SENTER ROAD OFFICE PROJECT NOISE AND VIBRATION ASSESSMENT

San José, California

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Prepared for:

Shannon George
Senior Project Manager
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Emilie To and
Michael S. Thill

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
1 Willowbrook Court, Suite 120
Petaluma, CA 94954
(707) 794-0400

Project: 16-171

INTRODUCTION

An office development has been proposed on the southwest side of Senter Road, between Phelan Avenue and Burke Street, in San José, California. The project proposes to develop a two-story office building (up to a height of 33 feet) and a surface parking lot adjacent to an existing 50,360 square foot office building located at 1919 Senter Road. The first floor of the office building would be approximately 25,113 square feet and the second floor of the office building would be approximately 24,740 square feet, with a combined total of 49,853 square feet.

Currently, the 2.69-acre project site is undeveloped. This project site is designated as *Heavy Industrial* under the City's General Plan and is zoned *A(PD) – Planned Development*. The *Heavy Industrial* designation is intended for industrial users with nuisance or hazardous characteristics which for reasons of health, safety, environmental effects, or welfare are best segregated from other uses. Because of the limited supply of land available for heavy industrial uses, the Land Use Policies in the *Envision San José 2040 General Plan* restrict land use changes in areas reserved exclusively for industrial uses. *The Heavy Industrial* designation allows for a floor area ratio (FAR) up to 1.5 and building heights up to three stories. The *A(PD) – Planned Development* zoning designation is intended to meet the needs of the territory zoned. The uses and requirements of the district shall be reflected in the general development plan. While proposed as a commercial building, the building would be initially occupied by the Santa Clara County Administrative and Support Services. The proposed project would require a rezoning and conditional use permit.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency Section discusses noise and land use compatibility utilizing policies in the City's General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

SETTING

Fundamentals of Environmental Noise

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

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

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

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

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

Fundamentals of Ground-borne Vibration

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

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

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

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

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

TABLE 1 Definition of Acoustical Terms Used in this Report

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

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

TABLE 2 Typical Noise Levels in the Environment

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

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

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

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

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

Regulatory Background - Noise

The State of California and the City of San José have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

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

(b) Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels;

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

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

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

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the DNL noise level resulting from the project at noise sensitive land uses of 3 dBA or greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use. An increase of 5 dBA DNL or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

2013 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2010 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). These standards were not altered in the 2013 revisions, and the sections that pertain to this project are as follows:

5.507.4.1 Exterior noise transmission, prescriptive method. Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA DNL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.

5.507.4.2 Performance method. For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal of minimizing the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies in the City of San José. The following policies are applicable to the proposed project:

EC-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state and City noise standards and guidelines as a part of new development review.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA)) 55	60	65	70	75	80
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]						
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds						
3. Schools, Libraries, Museums, Meeting Halls, Churches						
4. Office Buildings, Business Commercial, and Professional Offices						
5. Sports Arena, Outdoor Spectator Sports						
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters						

[1]Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

- Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3, and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable"; or
- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level.

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

City of San José Municipal Code. The City's Municipal Code contains a Zoning Ordinance that limits noise levels at adjacent properties. Chapter 20.30.700 states that sound pressure levels generated by any use or combination of uses on a property shall not exceed 55 dBA at any property line shared with land zoned for residential use, except upon issuance and in compliance with a Conditional Use Permit. Chapter 20.50.300 states the sound pressure level generated by any use or combination of uses shall not exceed 70 dBA at any property line shared with land zoned for industrial use, except upon issuance and in compliance with a Conditional Use Permit.

Chapter 20.100.450 of the Municipal Code establishes allowable hours of construction within 500 feet of a residential unit between 7:00 am and 7:00 pm Monday through Friday unless permission is granted with a development permit or other planning approval. No construction activities are permitted on the weekends at sites within 500 feet of a residence.

Regulatory Background – Vibration

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of San José. The following policies are applicable to the proposed project:

EC-2.3 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

Existing Noise Environment

The project site is located west of Senter Road between Phelan Avenue and Burke Street in San José, California. Senter Road is a six-lane road with a posted speed limit of 40 miles per hour. Existing commercial land uses are located northwest of the project site, along Senter Road. To the northeast, opposite Senter Road, there are multi-family residential buildings mixed with commercial land uses. Business and commercial offices are located to the southeast. Bordering the project's southwestern boundary is the parking lot of the Santa Clara Social Services building.

A noise monitoring survey was performed in the project vicinity beginning Thursday, November 3, 2016 and concluding on Monday, November 7, 2016. The monitoring survey included one long-term (LT-1) noise measurement and four short-term (ST-1 through ST-4) noise measurements. All measurement locations are shown in Figure 1. The existing noise environment at the project site results primarily from vehicular traffic on Senter Road.

Long-term noise measurement LT-1 was made along Senter Road, approximately 82 feet east of the centerline. Hourly average noise levels at this location typically ranged from 61 to 76 dBA L_{eq} during the day, and from 53 to 69 dBA L_{eq} at night. The day-night average noise level from Thursday, November 3, 2016 through Monday, November 7, 2016 ranged from 68 to 72 dBA DNL. The daily trend in noise levels at LT-1 is shown in Figures 2 through 6. Apart from isolated events such as loud vehicular passbys or local activities, the acoustic environment at LT-1 was dominated by traffic on Senter Road.

Each of the short-term noise measurements were taken around the perimeter of the project site, as shown in Figure 1. The short-term noise measurements were made over periods of ten-minutes, concurrent with the long-term noise data, on Monday, November 7, 2016 between 1:50 p.m. and 3:10 p.m. All short-term measurements are summarized in Table 4.

ST-1 was taken at the southwest boundary line of the project site, adjacent to the southeast corner of the parking lot of the Santa Clara Social Services building. The ten-minute average noise level measured at ST-1 was 52 dBA $L_{eq(10\text{-}min)}$, and the estimated day-night average noise

level at ST-1 was 55 dBA DNL. ST-2 was made at the boundary line facing Senter Road, approximately 75 feet west of the centerline. The ten-minute average noise level measured at ST-2 was 70 dBA $L_{eq(10\text{-}min)}$, and the estimated day-night average noise level at that location was 72 dBA DNL. ST-3 was made along the shared property line of the project site and the mixed-used building located south of the project site. ST-3 was approximately 152 feet west from the centerline of Senter Road. The ten-minute average noise level measured at ST-3 was 59 dBA $L_{eq(10\text{-}min)}$, and the estimated day-night average noise level was 61 dBA DNL. ST-4 was made at the front of the northeast multi-family residential complex facing Senter Road, approximately 88 feet from the centerline. The ten-minute average noise level measured at ST-4 was 68 dBA $L_{eq(10\text{-}min)}$, and the estimated day-night average noise level was 66 dBA DNL.

FIGURE 1 Noise Measurement Locations

Source: Google Earth 2016.

FIGURE 2

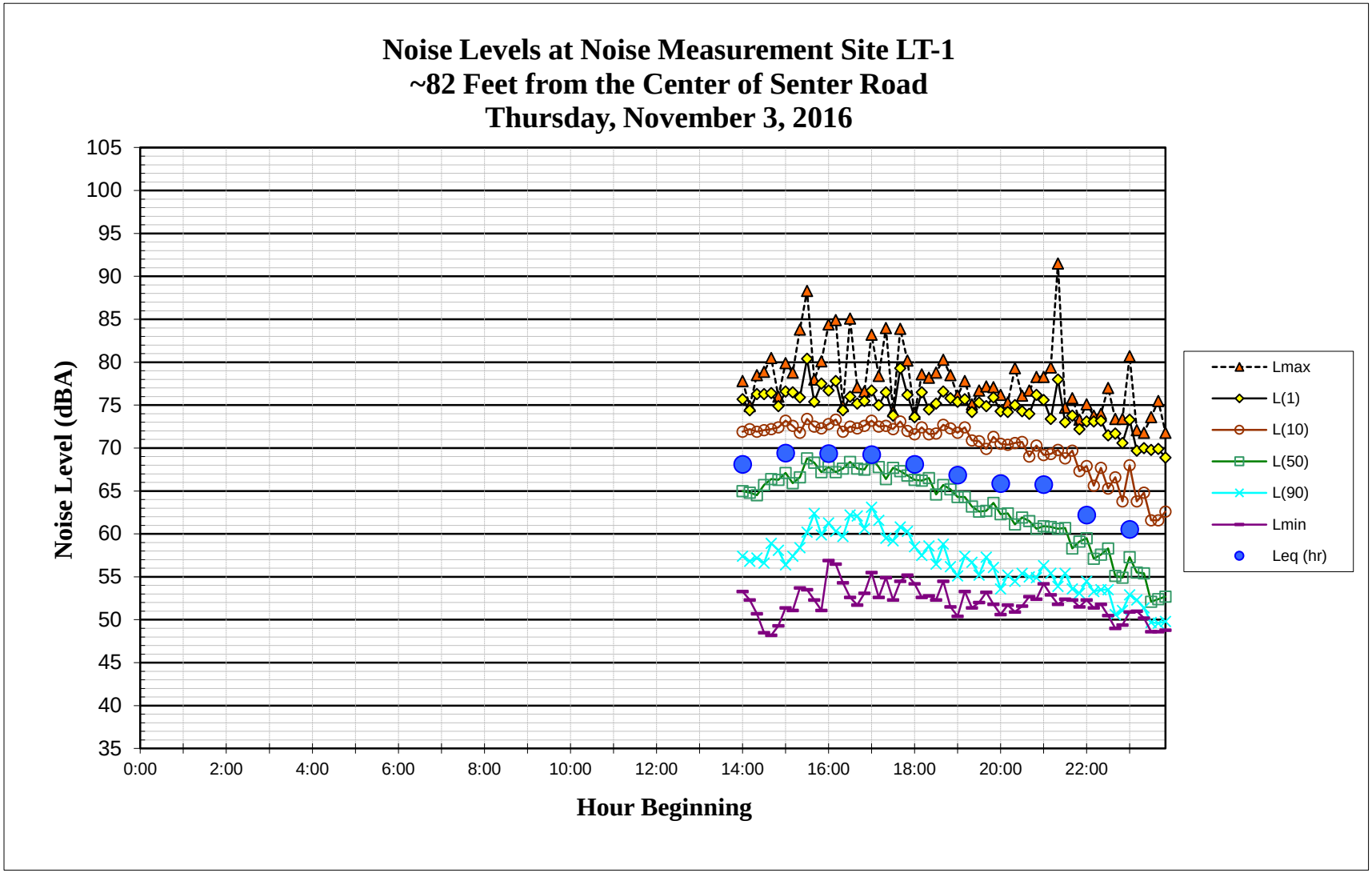
Noise Levels at Noise Measurement Site LT-1
~82 Feet from the Center of Senter Road
Thursday, November 3, 2016
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

FIGURE 3

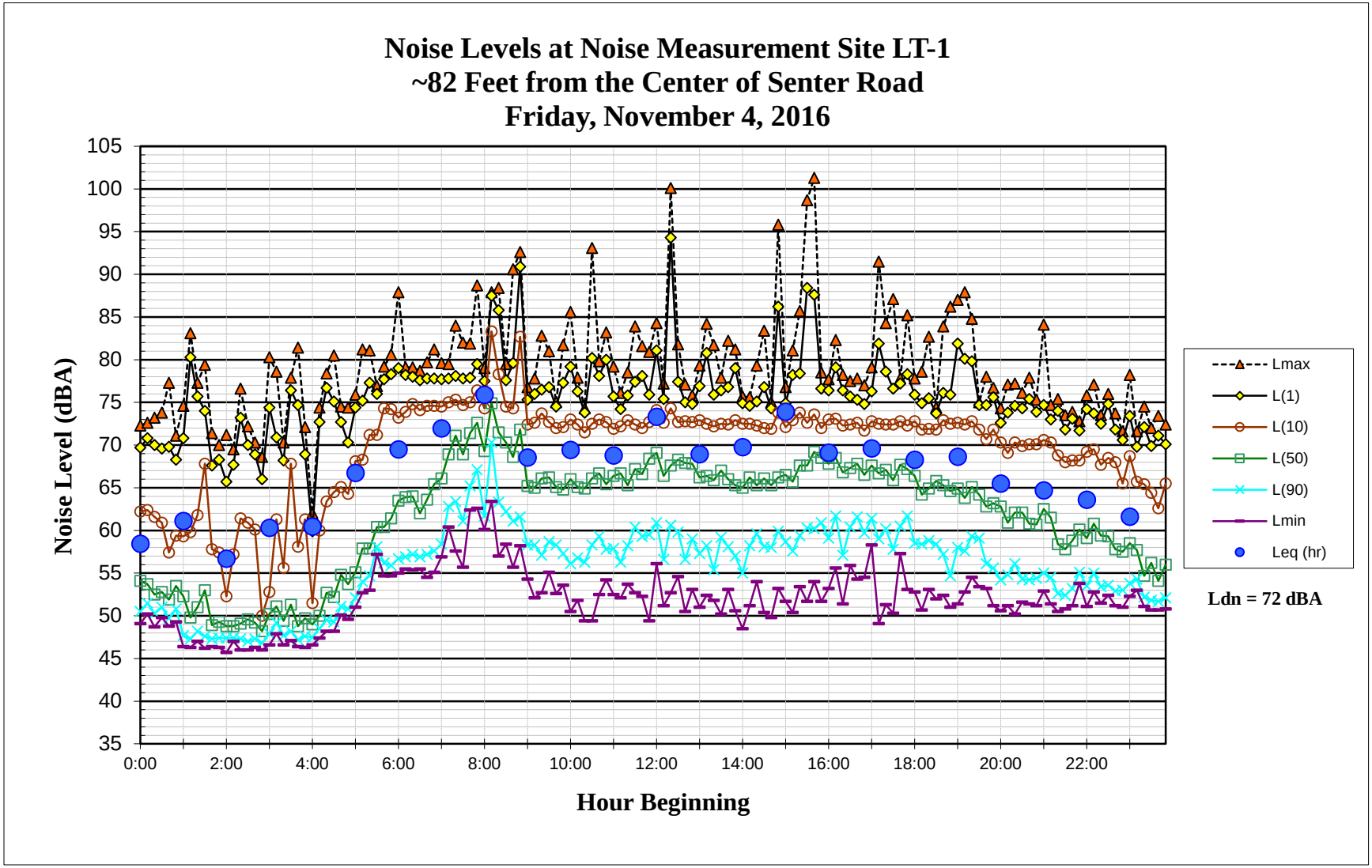
Noise Levels at Noise Measurement Site LT-1
~82 Feet from the Center of Senter Road
Friday, November 4, 2016
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 72 dBA

FIGURE 4

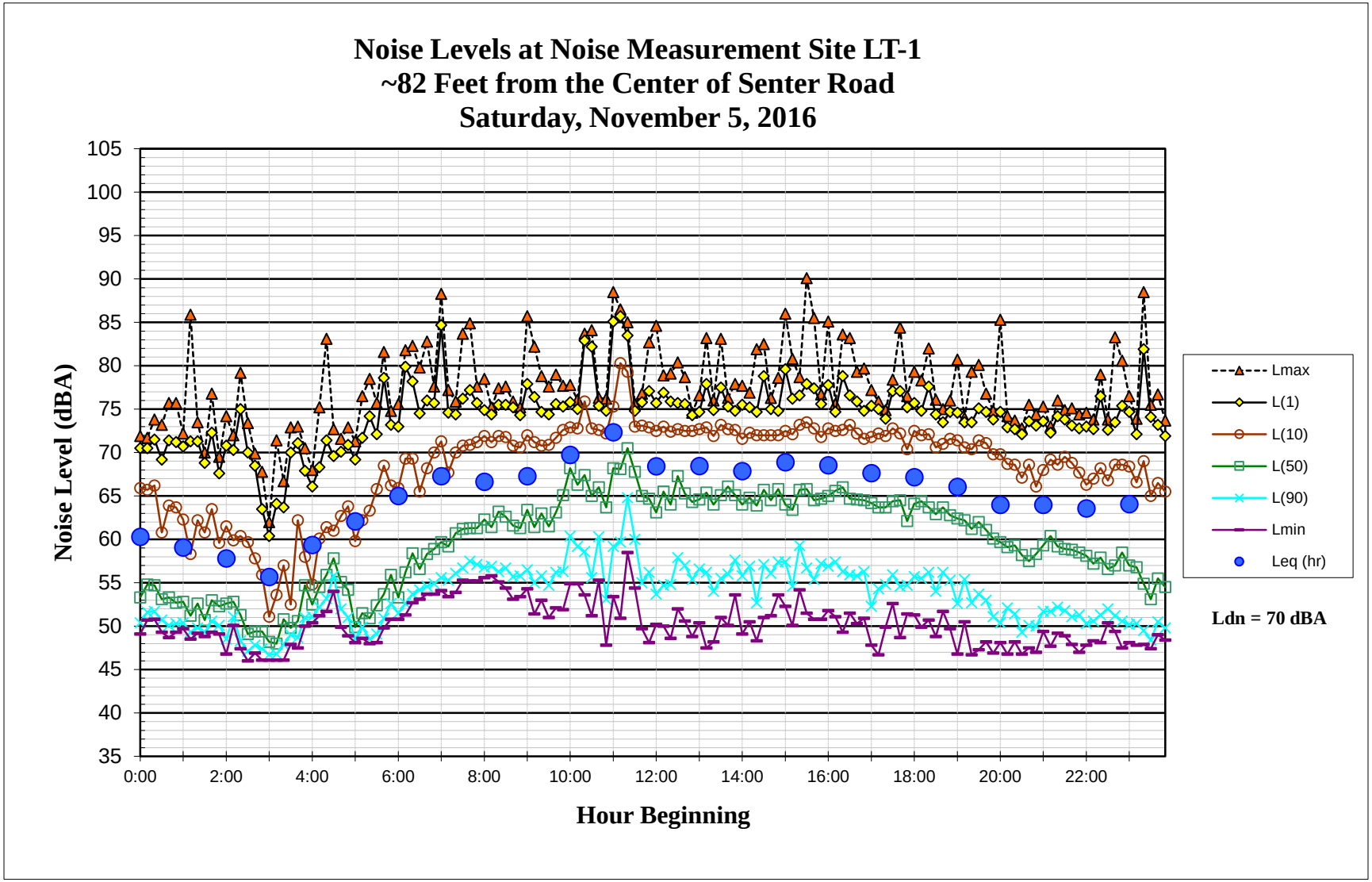
Noise Levels at Noise Measurement Site LT-1
~82 Feet from the Center of Senter Road
Saturday, November 5, 2016
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 70 dBA

FIGURE 5

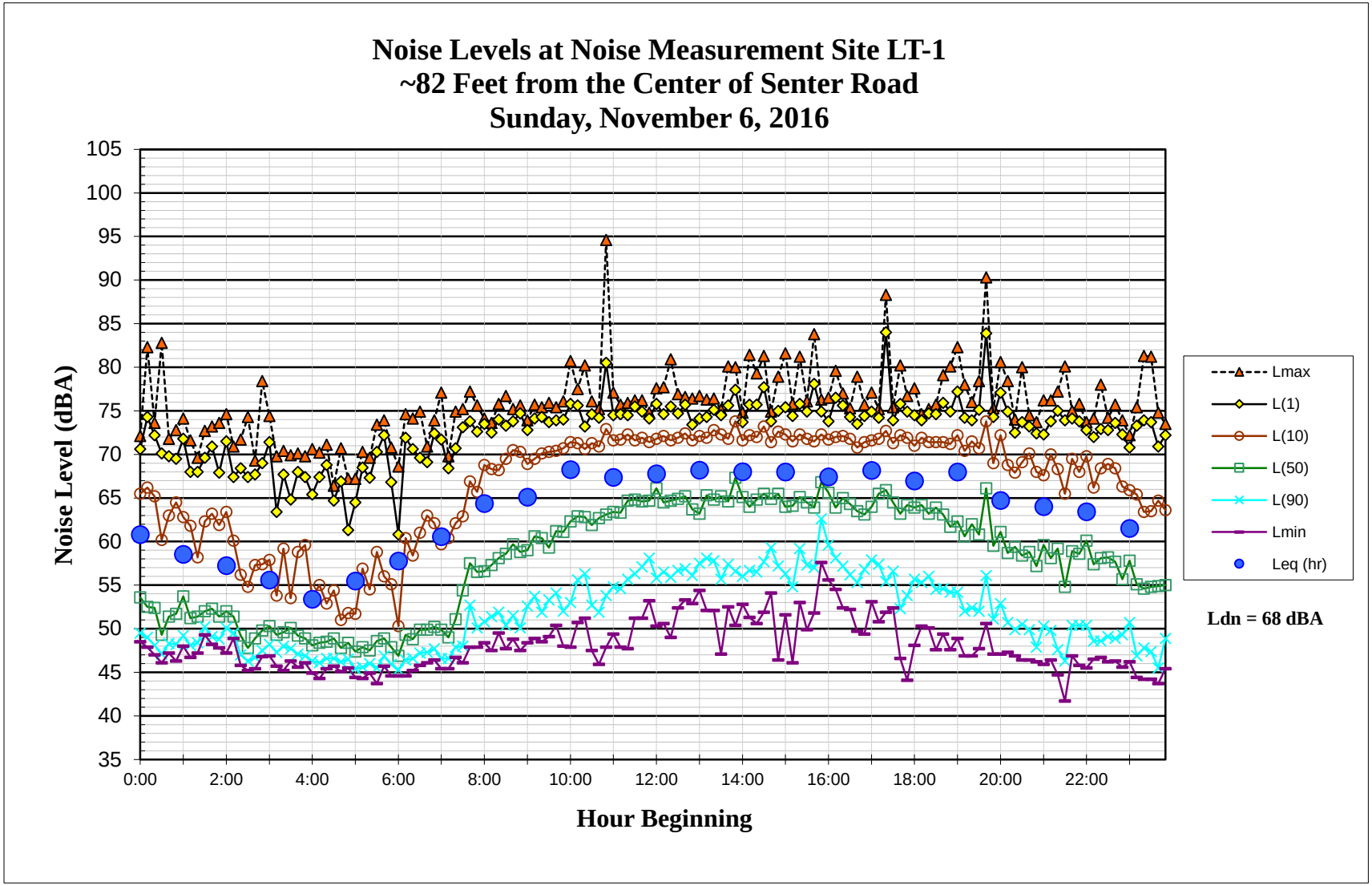
Noise Levels at Noise Measurement Site LT-1
~82 Feet from the Center of Senter Road
Sunday, November 6, 2016
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 68 dBA

FIGURE 6

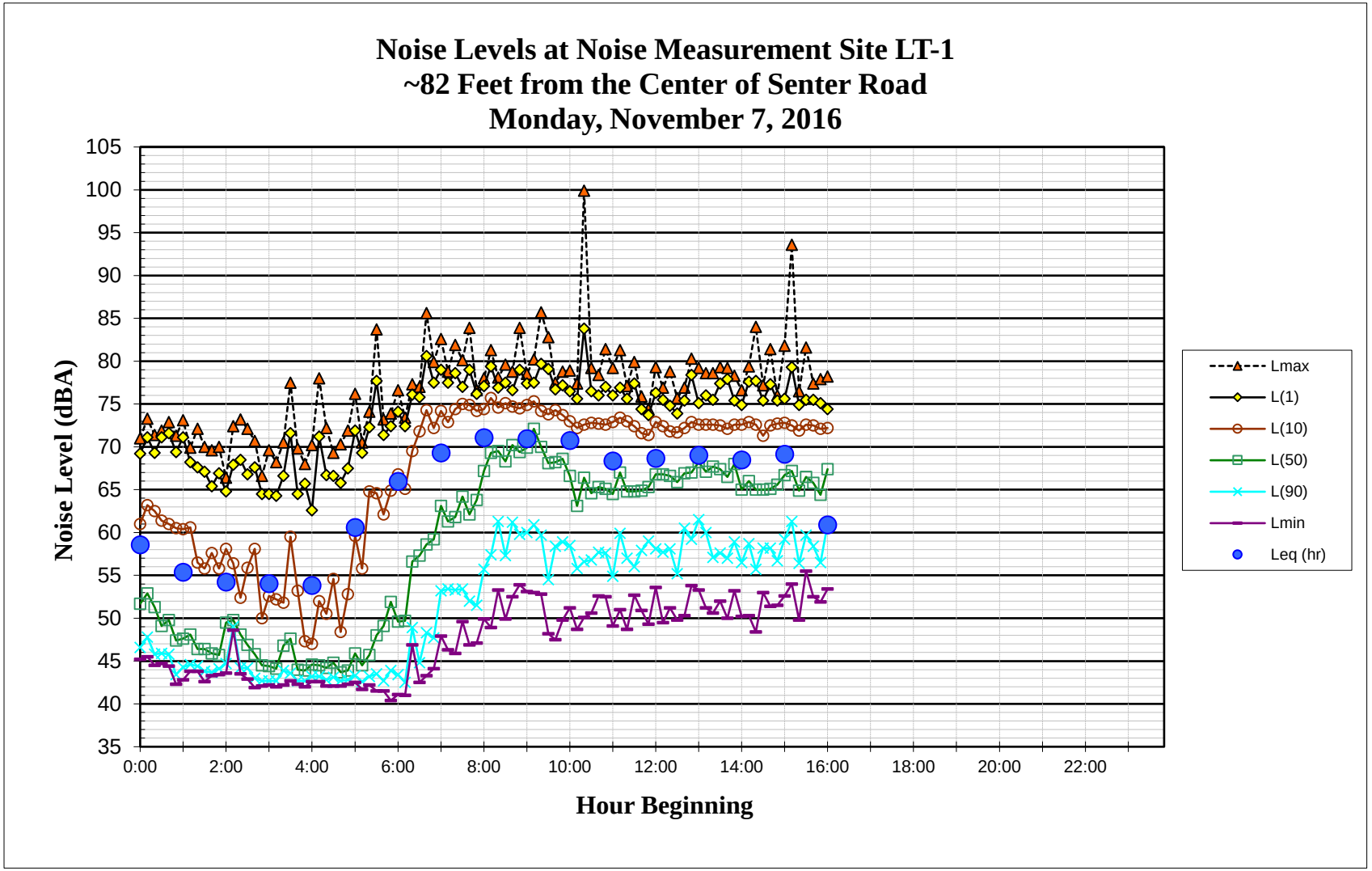
Noise Levels at Noise Measurement Site LT-1
~82 Feet from the Center of Senter Road
Monday, November 7, 2016
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

TABLE 4 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$	DNL
ST-1: ~356 feet west of center of Senter Road (11/7/2016, 1:50-2:00 p.m.)	59	57	54	51	49	52	55
ST-2: ~75 feet west of center of Senter Road (11/7/2016, 2:10-2:20 p.m.)	92	78	71	66	59	70	72
ST-3: ~152 feet west of center of Senter Road (11/7/2016, 2:30-2:40 p.m.)	81	65	61	57	54	59	61
ST-4: ~88 feet east of center of Senter Road (11/7/2016, 3:00-3:10 p.m.)	75	73	71	66	60	68	66

Note: DNL values for short-term measurements were calculated from the long-term data.

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The "normally acceptable" threshold for exterior noise, as established in the City's General Plan, is 70 dBA DNL for commercial uses. The CALGreen Code applies when a commercial property falls within the 65 dBA DNL noise contour.

For office developments, the noise and land use compatibility guidelines are designed to screen projects and provide guidance in determining when special building sound insulation treatments may be necessary in order to adequately control the intrusion of environmental noise. The noise level goal for average noise levels inside offices varies depending upon the type of office space. Typically, traffic noise levels should be reduced to an hourly average noise level between 35 and 45 dBA L_{eq}. The CALGreen Code requires interior noise levels to be maintained at 50 dBA $L_{eq(1\text{-}hr)}$ or less during hours of operation.

The proposed office building would have direct line-of-site to traffic noise along Senter Road. The northeastern façade of the building would be approximately 75 feet southwest of the centerline of Senter Road. At this distance, the nearest offices facing Senter Road would be exposed to future exterior noise levels ranging from 61 to 76 dBA $L_{eq(1\text{-}hr)}$ during daytime hours.

Standard office construction with forced-air mechanical ventilation normally provides 30 dBA of noise reduction in interior spaces. Predicted interior noise levels at the nearest offices to Senter Road would range from 31 to 46 dBA L_{eq} assuming standard office construction methods. These interior noise levels would be compatible with the proposed use and would meet the 50 dBA $L_{eq(1\text{-}hr)}$ noise limit established in CALGreen Code Section 5.507.4.2. Interior noise levels would be compatible with the proposed use and below the CALGreen Code interior noise limit. Therefore, the impact would be considered less-than-significant.

In spaces where lower noise levels would be desired, such as private offices and conference rooms, may benefit from additional noise control in order to meet a lower, more desirable interior noise level. Additional noise control could be accomplished through building design by

selecting sound-rated windows (STC 30 or greater) for sensitive interior spaces along the northernmost and westernmost façades of the proposed office building.

Mineta San José International Airport is a public-use airport located approximately 4.2 miles northeast of the project site. Although aircraft-related noise could occasionally be audible at the project site, noise from aircraft would not substantially increase ambient noise levels due to traffic noise on Senter Road. The project site lies outside the 2017 and 2027 noise contours shown in the Norman Y. Mineta San José International Airport Master Plan Update Project[1] report published in February 2010 as an addendum to the Environmental Impact Report. Exterior and interior noise levels resulting from aircraft would be compatible with the proposed project.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

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

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Ground-borne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) the noise level increase is 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.

- A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels exceeding 60 dBA $L_{eq,}$ and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses.

[1] City of San José, "Norman Y. Mineta San José International Airport Master Plan Update Project: Eighth Addendum to the Environmental Impact Report," City of San José Public Project File No. PP 10-024, February 10, 2010.

Impact 1: **Noise Levels in Excess of Standards.** The proposed project would not generate noise in excess of standards established in the Municipal Code at the nearby sensitive receptors. **This is a less-than-significant impact.**

Stationary Equipment Noise

According to the City's Municipal Code, Chapter 20.30.700, noise levels from building equipment must be maintained at or below 55 dBA at noise-sensitive residential land uses. The proposed project would include a package rooftop system that includes heating, ventilation, and air conditioning components. This analysis assumes that the mechanical equipment package would be placed at the center of the rooftop of the project building, with setbacks of approximately 70 feet from the building's edges. Based on a review of the manufacturer's data sheet, the rooftop mechanical package would produce a noise level of 68 dBA L_{eq} at a distance of 50 feet. With mechanical equipment setbacks of at least 70 feet, operational noise levels at the shared property lines are estimated to be 52 dBA L_{eq} without the shielding provided by the building, roof-top parapet wall, and the proposed screen wall around the package. In all cases, the estimated noise levels produced by the operation of mechanical equipment associated with the project would not exceed the City's 55 dBA threshold resulting in a less-than-significant impact.

Mitigation Measure 1: No mitigation required.

Impact 2: **Exposure to Excessive Ground-borne Vibration due to Construction.** Construction-related vibration levels resulting from activities at the project site would not exceed 0.2 in/sec PPV at nearby buildings. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site preparation work, foundation work, and new building framing and finishing. Based on a review of the construction equipment list provided at the time of this study, the proposed project is not expected to require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation and City of San José recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.2 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No ancient buildings or buildings that are documented to be structurally weakened adjoin the project site. Conservatively, ground-borne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in a significant vibration impact.

Table 5 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

Existing residential land uses are located approximately 163 feet to the east, opposite Senter Road. At this distance, vibration levels would be 0.09 in/sec PPV or less. Commercial land uses to the northwest and southeast would be approximately 40 and 140 feet from the project site property lines, respectively, and the Santa Clara County Social Services building would be within a distance of approximately 60 feet. At 40 and 140 feet, these office commercial buildings would be exposed to vibration levels of 0.13 and 0.03 in/sec PPV, respectively, which would not exceed the City's significance threshold for construction vibration. The social services building would be exposed to vibration levels up to 0.08 in/sec PPV, which is below the City's significance threshold. This is a less-than-significant impact.

TABLE 5 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

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

Mitigation Measure 2: No mitigation required.

Impact 3: Permanent Noise Level Increase. The proposed project would not result in a substantial permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

Typically, a significant permanent noise increase would occur if the project would increase noise levels at noise-sensitive receptors by 3 dBA DNL or more where ambient noise levels exceed the "normally acceptable" noise level standard. Where ambient noise levels are at or below the "normally acceptable" noise level standard, noise level increases of 5 dBA DNL or more would be considered significant. According to the City's General Plan, the "normally acceptable" outdoor noise level standard for the residential land uses would be 60 dBA DNL, and existing ambient levels, based on the measurements made in the project vicinity, exceed 60 dBA DNL. Therefore, a significant impact would occur if traffic due to the proposed project would permanently increase ambient levels by 3 dBA DNL. For reference, a 3 dBA DNL noise increase would be expected if the project would double existing traffic volumes along a roadway.

The future noise environment at the project site would continue to result primarily from vehicular traffic along the surrounding roadways. A traffic report was prepared for a proposed project in November 2016 by *Hexagon Transportation Consultants*.[2] The Existing Plus Project peak hour traffic scenario was compared Existing traffic conditions, which resulted in noise level increases of less than half a decibel along all roadways associated with the project in the traffic study. The permanent noise level increase due to project-generated traffic would not exceed 3 dBA DNL along Senter Road. This is a-less-than-significant impact.

[2] Hexagon Transportation Consultants, Inc., 1995 Senter Road Office Development Draft Transportation Impact Analysis, November 3, 2016.

Mitigation Measure 3: **No mitigation required.**

Impact 4: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses or where construction noise exceeds 70 dBA L_{eq} and exceeds the ambient levels by at least 5 dBA L_{eq} at commercial land uses in the project vicinity for a period exceeding one year, the impact would be considered significant.

Existing residences opposite Senter Road are approximately 163 feet from the project site. At these locations, existing ambient levels range from 53 to 76 dBA L_{eq}. The typical range of maximum instantaneous noise levels for the proposed project, based on the equipment list provided, would be 80 to 85 dBA L_{max} at a distance of 50 feet (see Table 6). Table 7 shows the average noise level ranges, by construction phase. Hourly average noise levels during the construction of office buildings are about 75 to 89 dBA L_{eq} for office buildings, as measured at a distance of 50 feet and during the construction of parking garages are about 71 to 89 dBA L_{eq}. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

The proposed project is expected to take a total of about 9 months to complete, starting in April 2017 and concluding by the end of 2017. Construction activities would include demolition, site preparation, grading, excavation, trenching, exterior building construction, interior building construction, and paving. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Once construction moves indoors, minimal noise would be generated at off-site locations.

Table 8 summarizes the phases of construction, the time duration for each phase, the equipment expected to be used during each phase, and the estimated worst-case scenario construction noise levels for each phase at the nearest receptors. The estimated levels shown in the table represent unmitigated noise levels, which do not take into account possible shielding from existing barriers or fences or shielding from any intervening buildings. The information provided for the construction modeling indicated an overlap between the exterior and interior building phases, as well as both of these phases overlapping with the paving phase. The range of levels for the building interior phase shown in Table 8 includes that phase only and when combined with the

building exterior phase. The range of levels for the paving phase reflects that phase only and combined with both building exterior and interior phases.

TABLE 6 CONSTRUCTION EQUIPMENT 50-FOOT NOISE EMISSION LIMITS

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

[1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 7 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

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

TABLE 8 Estimated Construction Noise Levels at the Nearest Receptors

Phase	Time Duration	Construction Equipment (Quantity)	Calculated Hourly Average L_{eq}, dBA			
			NW Commercial Building (40ft)	NE Residences (95ft)	SE Commercial Building (140ft)	Social Service Building (60ft)
Demolition	4/3/2017-4/7/2017 (5 days)	Rubber-tired Dozer (1) Loader (1)	82[a]	74[a]	71[a]	78[a]
Site Preparation	4/3/2017-4/14/17 (10 days)	Ruber-tired Dozer (1) Loader (1)	82-86[b]	74-79[b]	71-75[b]	78-82[b]
Grading/Excavation	4/10/2017-5/20/2017 (51 days)	Scrapers (2) Backhoe (2) Loader (1)	81-86[c]	69-79[c]	70-75[c]	77-82[c]
Trenching	5/10/2017-5/19/2017 (8 days)	Backhoe (2) Loader (1)	81-86[d]	69-74[d]	70-75[d]	77-82[d]
Building-Exterior	5/1/2017-9/29/2017 (110 days)	Crane (1) Forklift (1) Boom Lift (1)	76-81[e]	67-69[e]	66-70[e]	73-77[e]
Building-Interior/ Architectural Coating	10/2/2017-12/29/2017 (59 days)	Scissor Lift (4)	76	68	65	72
Paving	11/3/2017-11/22/2017 (14 days)	Paving Equipment (2) Roller (2) Loader (2)	84	76	73	80

[a] The range of construction noise levels represents the levels during the Demolition phase only and combined with the Site Preparation phase.
[b] The range of construction noise levels represents the levels during the Site Preparation phase only and combined with the Demolition and Grading/Excavation phases.
[c] The range of construction noise levels represents the levels during the Grading/Excavation phase only and combined with the Site Preparation and Trenching phases.
[d] The range of construction noise levels represents the levels during the Trenching phase only and combined with the Grading/Excavation and Building-Exterior phases.
[e] The range of construction noise levels represents the levels during the Building-Exterior phase only and combined with the Trenching phase.

As shown in Table 8, noise levels would exceed 70 dBA L_{eq} at commercial land uses during project construction. Further, ambient levels at each of the surrounding land uses would be exceeded by 5 dBA L_{eq} or more throughout project construction.

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life.

Construction activities will be conducted in accordance with the provisions of the City's General Plan and the Municipal Code, which limits temporary construction work within 500 feet of residential land uses to between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday. Construction is prohibited on weekends at sites located within 500 feet of residential units. Further, the City shall require the construction crew to adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

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

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used such that noise is deadened at a distance of 75 feet, per Municipal Code regulations. Any enclosure openings or venting shall face away from sensitive receptors.

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

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.

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

- The contractor shall prepare a detailed construction plan identifying the schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

The implementation of the reasonable and feasible controls outlined above would reduce construction noise levels emanating from the site by 5 to 10 dBA in order to minimize disruption and annoyance. With the implementation of these controls, as well as the General Plan and Municipal Code limits on allowable construction hours, and considering that construction is temporary, the impact would be considered to be less-than-significant.

Mitigation Measure 5: No mitigation is required.