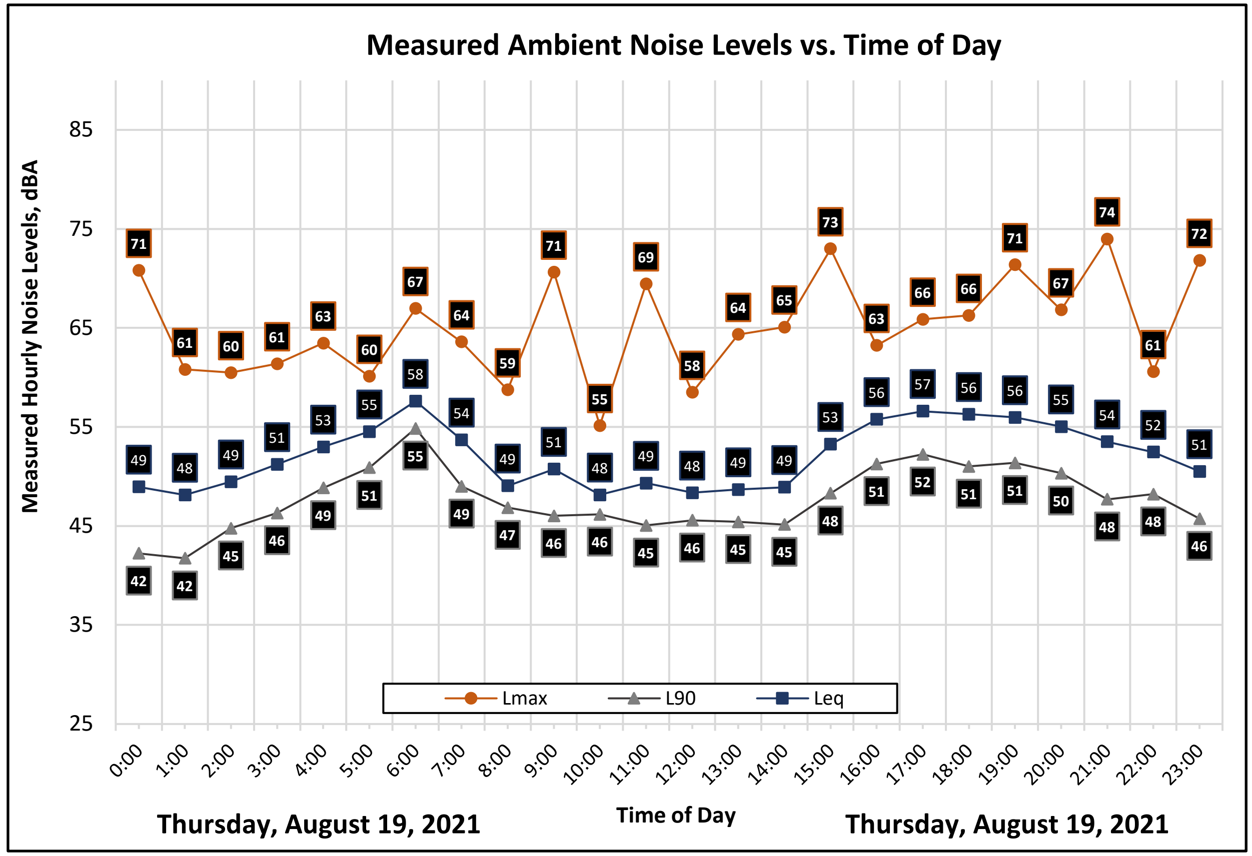
Appendix B: Continuous and Short-Term Ambient Noise Measurement Results

Appendix B1: Continuous Noise Monitoring Results

Site: LT-1
Project: Osage Avenue Warehouse
Location: Northeastern Project Corner
Coordinates: 38.5232982°, -121.3674273°
Meter: LDL 820-1
Calibrator: CAL200

Date	Time	Measured Level, dBA			
		L_{eq}	L_{max}	L_{50}	L_{90}
Thursday, August 19, 2021	0:00	49	71	46	42
Thursday, August 19, 2021	1:00	48	61	46	42
Thursday, August 19, 2021	2:00	49	60	48	45
Thursday, August 19, 2021	3:00	51	61	50	46
Thursday, August 19, 2021	4:00	53	63	53	49
Thursday, August 19, 2021	5:00	55	60	54	51
Thursday, August 19, 2021	6:00	58	67	57	55
Thursday, August 19, 2021	7:00	54	64	52	49
Thursday, August 19, 2021	8:00	49	59	49	47
Thursday, August 19, 2021	9:00	51	71	48	46
Thursday, August 19, 2021	10:00	48	55	48	46
Thursday, August 19, 2021	11:00	49	69	47	45
Thursday, August 19, 2021	12:00	48	58	48	46
Thursday, August 19, 2021	13:00	49	64	47	45
Thursday, August 19, 2021	14:00	49	65	48	45
Thursday, August 19, 2021	15:00	53	73	52	48
Thursday, August 19, 2021	16:00	56	63	55	51
Thursday, August 19, 2021	17:00	57	66	56	52
Thursday, August 19, 2021	18:00	56	66	56	51
Thursday, August 19, 2021	19:00	56	71	55	51
Thursday, August 19, 2021	20:00	55	67	54	50
Thursday, August 19, 2021	21:00	54	74	52	48
Thursday, August 19, 2021	22:00	52	61	52	48
Thursday, August 19, 2021	23:00	51	72	49	46

Statistics	Leq	Lmax	L50	L90
Day Average	53	66	51	48
Night Average	53	64	51	47
Day Low	48	55	47	45
Day High	57	74	56	52
Night Low	48	60	46	42
Night High	58	72	57	55
Ldn	59	Day %		68
CNEL	59	Night %		32



Appendix B1: Continuous Noise Monitoring Results

Site: LT-2

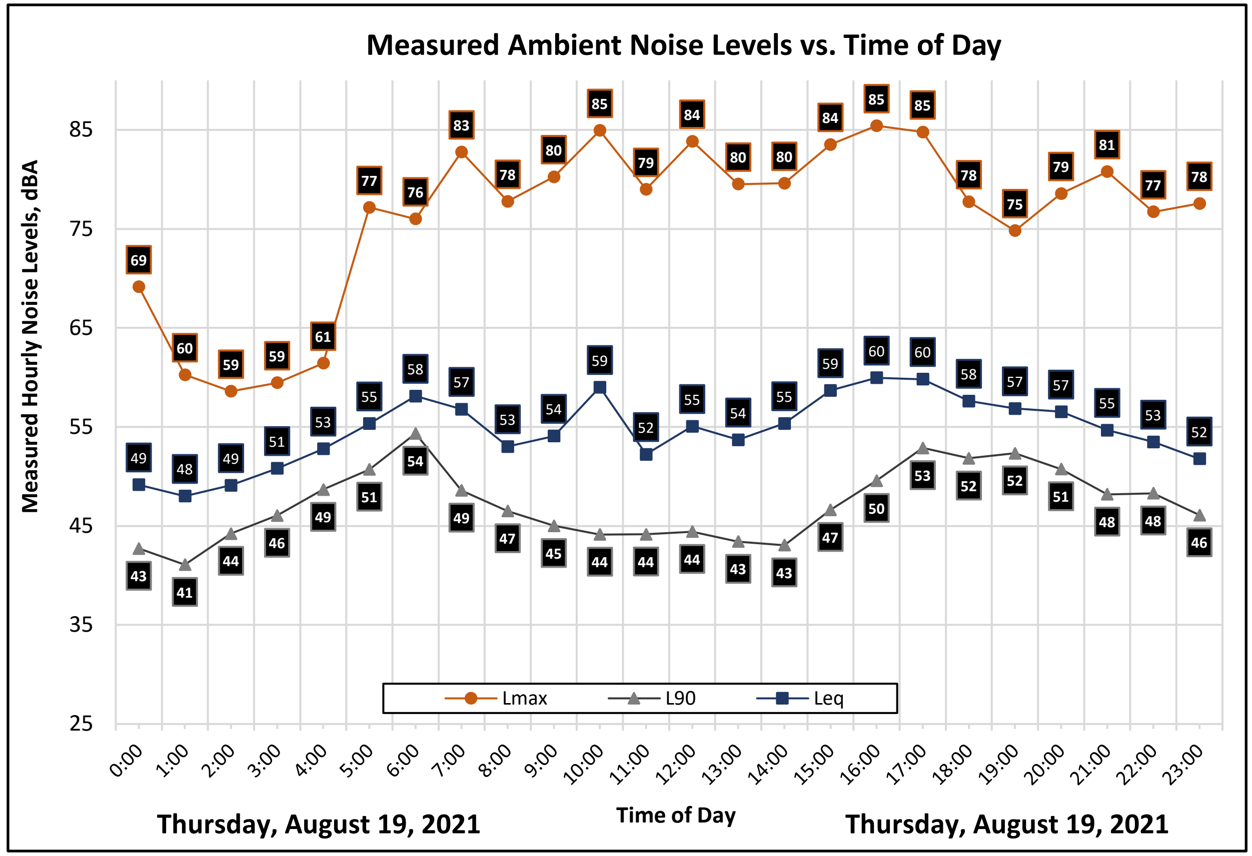
Project: Osage Avenue Warehouse | Meter: LDL 820-2

Location: Southeastern Project Corner | Calibrator: CAL200

Coordinates: 38.5221596°, -121.3674102°

Date	Time	Measured Level, dBA			
		L_{eq}	L_{max}	L_{50}	L_{90}
Thursday, August 19, 2021	0:00	49	69	47	43
Thursday, August 19, 2021	1:00	48	60	46	41
Thursday, August 19, 2021	2:00	49	59	48	44
Thursday, August 19, 2021	3:00	51	59	50	46
Thursday, August 19, 2021	4:00	53	61	52	49
Thursday, August 19, 2021	5:00	55	77	54	51
Thursday, August 19, 2021	6:00	58	76	57	54
Thursday, August 19, 2021	7:00	57	83	52	49
Thursday, August 19, 2021	8:00	53	78	48	47
Thursday, August 19, 2021	9:00	54	80	47	45
Thursday, August 19, 2021	10:00	59	85	46	44
Thursday, August 19, 2021	11:00	52	79	47	44
Thursday, August 19, 2021	12:00	55	84	47	44
Thursday, August 19, 2021	13:00	54	80	46	43
Thursday, August 19, 2021	14:00	55	80	46	43
Thursday, August 19, 2021	15:00	59	84	50	47
Thursday, August 19, 2021	16:00	60	85	55	50
Thursday, August 19, 2021	17:00	60	85	57	53
Thursday, August 19, 2021	18:00	58	78	56	52
Thursday, August 19, 2021	19:00	57	75	56	52
Thursday, August 19, 2021	20:00	57	79	54	51
Thursday, August 19, 2021	21:00	55	81	52	48
Thursday, August 19, 2021	22:00	53	77	52	48
Thursday, August 19, 2021	23:00	52	78	49	46

Statistics	Leq	Lmax	L50	L90
Day Average	57	81	51	47
Night Average	53	68	51	47
Day Low	52	75	46	43
Day High	60	85	57	53
Night Low	48	59	46	41
Night High	58	78	57	54
Ldn	60	Day %		81
CNEL	60	Night %		19



Appendix B3 : Short Term Noise Monitoring Results

Site: ST-1
Project: Osage Warehouse
Location: South-East of Project Site
Coordinates: 38.5221380°, -121.3693467°
Meter: LDL 831-3
Calibrator: CAL200

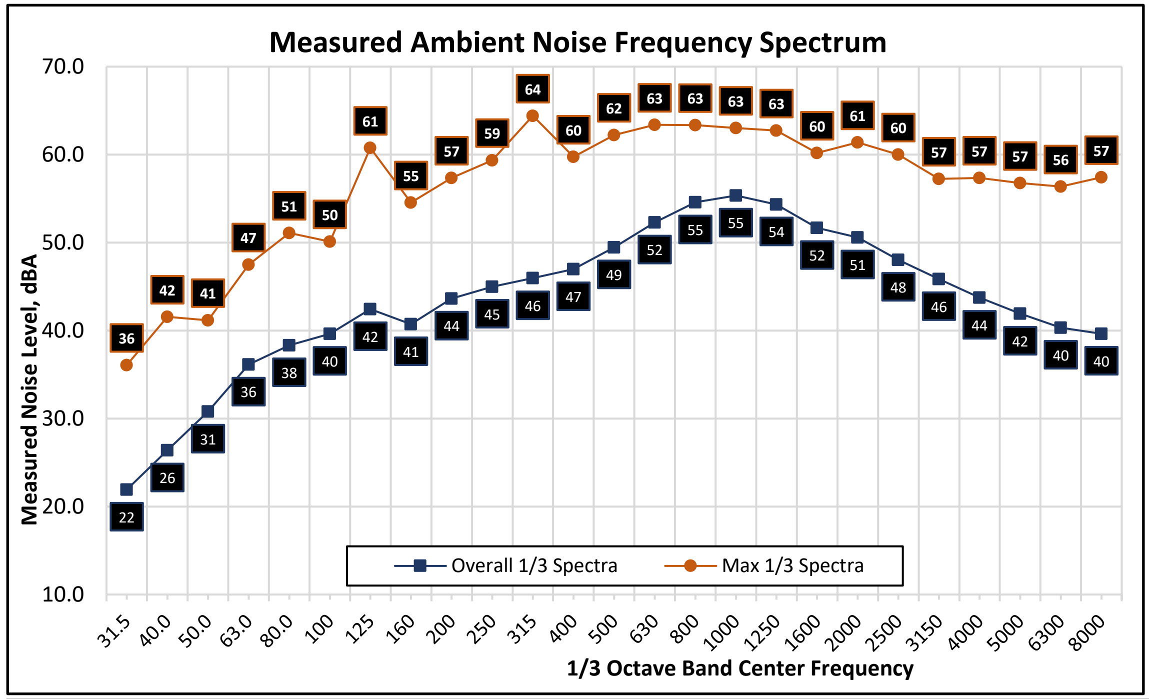
Start: 2021-08-20 09:40:32
Stop: 2021-08-20 09:50:32
SLM: Model 831
Serial: 1329

Measurement Results, dBA

Duration:	0:10
L_{eq}:	62
L_{max}:	72
L_{min}:	48
L_{50}:	61
L_{90}:	54

Notes

Primary noise sources include traffic eminating from South Watt Avenue



Appendix B4 : Short Term Noise Monitoring Results

Site: ST-2
Project: Osage Warehouse
Location: South-East of Project Site
Coordinates: 38.5221249°, -121.3660409°

Meter: LDL 831-3
Calibrator: CAL200

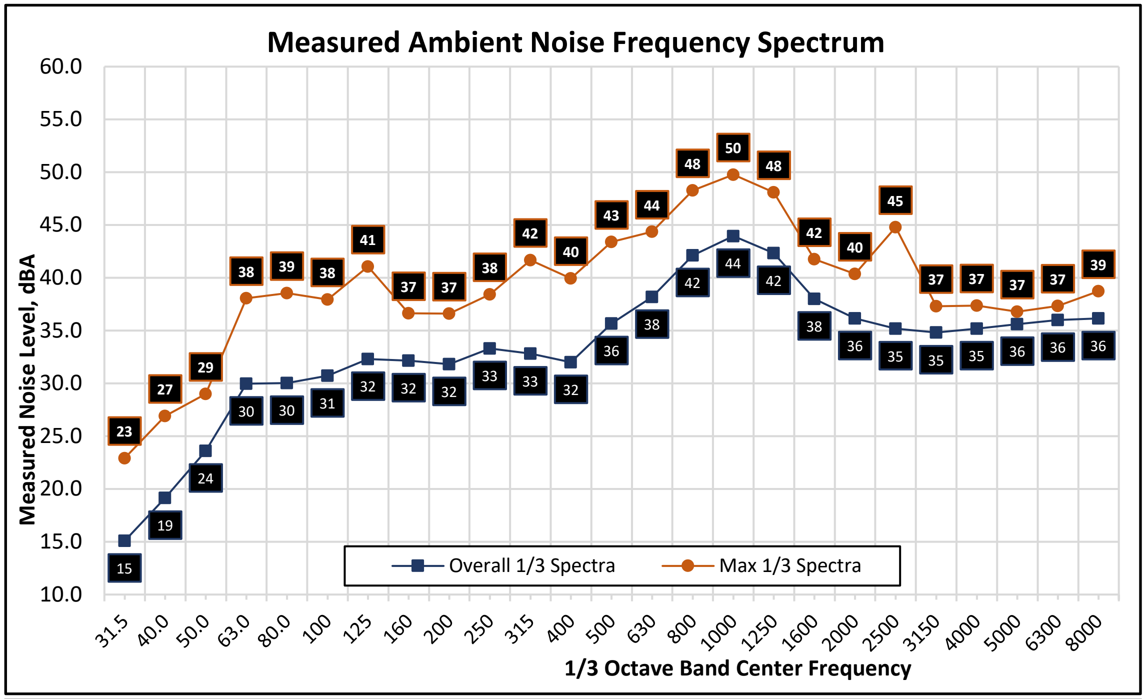
Start: 2021-08-20 10:01:51
Stop: 2021-08-20 10:09:46
SLM: Model 831
Serial: 1329

Measurement Results, dBA

Duration:	0:07
L_{eq}:	50
L_{max}:	54
L_{min}:	45
L_{50}:	49
L_{90}:	47

Notes

Primary noise sources include traffic from South Watt Avenue.



Appendix C: Traffic Noise Calculation Inputs and Results

Appendix C-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Project #: 210802

Description: Osage Warehouse - Existing Traffic

Ldn/CNEL: Ldn

Hard/Soft: Soft

Segment	Roadway	Segment	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)	Contours (ft.) - No Offset 60 dBA	65 dBA	70 dBA	Level, dBA
1	Osage	East of S Watt Ave	440	81	0	19	1.0%	0.5%	25	120	-5	8	4	2	37.0
2	Osage	West of Project Driveway 1	440	81	0	19	1.0%	0.5%	25	120	-5	8	4	2	37.0
3	Osage	West of Project Driveway 2	440	81	0	19	1.0%	0.5%	25	120	-5	8	4	2	37.0
6	S Watt	1	20,000	81	0	19	2.0%	4.0%	60	160	0	500	232	108	67.4
7	S Watt	2	20,000	81	0	19	2.0%	4.0%	60	340	0	500	232	108	62.5
8	S Watt	3	20,000	81	0	19	2.0%	4.0%	60	500	0	500	232	108	60.0

Appendix C-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Project #: 210802

Description: Osage Warehouse - Existing Plus Project Traffic

Ldn/CNEL: Ldn

Hard/Soft: Soft

Segment	Roadway	Segment	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)	Contours (ft.) - No Offset			Level, dBA
												60 dBA	65 dBA	70 dBA	
1	Osage	East of S Watt Ave	1,740	81	0	19	1.0%	6.5%	25	120	0	49	23	11	54.2
2	Osage	West of Project Driveway 1	1,740	81	0	19	1.0%	6.5%	25	120	0	49	23	11	54.2
3	Osage	West of Project Driveway 2	960	81	0	19	1.0%	54.2%	25	120	0	123	57	26	60.2
6	S Watt	1	21,300	81	0	19	2.0%	4.0%	60	160	0	521	242	112	67.7
7	S Watt	2	21,300	81	0	19	2.0%	4.0%	60	340	-1	521	242	112	61.8
8	S Watt	3	21,300	81	0	19	2.0%	4.0%	60	500	-5	521	242	112	55.3