AVENUES: THE WORLD SCHOOL NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The project site is located just north of I-280 on the north side of Parkmoor Avenue, between Meridian Avenue and Race Street, in the City of San José. The site is currently developed with two 3-story office buildings totaling 153,413 square feet (sf) along the Meridian Avenue frontage (550 and 570 Meridian Avenue) that are served by a 4-level, 475-space parking structure in the center of the site, three large warehouse buildings fronting Race Street (529,581, and 691 Race Street) totaling 150,204 sf, and a two-story, 60,060 sf office building facing Parkmoor Avenue (1401 Parkmoor Avenue).

The proposed campus would be built in four phases to support up to 2,744 toddler to grade 12 students and 480 faculty and staff. Primary vehicle access would be provided via Harmon Avenue connecting to the parking structure and an internal drive extending south across the site to Parkmoor Avenue. An existing driveway on Meridian Avenue would provide access to a small surface parking lot at the southwest corner of the site. Secondary vehicle access would be provided at the northeast corner of the site from Race Street, with an internal drive extending south and west to exit to Parkmoor Avenue.

This report evaluates the project's potential to result in significant impacts with respect to the 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 land use compatibility utilizing noise-related 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.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA DNL. Typically, the highest steady traffic noise level during the daytime is about equal to the DNL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure

and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA DNL with open windows and 65-70 dBA DNL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The DNL as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA DNL. At a DNL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the DNL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a DNL of 60-70 dBA. Between a DNL of 70-80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the DNL is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

Fundamentals of Groundborne Vibration

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

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such

activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause 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. 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 paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. 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.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at 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.

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	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

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

Regulatory Background

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

State CEQA Guidelines. The California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of environmental noise impacts attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Generation of 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, if the project would expose people residing or working in the project area to excessive noise levels.

The impacts of the project on the surrounding land uses are addressed in the Noise Impacts and Mitigation Measures Section of the report. The impacts of site constraints such as exposure of the

proposed project to excessive levels of noise and vibration are not considered under CEQA and are discussed in a separate section addressing Noise and Land Use Compatibility for consistency with the policies set forth in the City's General Plan.

2019 California Green Building Standards Code (Cal Green Code). The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2019 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). Section 5.507 states that either the prescriptive (Section 5.507.4.1) or the performance method (Section 5.507.4.2) shall be used to determine environmental control at indoor areas. The prescriptive method is very conservative and not practical in most cases; however, the performance method can be quantitatively verified using exterior-to-interior calculations. For the purposes of this report, the performance method is utilized to determine consistency with the Cal Green Code. 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 L_{dn} 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.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

Collaborative for High-Performance Schools. The California Collaborative for High-Performance Schools Best Practices Manual, 2014 Edition, establishes standards for background noise levels due to exterior noise sources. Sections EQ14.0 and EQ 14.1 of the CA-CHPS Manual state that the A-weighted background noise levels produced by exterior sound sources shall be no more than 45 dBA L_{eq}. A maximum level of 35 dBA L_{eq} is recommended for enhanced learning environments.

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 and vibration on people, residences, and businesses 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. Applicable standards and guidelines for land uses in San José include:

Exterior Noise Levels

The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses including schools (Table EC-1). Outdoor sports and recreation areas and playgrounds are considered acceptable in noise environments of 65 dBA DNL or less.

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-1.7 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.

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-2.1 Near light and heavy rail lines or other sources of ground-borne vibration, minimize vibration impacts on people, residences, and businesses through the use of setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the Federal Transit Administration. Require new development within 100 feet of rail lines to demonstrate prior to project approval that vibration experienced by residents and vibration sensitive uses would not exceed these guidelines.

EC-2.3 Require new development to minimize continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous 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 continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited to: excavation equipment; static compaction

equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

Existing Noise Environment

The project site is located on the north side of Parkmoor Avenue, between Meridian Avenue and Race Street, and is bordered by residential and commercial land uses. A noise monitoring survey was made to document existing noise conditions at the site and in the surrounding area from Tuesday, September 17th to Friday, September 20th, 2019. The noise monitoring survey included four long-term measurements and three short-term noise measurements. Noise measurement locations are shown in Figure 1. Figures 2-17 summarize the noise data collected at the long-term noise measurement sites.

Long-term noise measurement site LT-1 was positioned approximately 40 feet from the center of Meridian Avenue in front of a single-family residence to quantify existing traffic noise levels at receptors along the roadway. The primary noise source at this location was vehicular traffic on Meridian Avenue. Hourly average noise levels at LT-1 ranged from 68 to 75 dBA L_{eq} during the day and from 55 to 69 dBA L_{eq} during the night. The day-night equivalent noise level at LT-1 was calculated to be 73 dBA DNL.

Site LT-2 was positioned at the east end of Harmon Avenue to represent ambient noise levels at multi-family residential land uses north of the project's proposed loading dock area and parking garage. Traffic along Meridian Avenue and Harmon Avenue was the primary source of ambient noise. Hourly average noise levels at LT-2 ranged from 51 to 66 dBA L_{eq} during the day and from 44 to 56 dBA L_{eq} during the night. The day-night equivalent noise level at LT-2 ranged from 59 to 60 dBA DNL.

LT-3 documented existing ambient noise levels at multi-family residential land uses located north of the site along Race Street. The noise measurement was made approximately 35 feet from the centerline of the roadway at a height of 12 feet above the ground. Hourly average noise levels at LT-3 ranged from 65 to 75 dBA L_{eq} during day and 53 to 68 dBA L_{eq} during the night. The day-night equivalent noise level at LT-3 was calculated to be 70 dBA DNL.

The final long-term noise measurement, LT-4, was positioned at the southeast corner of the project site near the intersection of Race Street, Parkmoor Avenue, and the light-rail and heavy-rail tracks. The primary noise source affecting the noise levels measured at this site was

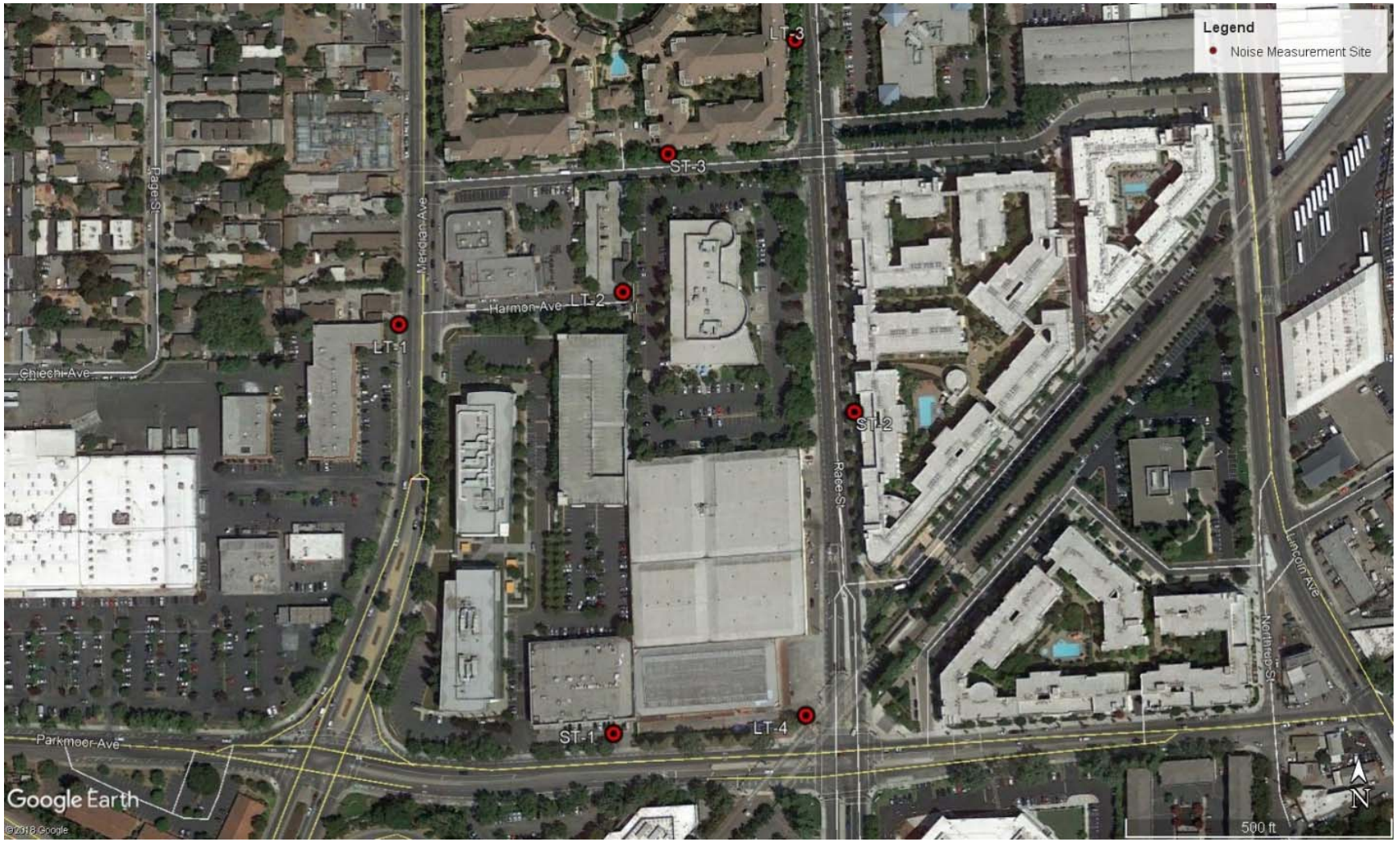
vehicular traffic along Race Street and Parkmoor Avenue. Light-rail trains were secondary noise sources. Hourly average noise levels at LT-1 ranged from 66 to 74 dBA L_{eq} during the day and from 53 to 70 dBA L_{eq} during the night. The day-night equivalent noise level at LT-4 ranged from 72 to 73 dBA DNL.

Short-term (10-minute interval) noise measurements were made at three locations on the morning of September 17th, 2019 to complete the noise monitoring survey. Table 4 summarizes the results of these measurements.

TABLE 4 Summary of Short-Term Noise Measurement Data, September 17th, 2019

ID	Location (Time)	Measured Noise Levels, dBA				Primary Noise Sources
		L_{10}	L_{50}	L_{90}	L_{eq}	
ST-1	~80 feet from the center of Parkmoor Avenue along south boundary of project site. (9:00 a.m. to 9:10 a.m.)	68	59	56	64	Parkmoor Avenue, VTA Light-rail train, UPRR train
ST-2	~50 feet from the center of Race Street at multi-family residences east of the site. (9:20 a.m. to 9:30 a.m.)	70	59	53	66	Race Street
ST-3	~25 feet from the center of Saddle Rack Street at multi-family residences north of the site. (9:40 a.m. to 9:50 a.m.)	65	53	47	60	Saddle Rack Street

FIGURE 1 Noise Measurement Locations



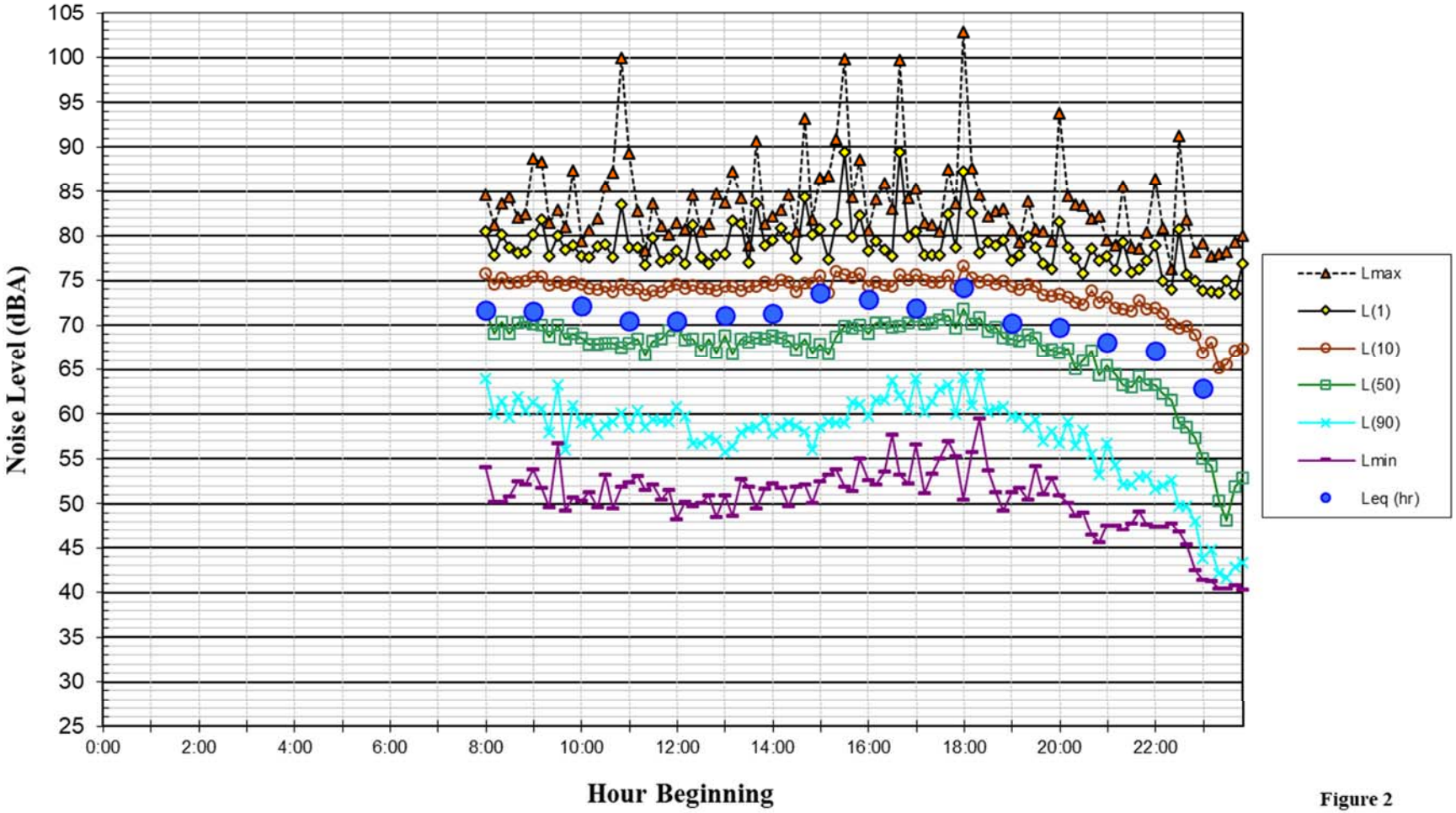

Noise Levels at Noise Measurement Site LT-1
~ 40 feet from the Centerline of Meridian Avenue
Tuesday, September 17, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 2

Noise Levels at Noise Measurement Site LT-1
~ 40 feet from the Centerline of Meridian Avenue
Wednesday, September 18, 2019

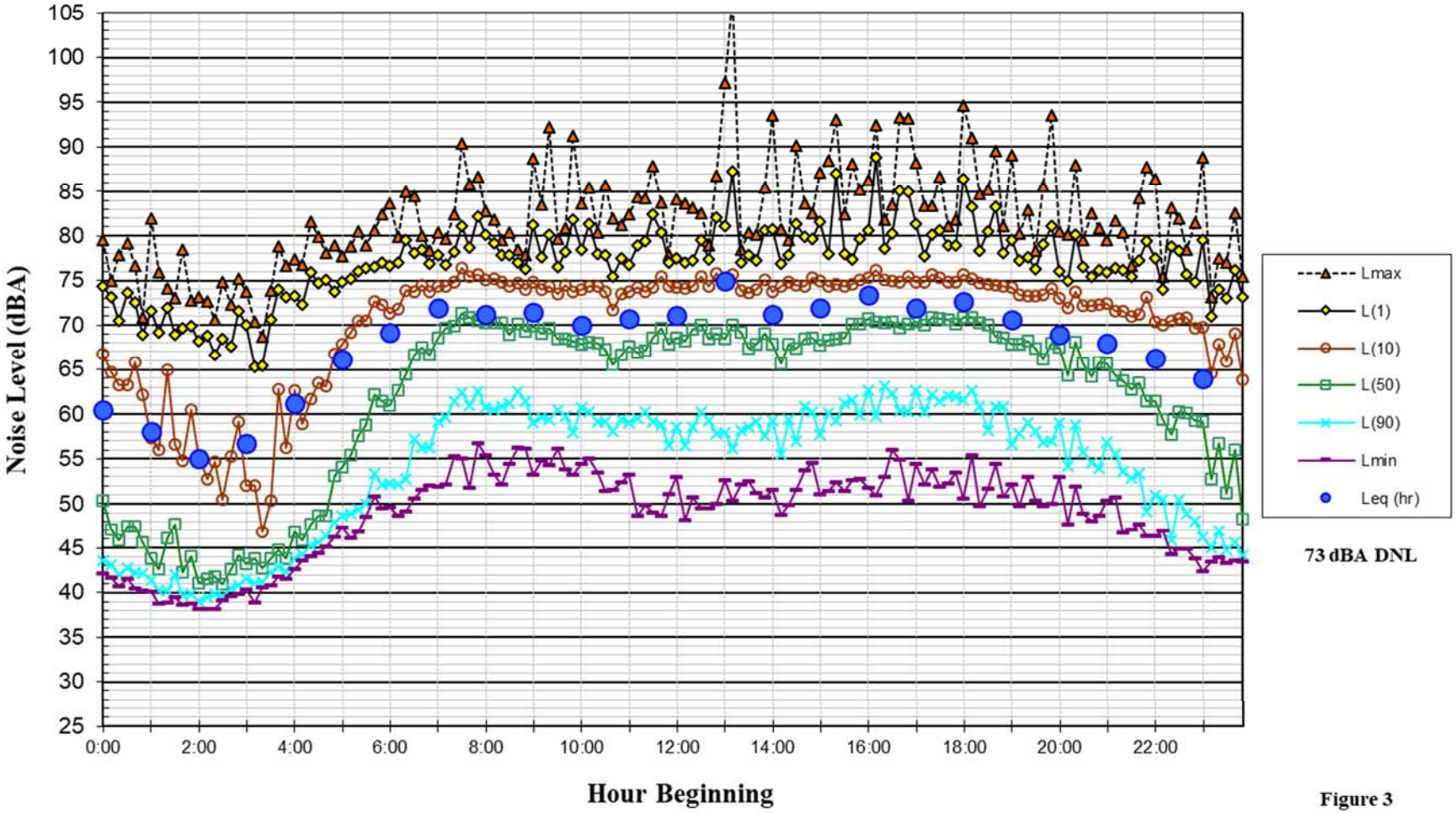


Figure 3

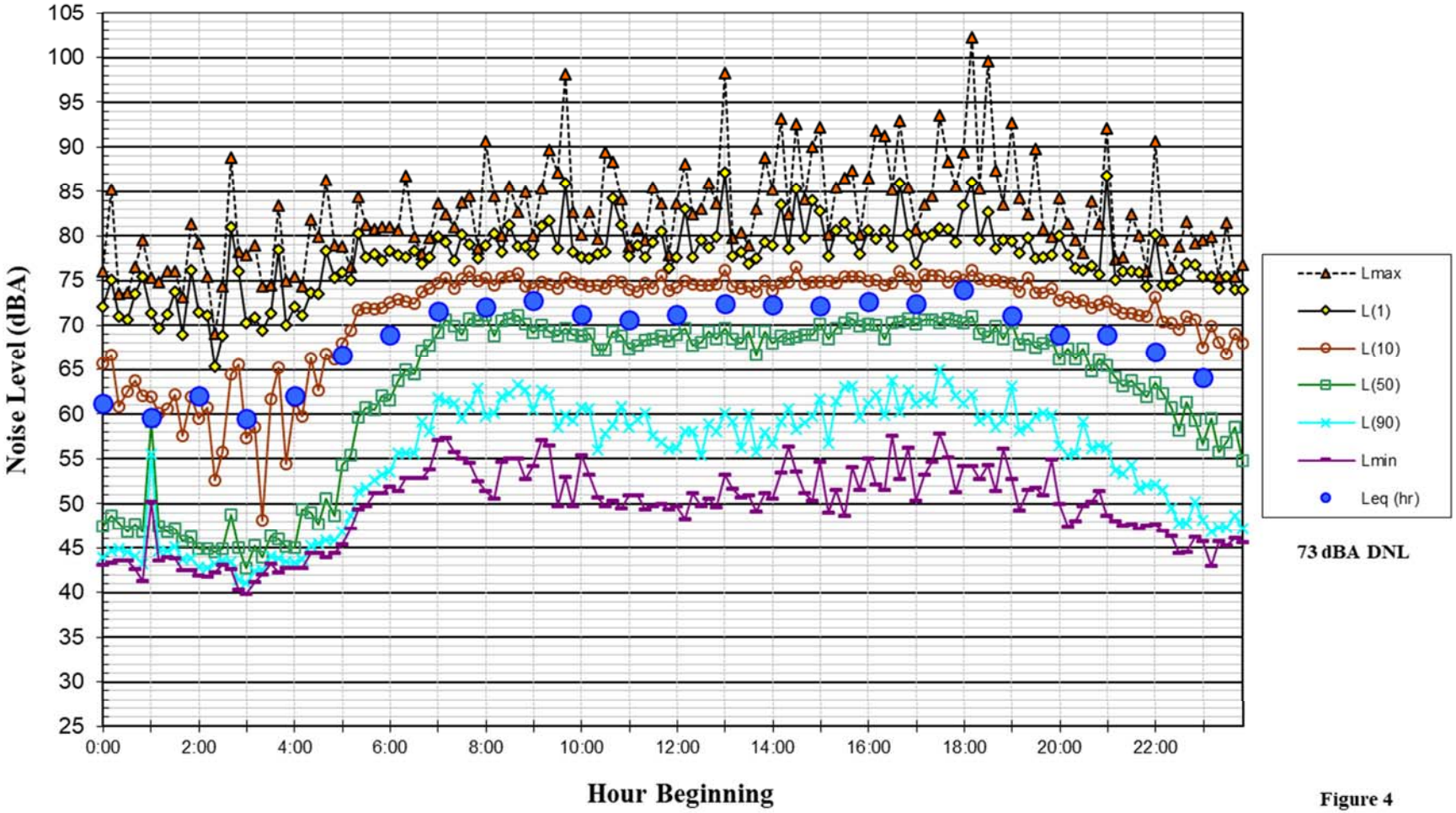

Noise Levels at Noise Measurement Site LT-1
~ 40 feet from the Centerline of Meridian Avenue
Thursday, September 19, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
73 dBA DNL

Figure 4

Noise Levels at Noise Measurement Site LT-1
~ 40 feet from the Centerline of Meridian Avenue
Friday, September 20, 2019

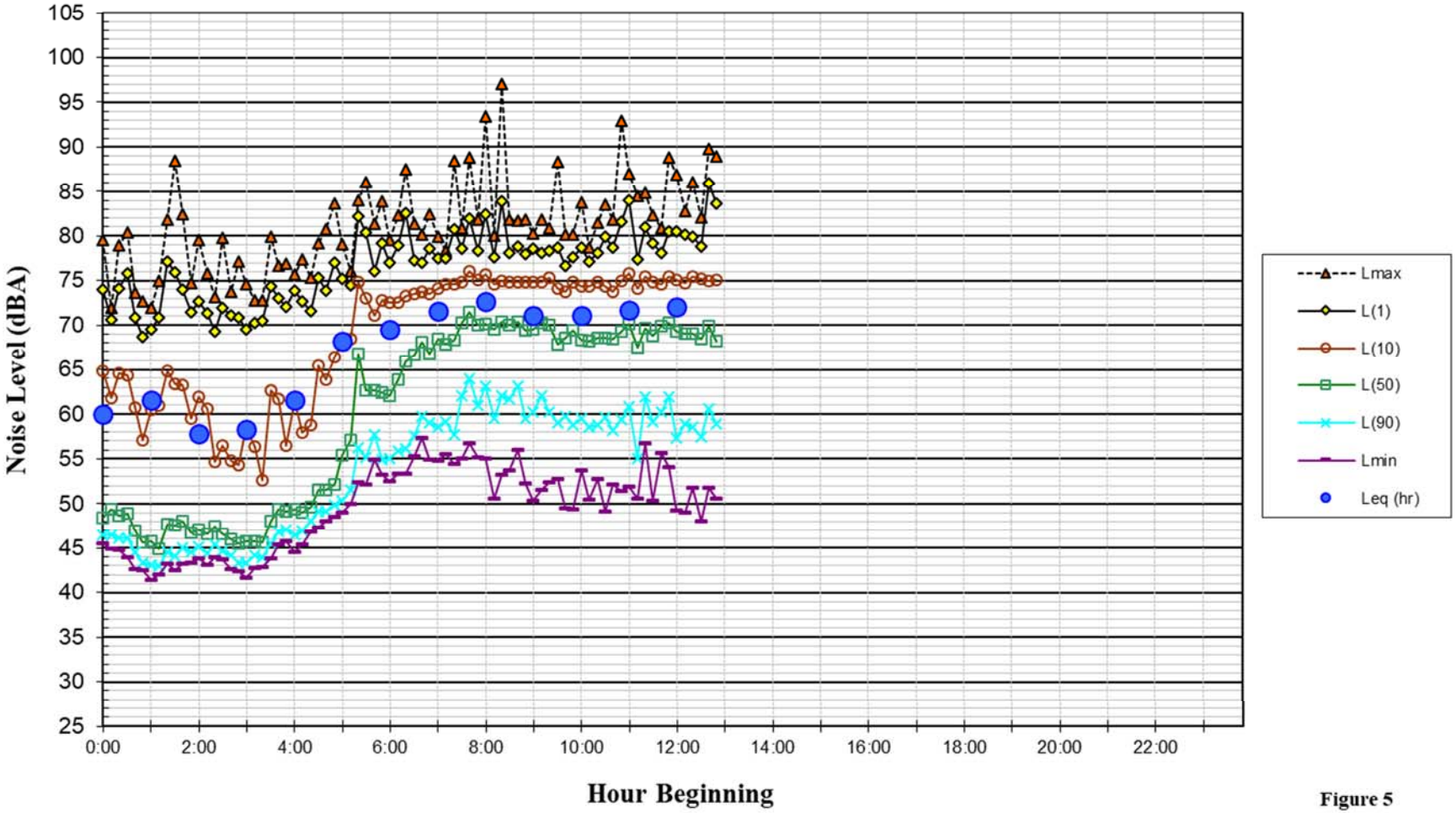
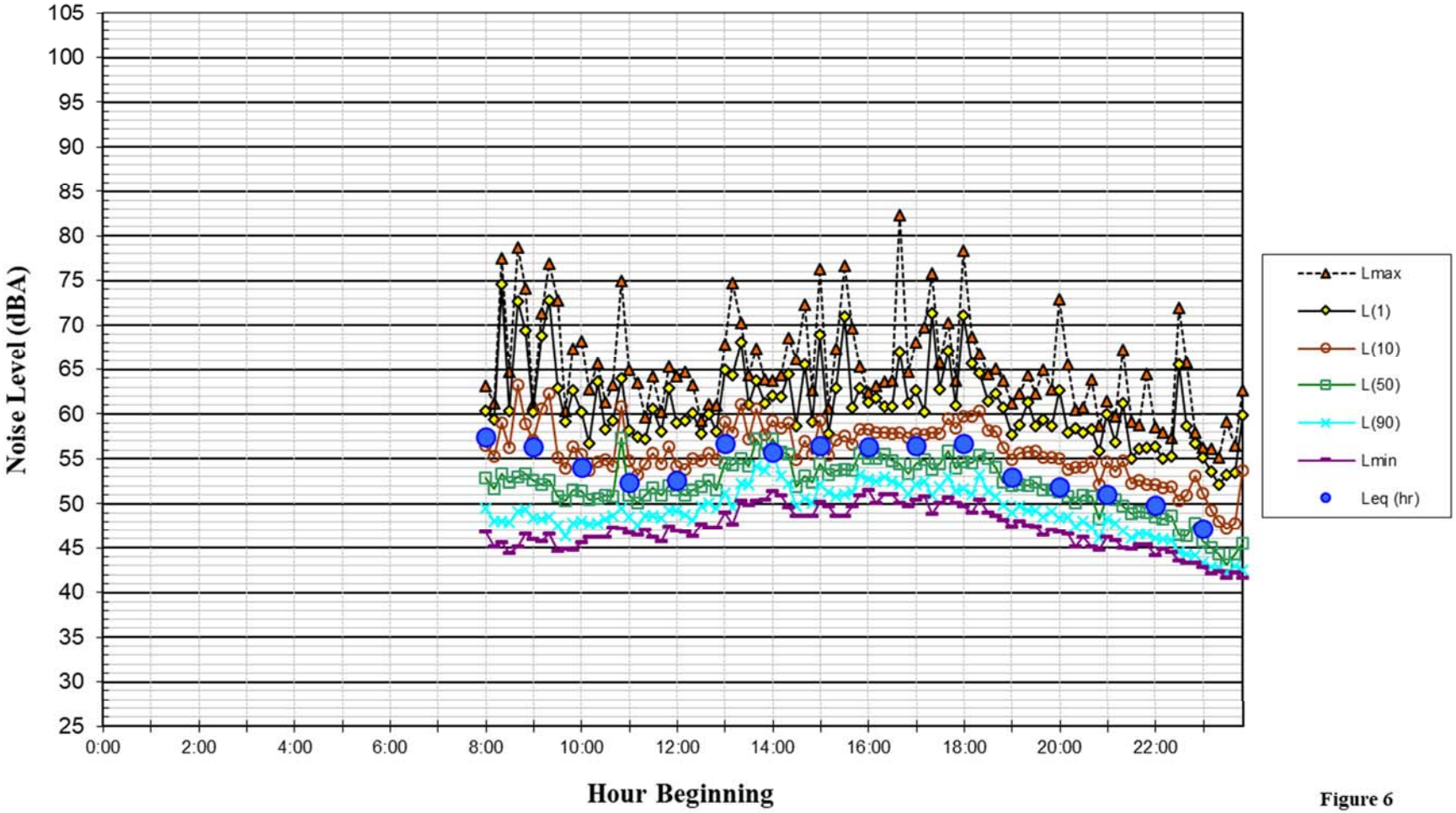


Figure 5


Noise Levels at Noise Measurement Site LT-2
East Terminus of Harmon Avenue
Tuesday, September 17, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
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0:00
2:00
4:00
6:00
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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 6

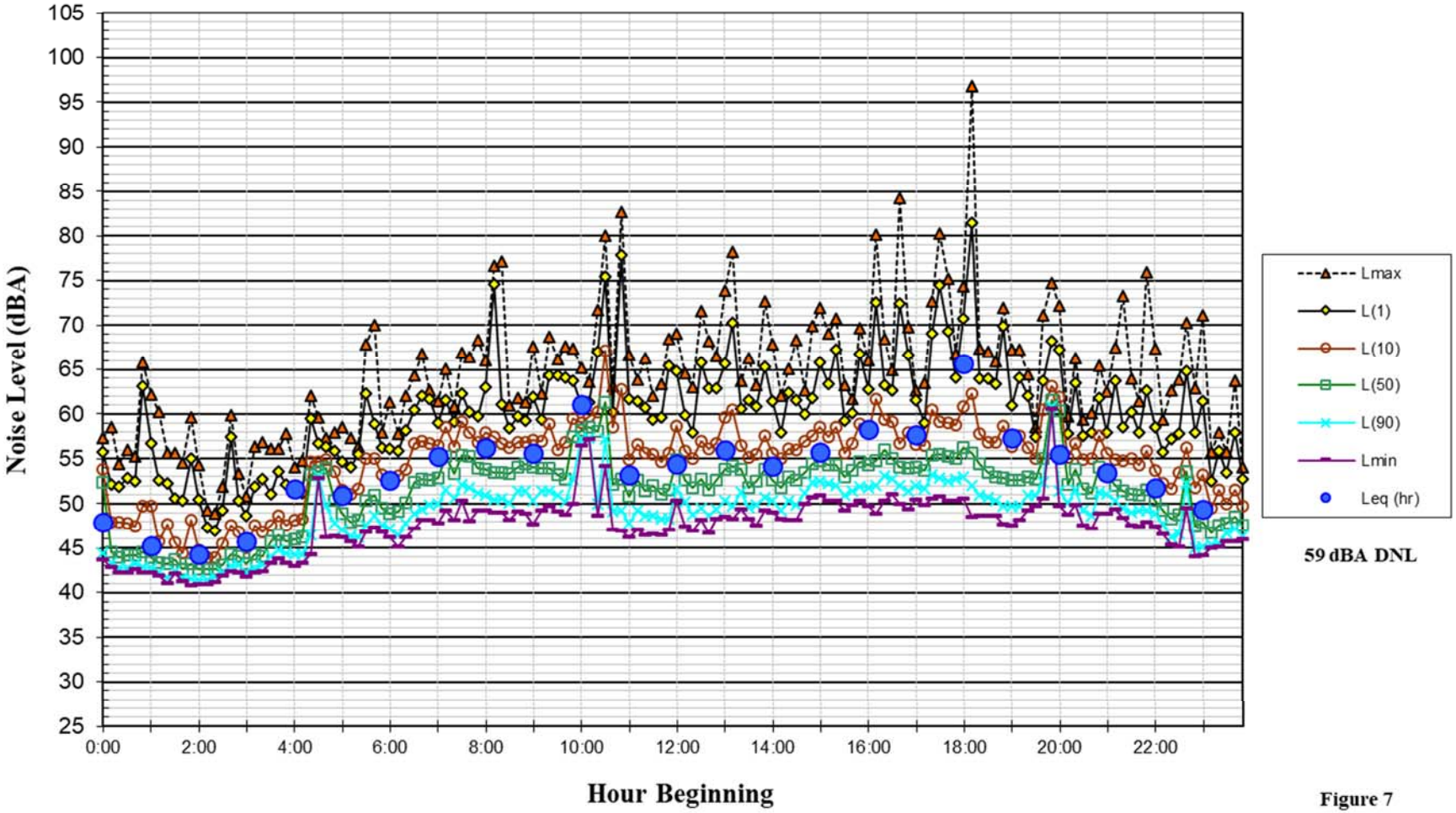
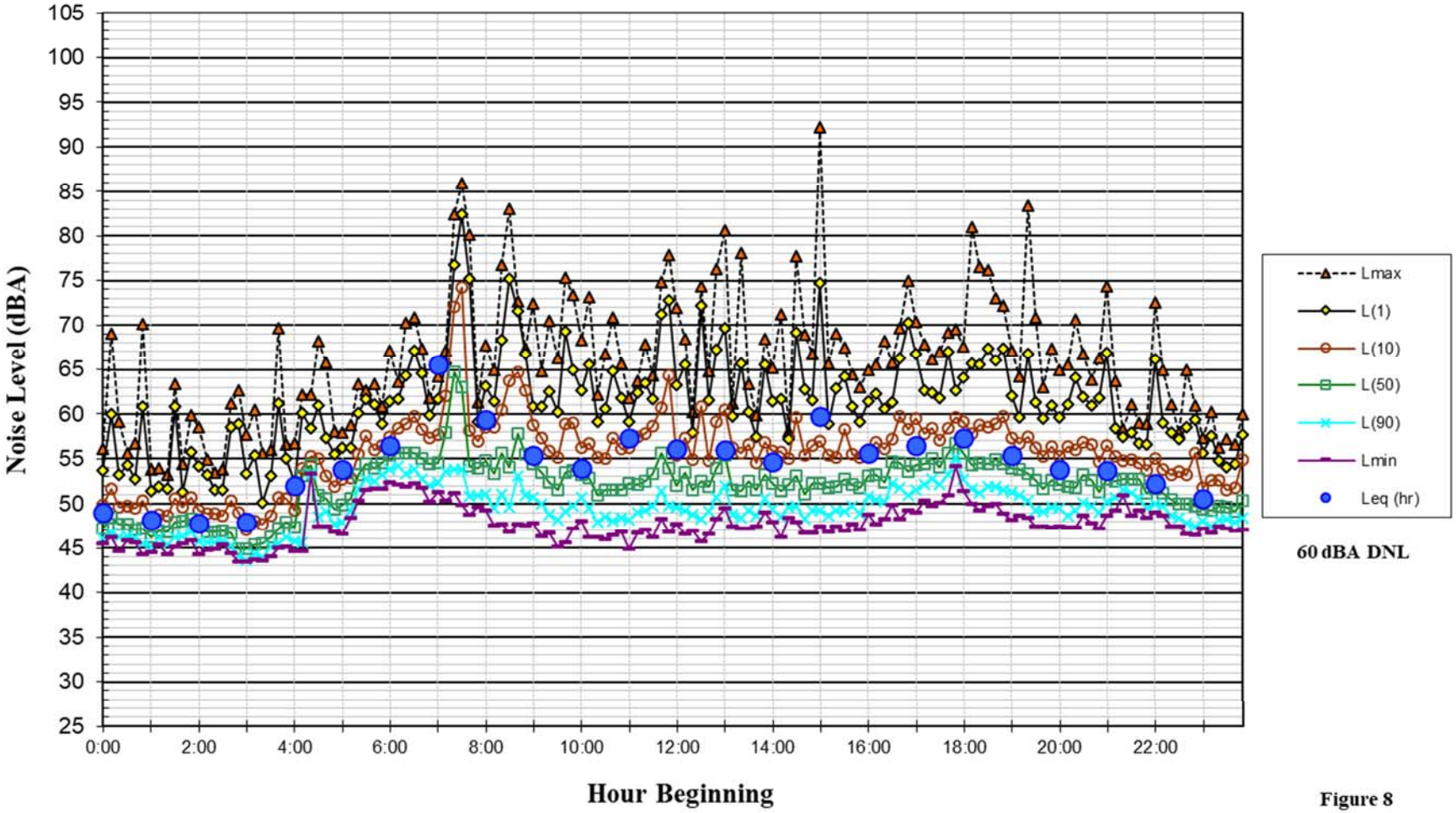

Noise Levels at Noise Measurement Site LT-2
East Terminus of Harmon Avenue
Wednesday, September 18, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
59 dBA DNL

Figure 7


Noise Levels at Noise Measurement Site LT-2
East Terminus of Harmon Avenue
Thursday, September 19, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
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16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
60 dBA DNL

Figure 8

Noise Levels at Noise Measurement Site LT-2
East Terminus of Harmon Avenue
Friday, September 20, 2019

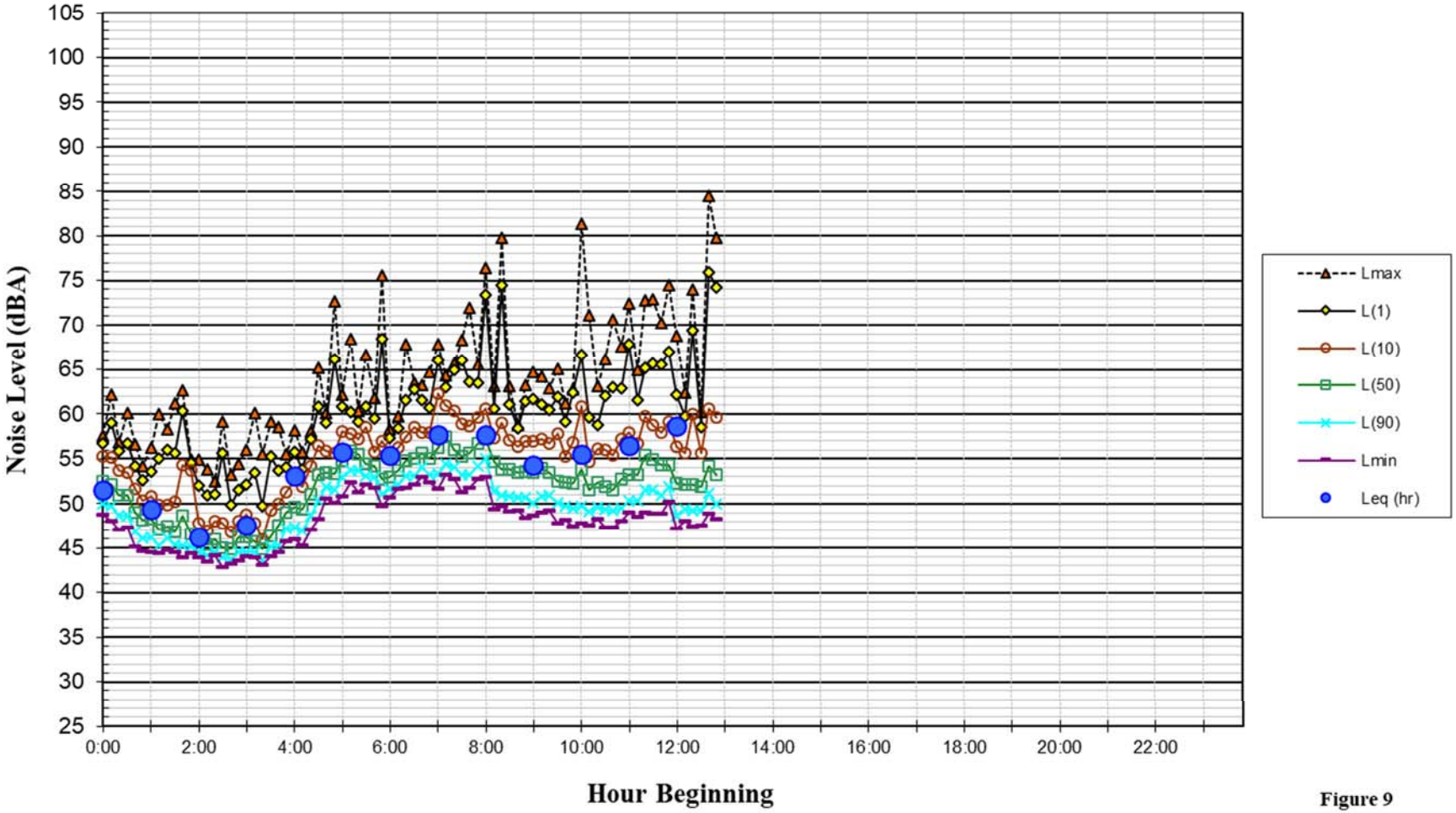


Figure 9

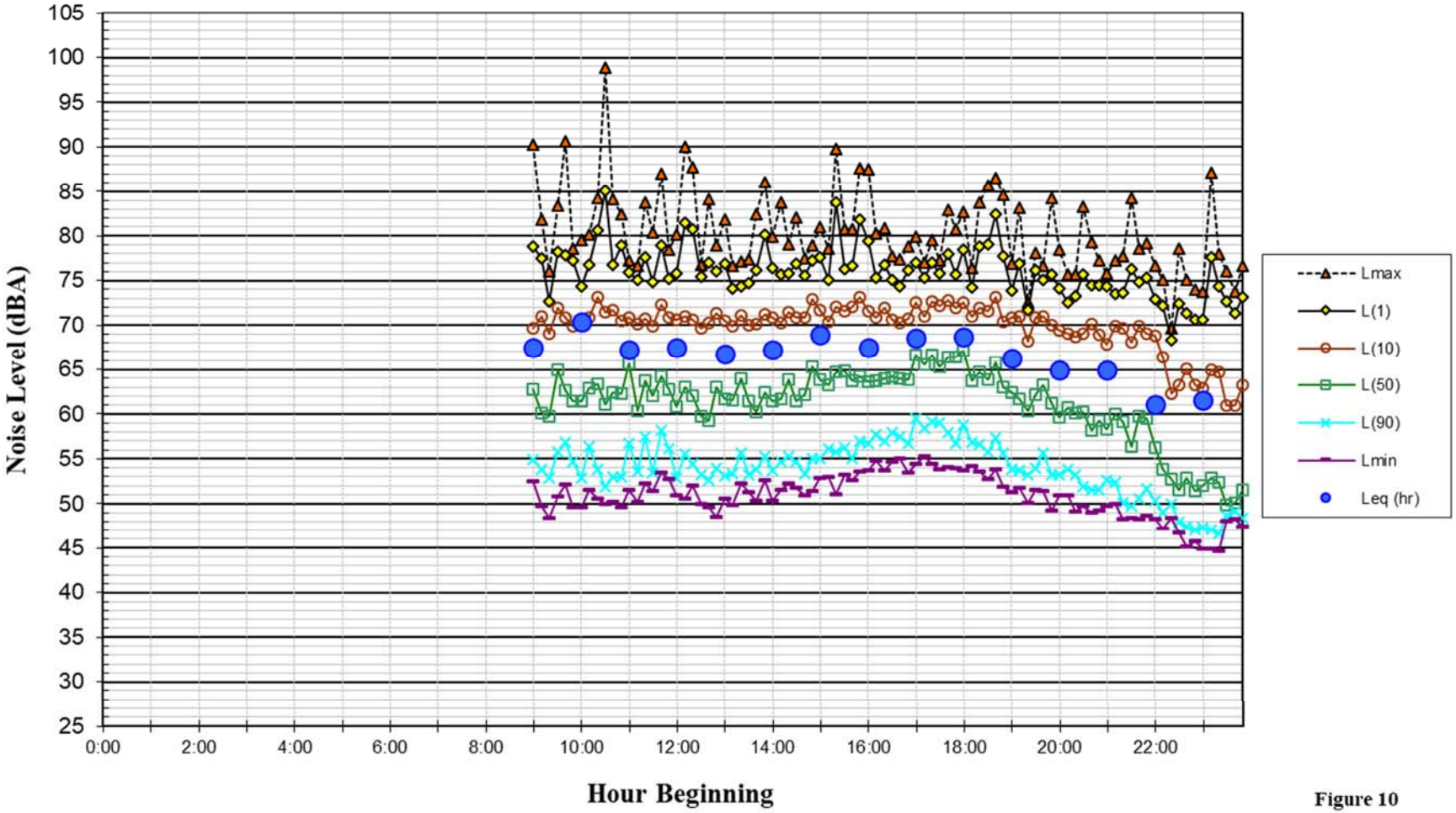
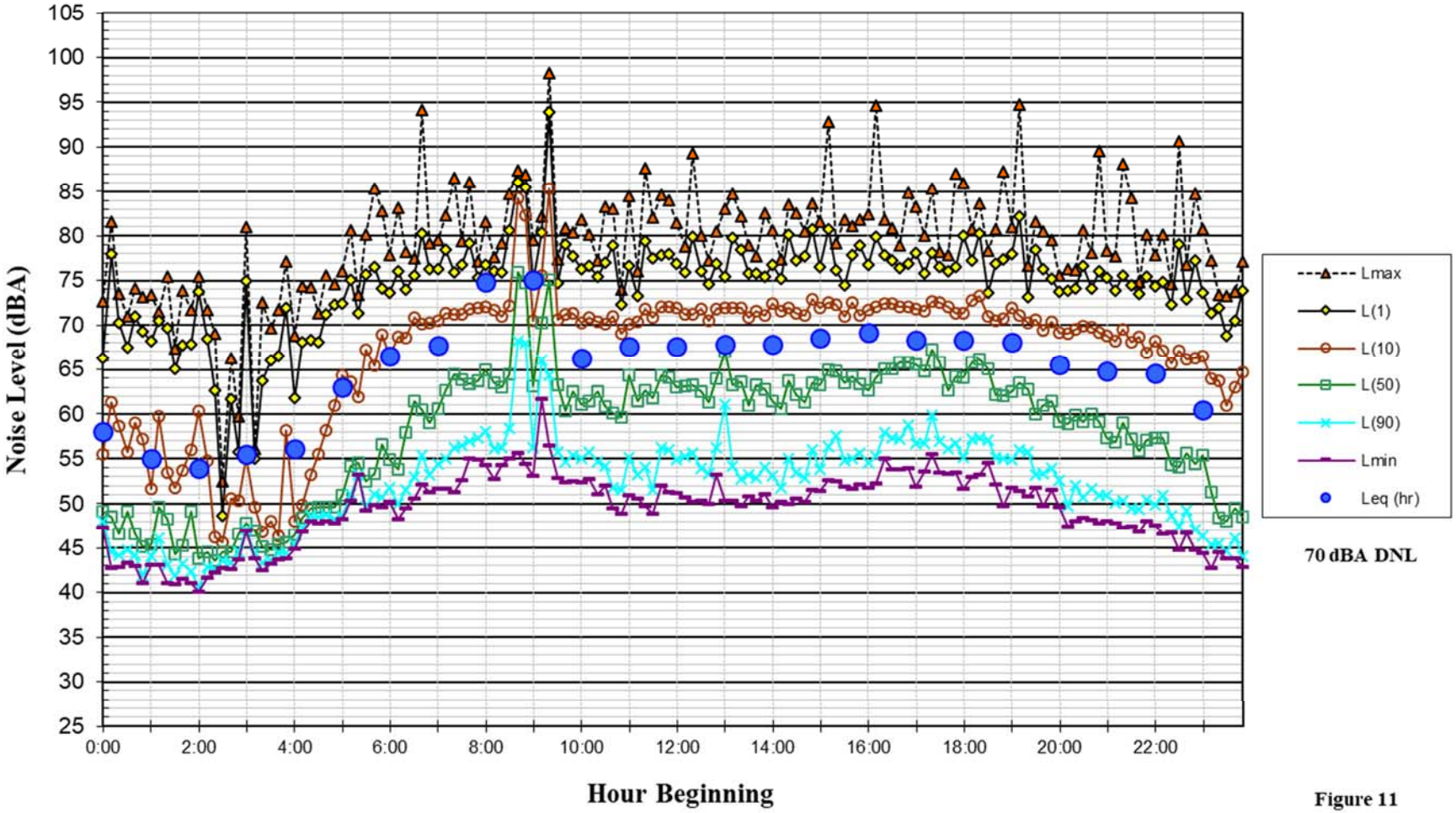

Noise Levels at Noise Measurement Site LT-3
~ 35 feet from the Centerline of Race Street
Tuesday, September 17, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 10


Noise Levels at Noise Measurement Site LT-3
~ 35 feet from the Centerline of Race Street
Wednesday, September 18, 2019
Noise Level (dBA)
105
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80
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35
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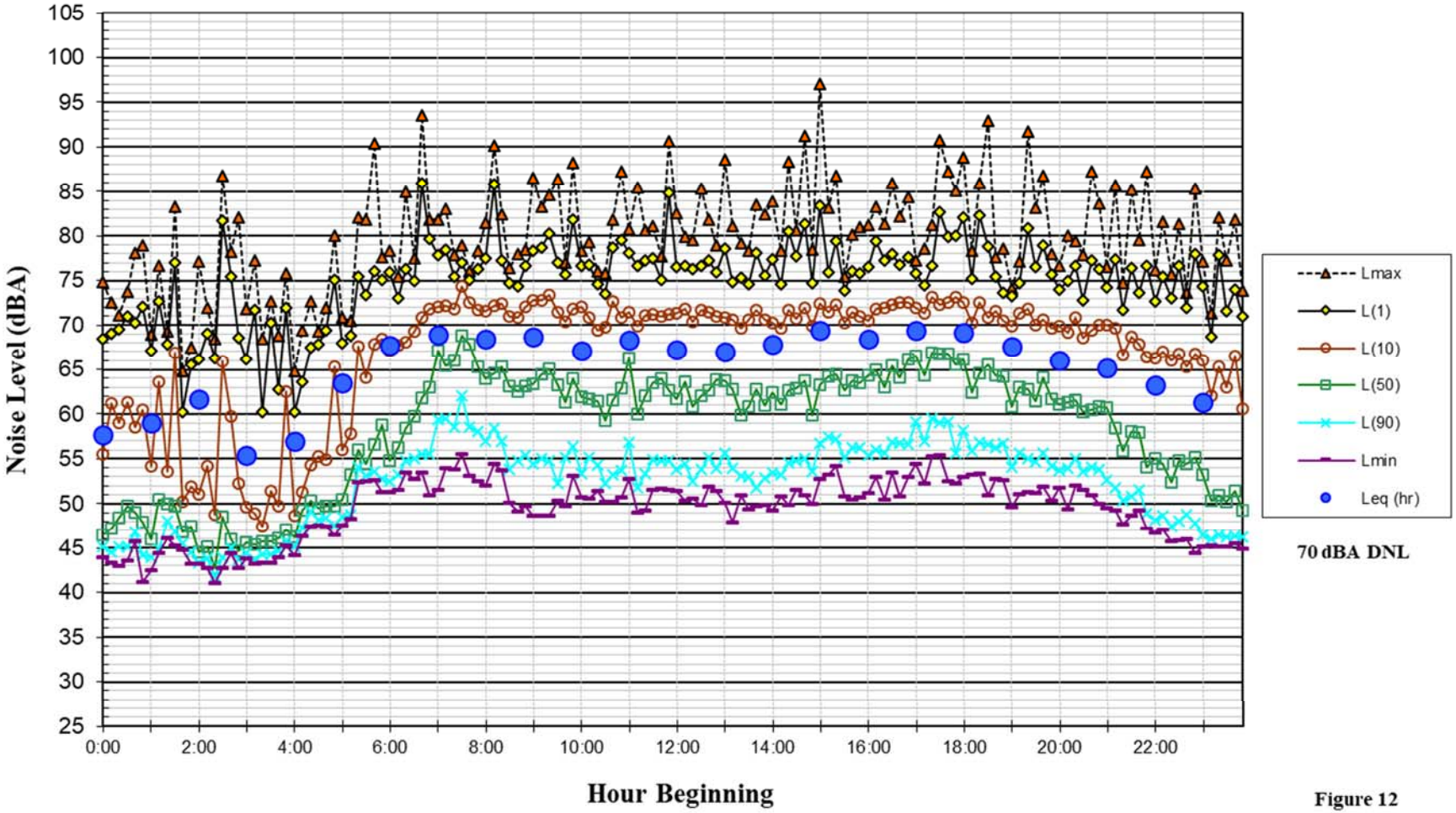
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
70 dBA DNL

Figure 11


Noise Levels at Noise Measurement Site LT-3
~ 35 feet from the Centerline of Race Street
Thursday, September 19, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
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50
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4:00
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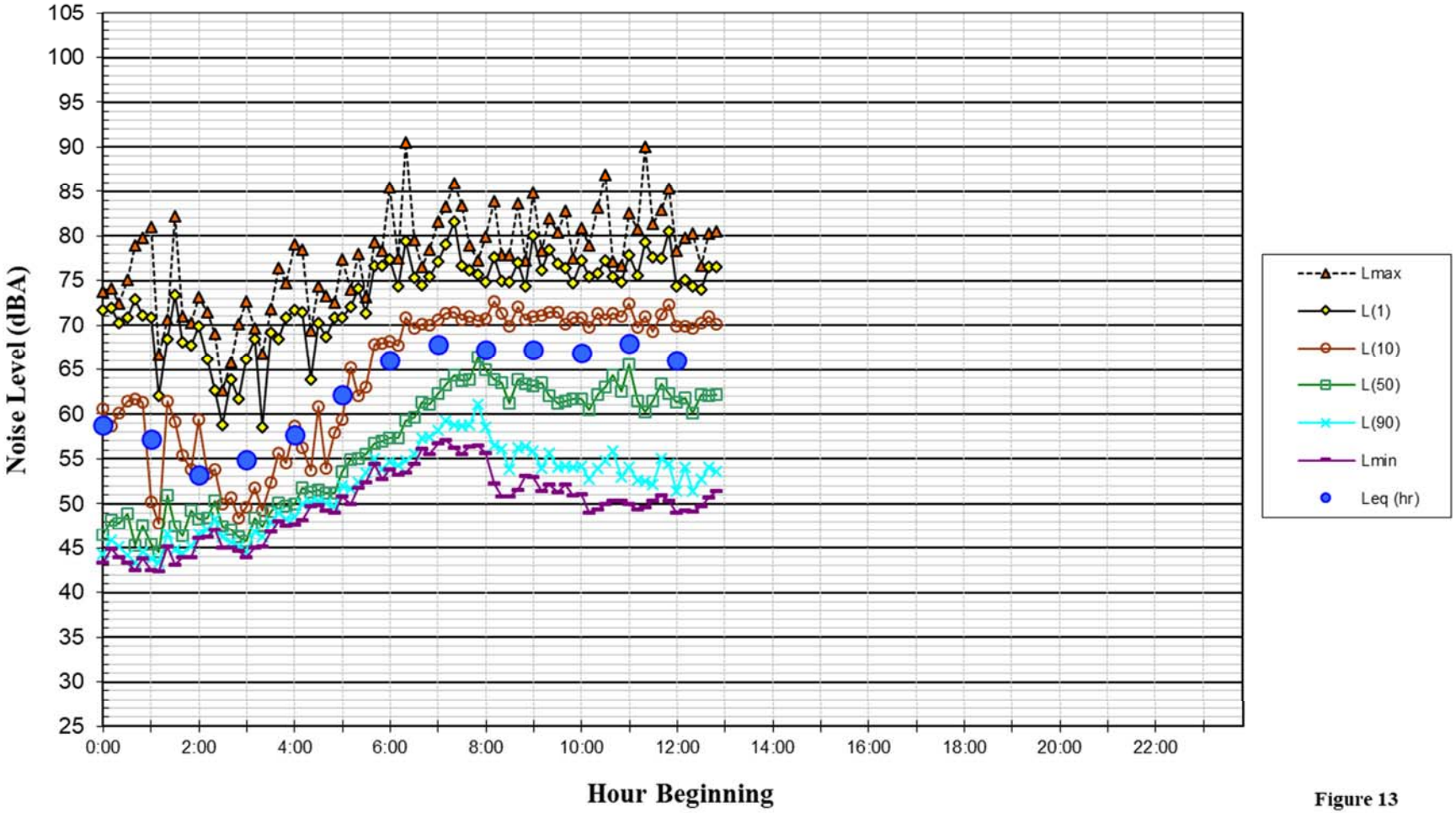
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
70 dBA DNL

Figure 12


Noise Levels at Noise Measurement Site LT-3
~ 35 feet from the Centerline of Race Street
Friday, September 20, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
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40
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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 13

Noise Levels at Noise Measurement Site LT-4
Southeast Corner of Project Site
Tuesday, September 17, 2019

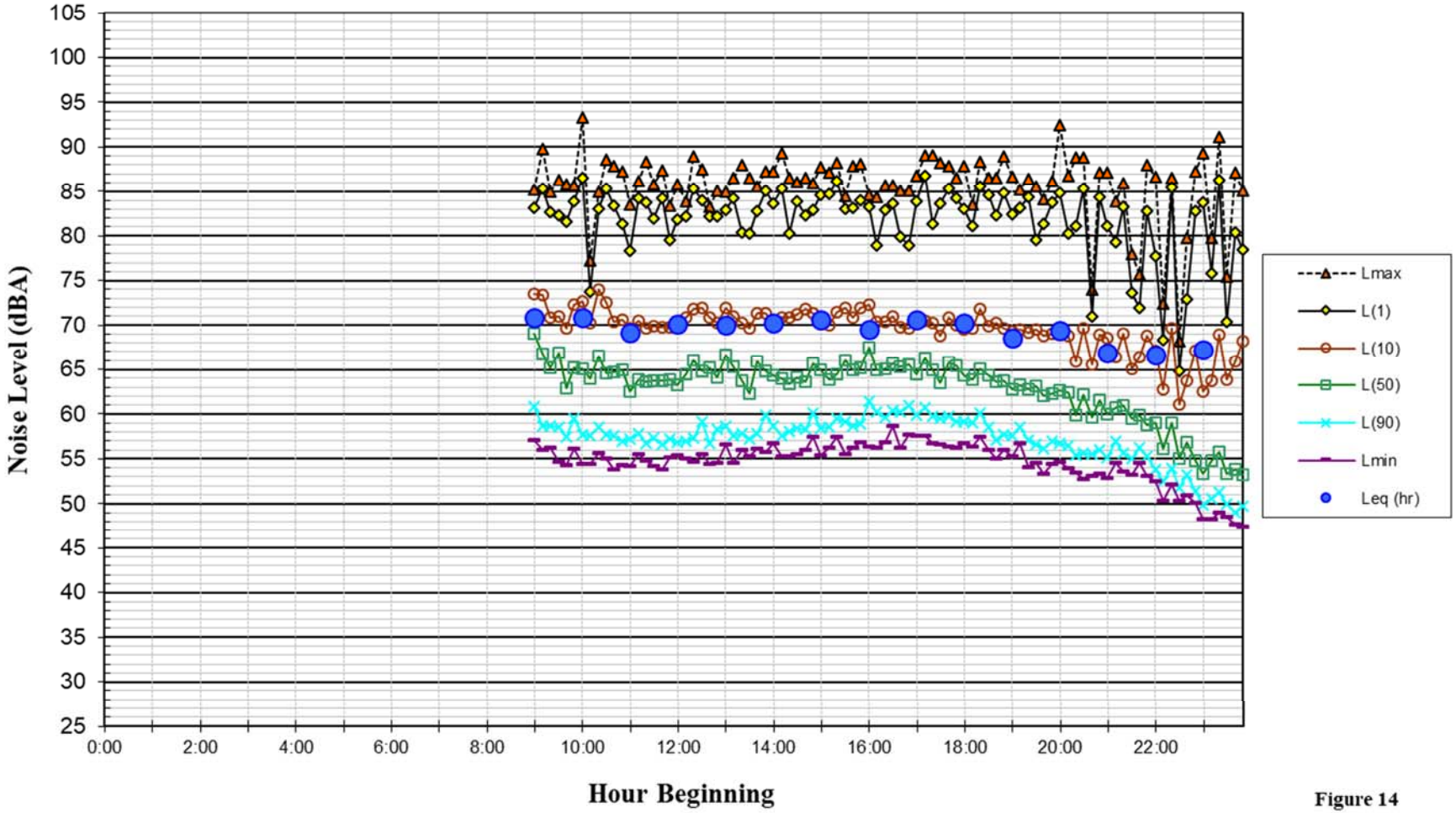
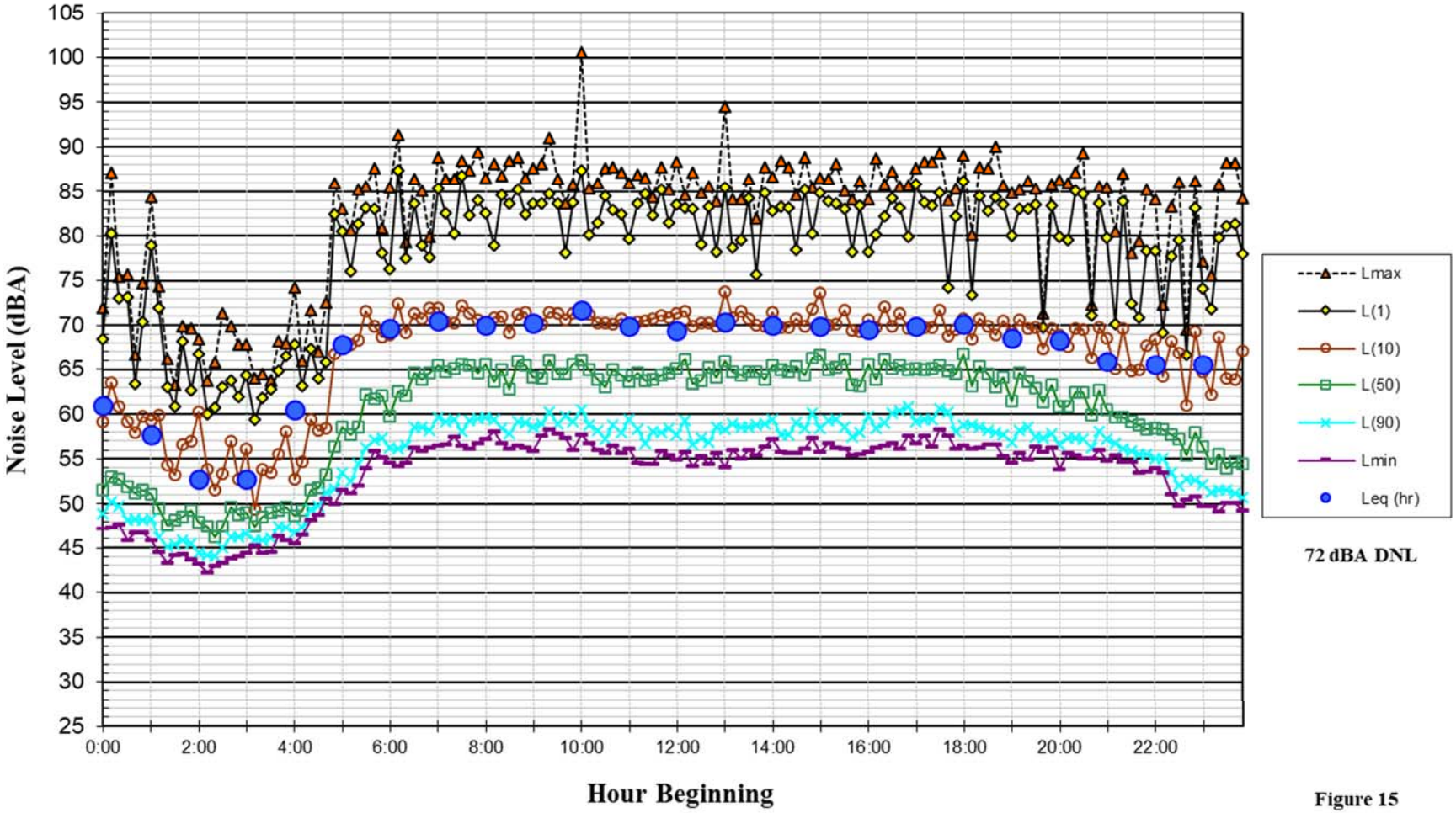


Figure 14


Noise Levels at Noise Measurement Site LT-4
Southeast Corner of Project Site
Wednesday, September 18, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
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25
0:00
2:00
4:00
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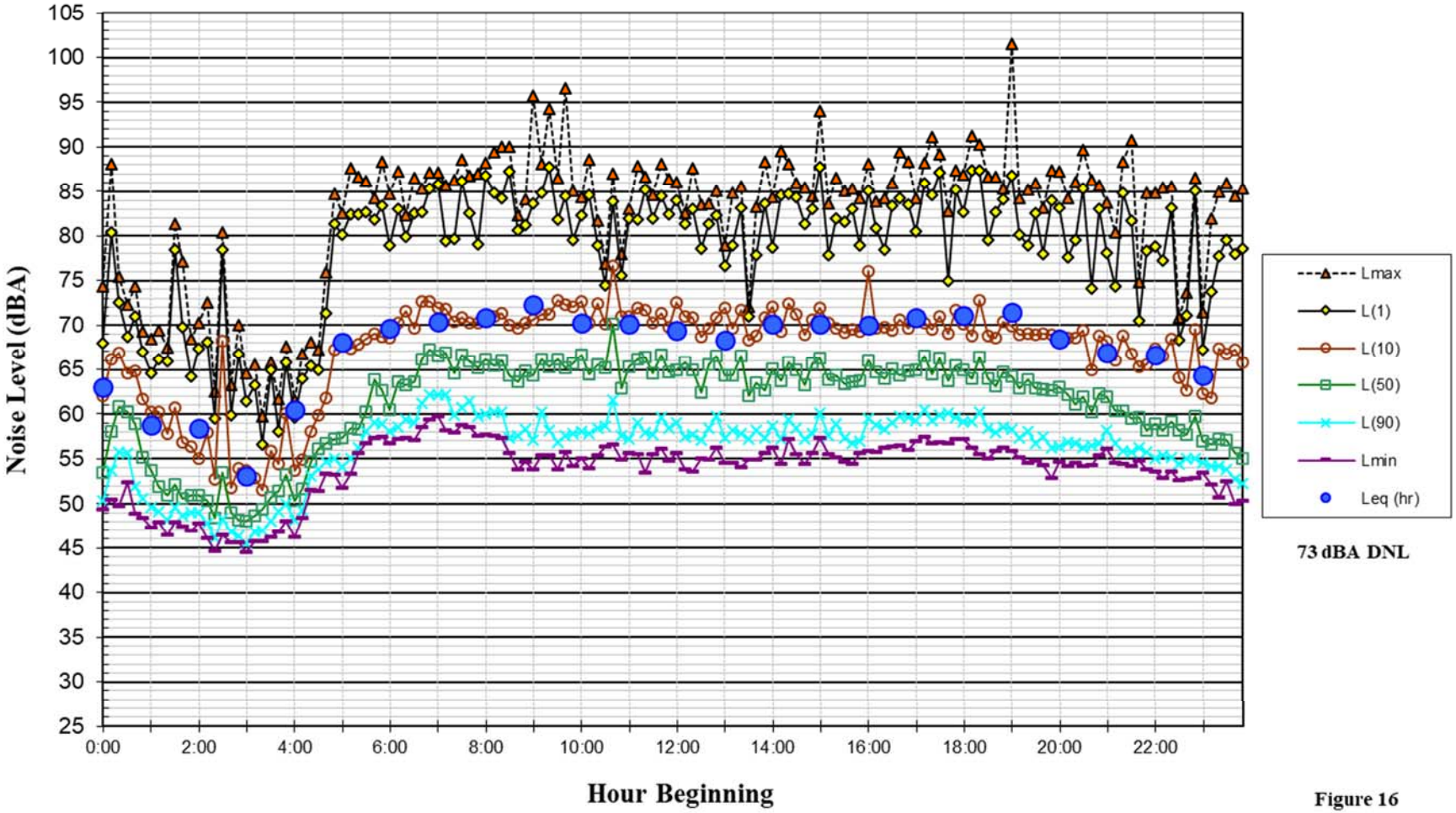
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
72 dBA DNL

Figure 15


Noise Levels at Noise Measurement Site LT-4
Southeast Corner of Project Site
Thursday, September 19, 2019
Noise Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
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0:00
2:00
4:00
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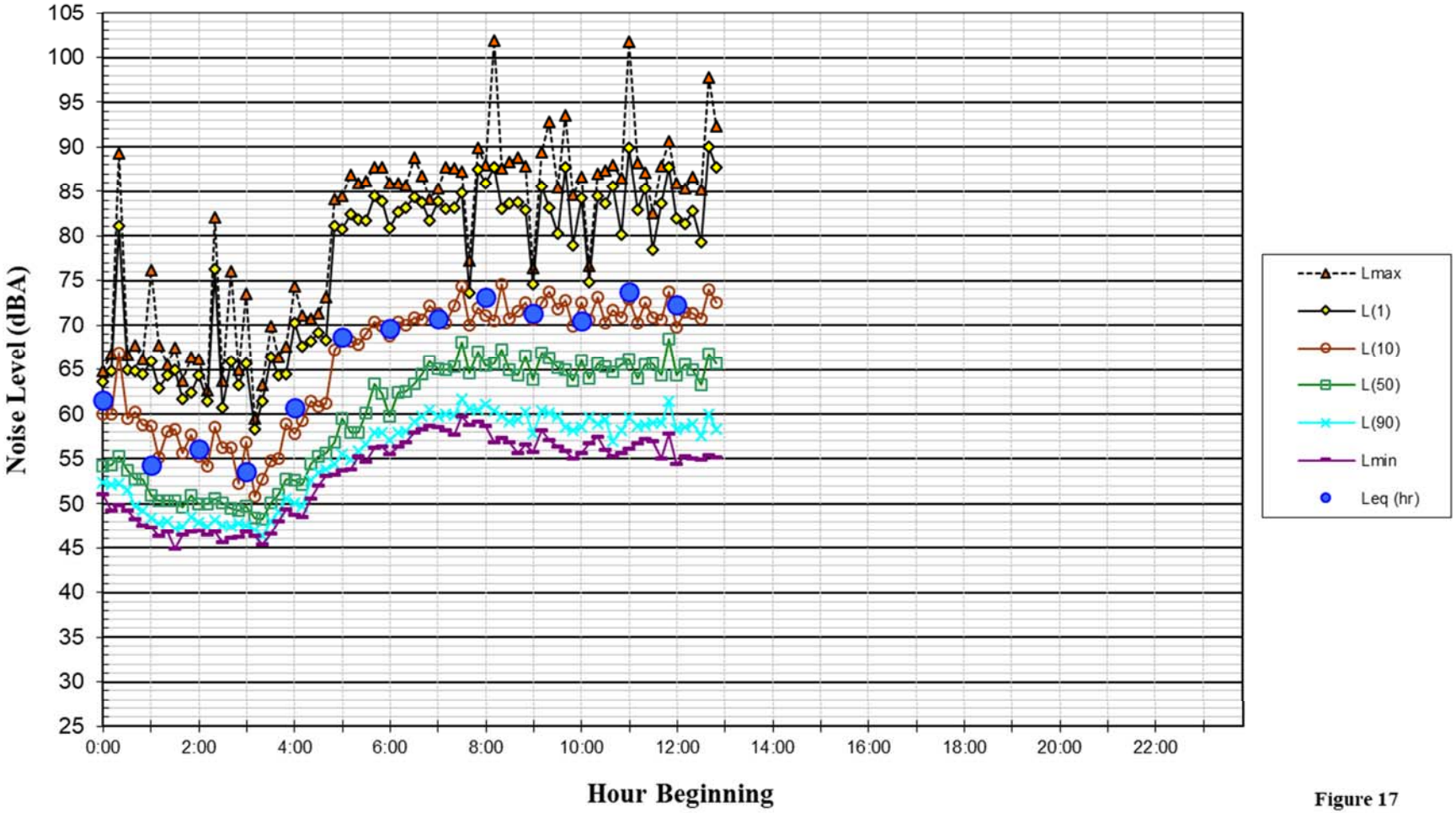
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
73 dBA DNL

Figure 16


Noise Levels at Noise Measurement Site LT-4
Southeast Corner of Project Site
Friday, September 20, 2019
Noise Level (dBA)
105
100
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85
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75
70
65
60
55
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14:00
16:00
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20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 17

PLAN CONSISTENCY ANALYSIS

Site constraints, such as the exposure of the proposed project to excessive levels of noise or vibration, are not considered under CEQA. This plan consistency analysis addresses the compatibility of the project with the noise and vibration environment expected at the site.

Consistency Analysis Thresholds

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 applicable General Plan policies were presented in detail in the Regulatory Background section and are summarized below for the proposed project:

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for the proposed school use and 65 dBA DNL for outdoor sports and recreational uses (Table EC-1).

- The Cal Green Code standards specify an interior noise environment attributable to exterior sources not to exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas of non-residential uses during any hour of operation.

Noise and Land Use Compatibility

Future Exterior Noise Environment

Primary exterior use areas proposed by the project include playgrounds north of Building 1 and southwest of Building 2, an artificial turf sports field just north of Parkmoor Avenue, and a rooftop playspace south of the existing parking structure. The main campus quad and high school plaza areas would be located in the central portion of the site and would be partially shielded by intervening buildings. The primary noise sources affecting the noise environment at these outdoor use areas are local traffic along Meridian Avenue and Parkmoor Avenue. Race Street traffic and VTA light-rail trains would be mostly shielded by intervening buildings.

Based on measurements made during the noise monitoring survey (see Setting Section) and traffic volumes provided in the Traffic Impact Assessment Report1 (see Impact 3), proposed playgrounds north of Building 1 and southwest of Building 2 would be exposed to noise levels of ranging from 62 to 63 dBA DNL when accounting for the 5-foot noise barriers (berm/wall combination) proposed at the boundaries of the playgrounds to attenuate traffic noise generated by Parkmoor Avenue and Meridian Avenue. Proposed 5 foot noise barriers or earth berms, or barrier/berm combination, located as shown in Figures 18 and 19, would provide the necessary noise level reduction to meet the normally acceptable exterior noise level threshold.

[1] Harker Middle School – 4525 Union Avenue, Draft Transportation Impact Analysis; Hexagon Transportation Consultants, Inc., May 21, 2018.

Noise levels at the center of the artificial turf sports field and rooftop playspace are calculated to be less than 60 dBA DNL, and would not exceed the City's normally acceptable exterior noise level noise level threshold.

Future Interior Noise Environment

The Cal Green code requires interior noise levels attributable to exterior sources to not exceed 50 dBA $L_{eq\text{-}1hr}$ in non-residential spaces. The calculated exterior noise level exposures at worst-case building façades are summarized in Table 5, based on the results of the noise monitoring survey and the expected increase in noise levels due to future traffic projections.

TABLE 5 Calculated Noise Levels at Existing and Proposed Buildings, dBA

Roadway	Building - Facade	Exterior, DNL	Exterior, $L_{eq\text{-}1hr}$	Interior, DNL	Interior, $L_{eq\text{-}1hr}$
Meridian Avenue	Buildings 1 and 2 West Façade	72	72	42-47	42-47
Parkmoor Avenue	Buildings 2, 6, and 7 South Facade	66	65	36-41	35-40
Race Street	Buildings 4, 5, and 7 East Facade	67	67	37-42	37-42

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. This analysis assumes that all interior spaces would be mechanically ventilated and windows and doors would be closed for noise control purposes. Standard construction with the windows closed provides approximately 25 to 30 dBA of noise reduction in interior spaces. As shown in Table 5, noise levels inside the existing and proposed buildings would be expected to remain below the CalGreen criterion of 50 dBA $L_{eq(1\text{-}hr)}$ assuming standard construction methods with the windows and doors closed.

The California Collaborative for High-Performance Schools Best Practices Manual states that unoccupied public school classrooms must have a maximum background noise level of no more than 45 dBA L_{eq}. However, it strongly encourages districts and designers to move beyond these prerequisites and achieve background noise levels of 35 dBA L_{eq} for all classrooms. Noise levels would need to be reduce by at least 30 dBA to reach the 45 dBA L_{eq} interior classroom standard and reduced by at least 40 dBA to reach the encouraged 35 dBA L_{eq} interior classroom goal. Standard construction materials, sound-rated performance windows/doors, and the incorporation of an adequate forced air mechanical ventilation system would reduce levels to the 45 dBA L_{eq} interior classroom standard. Sound-insulating wall construction, high sound-rated performance windows/doors, and the incorporation of an adequate forced air mechanical ventilation system would reduce levels to the 35 dBA L_{eq} interior classroom goal.
The following available measures should be considered during final design to reduce interior noise levels to acceptable levels:

- Provide a suitable form of forced-air mechanical ventilation in buildings throughout the site, as determined by the local building official, so that windows can be kept closed to control interior noise and achieve acceptable or desired interior noise levels.

- Confirm the final specifications for noise insulation during the design of the project. In addition to sound-rated windows and doors, other treatments may include, but are not limited to; sound rated exterior wall construction methods, acoustical caulking, insulation, acoustical vents, etc.

Figure 18 Proposed Location of 5-foot Noise Barrier at Building 1 Playground

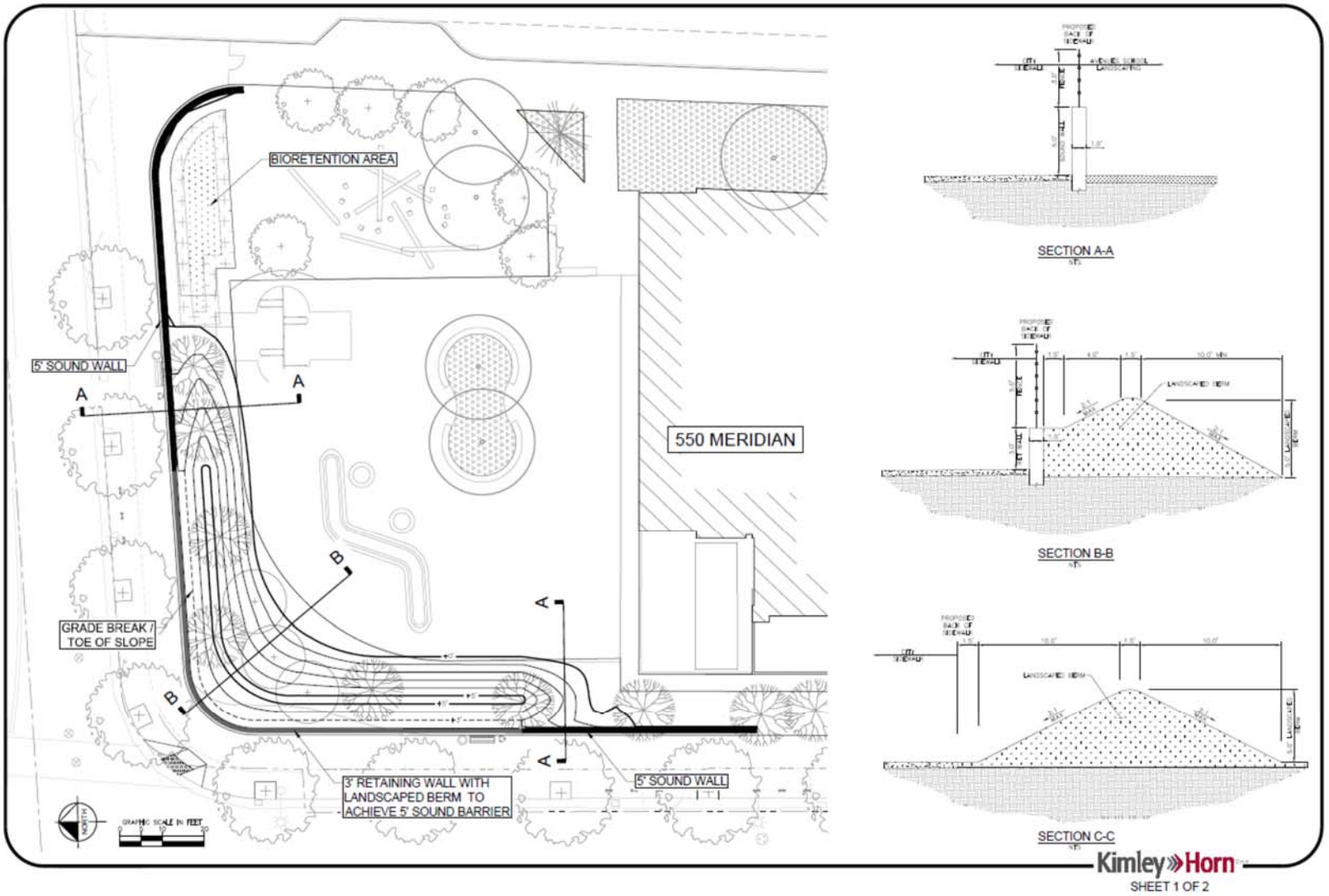
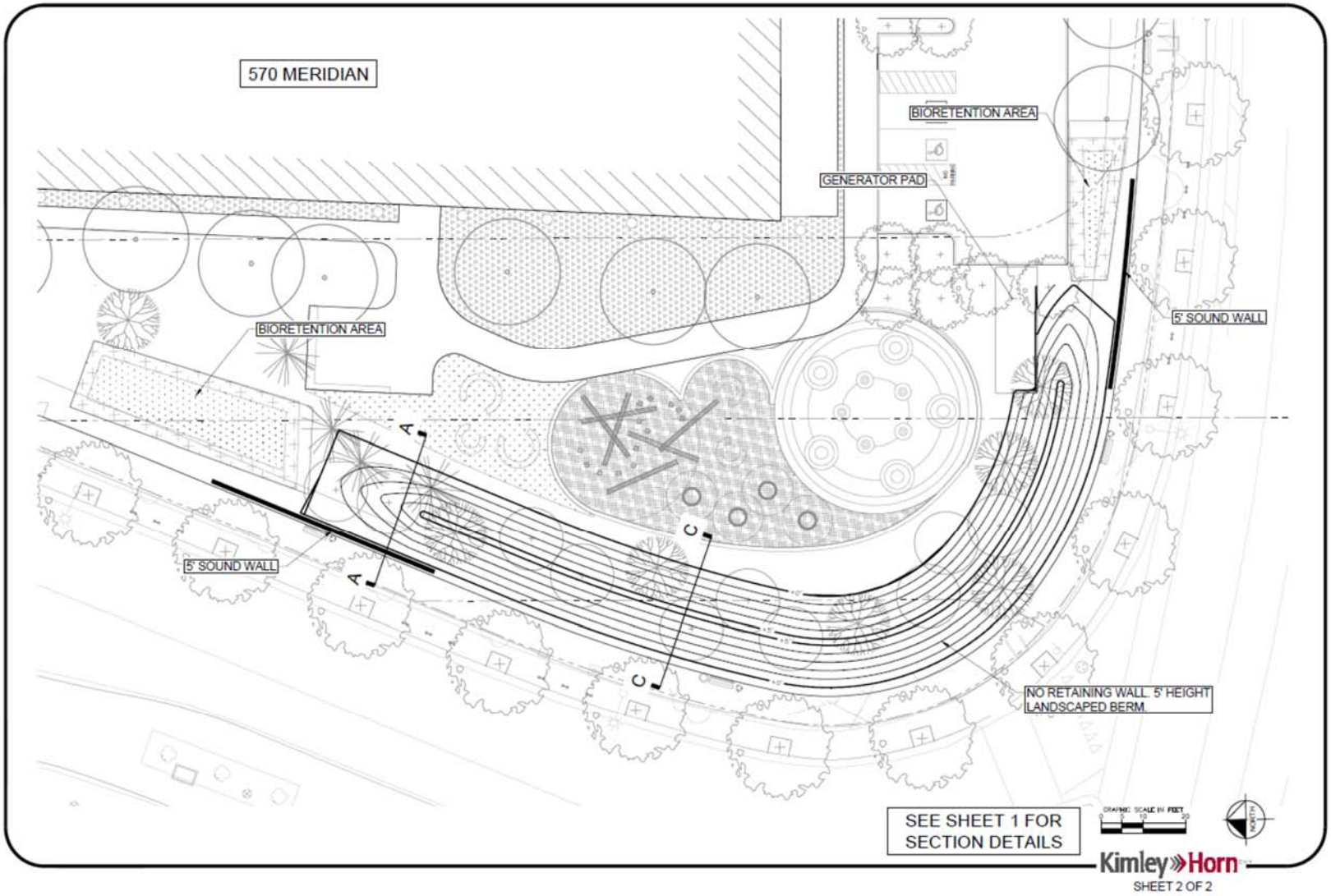


Figure 19 Proposed Location of 5-foot Noise Barrier at Building 2 Playground



Vibration and Land Use Compatibility

The U.S. Department of Transportation, Federal Transit Administration's (FTA) vibration impact assessment criteria[2] were used to evaluate vibration levels produced by light-rail trains at the project site. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria for groundborne vibration are shown in Table 6. Note that there are criteria for frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).[3]

The frequency of the VTA light-rail trains would place the level of train activity in the "frequent events" category and the applicable threshold is 75 VdB for institutional land uses with primarily daytime use. According to the FTA Generalized Ground Surface Vibration Curves[4], vibration levels would be 75 VdB or less at a distance of 40 feet from the centerline of the light-rail train tracks assuming a light-rail train travel speed of 50 mph. Building 7 would be located approximately 65 feet from the light-rail train tracks and exposed to vibration levels of 72 VdB or less, which is below the 75 VdB threshold level. Persons at rest may perceive the vibration; however, vibration controls are not required.

[2]U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, September 2018, FTA Report No. 0123.

[3] These criteria are applied in this analysis to the vibration produced by VTA light rail trains. According to FTA, the criteria may be disregarded altogether for spur rail lines that carry very little rail traffic or have short trains. The spur rail adjoining the site carries very little heavy rail traffic. Based on available data, UPRR reports that there are a total of 2 switching trains daily along this track that serves Lehigh Permanente Quarry. The train passbys occur during daylight hours at speeds between 5 and 10 mph.

TABLE 6 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 µinch/sec, RMS)		
	Frequent Events[1]	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:
1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

1. A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.

    - A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The City of San José considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices.

- A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.

- 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.

2. A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.2 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

3. A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing noise-sensitive land uses would be exposed to a temporary increase in ambient noise levels due to project construction activities. This is a **potentially significant** temporary noise impact.

The potential for temporary noise impacts due to project construction activities would 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. Policy EC-1.7 of the City's General Plan requires that all construction operations within the City to use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours, which are between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday when construction occurs within 500 feet of a residential land use. Further, 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.

Construction activities generate considerable amounts of noise, especially during earth-moving activities and during the construction of the building's foundation when heavy equipment is used. The highest noise levels would be generated during grading, excavation, and foundation construction. The hauling of excavated materials and construction materials would generate truck trips on local roadways, as well.

The total construction duration is assumed to be approximately ten-to fifteen years, estimated to begin in August 2020.

The commencement dates provided for Phases III and IV are estimates and would be subject to market conditions and student enrollment. Each construction phase is estimated to last for approximately a year.

Phase I - The first phase would include the adaptive re-use of the existing buildings at 550 and 570 Meridian Avenue from their current use as commercial office buildings to education facilities, and would demolish the office building at 1401 Parkmoor Avenue and the remaining warehouses along Race Street. The first phase would also construct a portion of the gymnasium building (Building 4), and a portal structure connecting the 550 and 570 Meridian Avenue buildings. The total area for Phase I is approximately 184,000 gross square feet (excluding the new sports field and existing parking structure that would be retained) and would accommodate 1,112 students. The sports field would be built during Phase I. It is anticipated that construction of Phase I would commence in the summer of 2020 and would be complete in fall of 2021 for the beginning of the school year.

Phase II - The second phase of construction would add an approximate 120,000 gross square foot academic building located to the east of the sports field. Phase II would accommodate an additional 1,008 students. It is anticipated that construction of Phase II would commence in the winter of 2023 and would be complete in summer of 2024 for the beginning of the school year.

Phase III - The third phase of construction would expand the gymnasium facilities to include an
aquatic center as well as a theater building. The total area for Phase III construction is approximately 87,000 gross square feet and would accommodate an additional472 students to the campus. It is anticipated that construction of Phase III would commence in the winter of 2027 or 2028 and would be complete in summer of 2028 or 2029, for the beginning of the school year.

Phase IV - The fourth and final phase of construction would construct an approximate 67,000 gross square foot academic building on the southeast corner of the site. Phase IV would add152 new students. It is anticipated that construction of Phase IV would commence in the winter of 2032 or 2033 and would be complete in summer of 2033 or 2034, for the beginning of the school year.

Approximately 9,500 cubic yards of soil would be excavated during Phase I to establish a basement level under Building 4; approximately 43,000 cubic yards would be excavated during Phase III to establish two subterranean levels under Building 5 and complete the expansion of Building 4; and approximately 7,000 cubic yards would be excavated during Phase IV to establish a basement level under Building 7. In total, the project would excavate approximately 59,500 cubic yards of soil to a maximum depth of 22 feet.

A detailed list of construction equipment was not available at the time of this study. 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. Typical construction noise levels at a distance of 50 feet are shown in Tables 7 and 8. Table 7 shows the average noise level ranges, by construction phase, and Table 8 shows the maximum noise level ranges for different construction equipment. Most demolition and construction noise falls with the range of 80 to 90 dBA at a distance of 50 feet from the source. Such noise levels would be expected at the nearest receptors to the site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor.

Table 9 summarizes the predicted noise levels at each receptor during each construction phase. Average construction noise levels were predicted from a source location near the center of each construction phase area, and although shielding by buildings or terrain often result in lower construction noise levels at distant receptors, additional attenuation due to intervening buildings was not accounted for in the calculations. Figure 20 shows the locations of the four proposed construction phases and the receptor locations used to represent sensitive land uses in the project vicinity.

TABLE 7 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 8 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 9 Range of Construction Noise Levels at Receptors by Phase

Receptor	Hourly Average Noise Level, L_{eq} (dBA)			
	Phase I	Phase II	Phase III	Phase IV
R1 – Meridian Avenue Residences	55-69	50-64	50-64	49-63
R2 – Harmon Avenue Residences	56-70	52-66	53-67	50-64
R3 – Vocera Office Building	57-71	54-68	57-71	53-67
R4 – Race Street Residences	53-67	57-71	63-77	58-72
R5 – Race Street/Parkmoor Avenue Residences	51-65	55-69	57-71	58-72
R6 – BASIS Independent School	50-64	54-68	53-67	57-71
R7 – Sobrato Office Building	54-68	59-73	56-70	61-75
R8 – Parkmoor Office Center	51-65	50-64	49-63	49-63

Residences in the project vicinity would be exposed to construction noise levels ranging from 49 to 77 dBA L_{eq} depending on the distance between the construction source and receptor. The BASIS Independent School would be exposed to construction noise levels ranging from 50 to 71 dBA L_{eq}, and nearby commercial office buildings would be exposed to construction noise levels ranging from 49 to 75 dBA L_{eq}. Noise levels due to construction activities would substantially exceed ambient conditions for a period exceeding one year resulting in a **potentially significant** impact.

FIGURE 20 Construction Phases and Receptor Locations

Mitigation Measure 1a:

The potential short-term noise impacts associated with construction of the project would be mitigated by the implementation of General Plan Policy EC-1.7. This policy states:

> Construction operations within the City will be required to use available noise suppression devices and techniques and continue to 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.

The following standard noise control measures shall be implemented:

- Construction will be limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday for any on-site or off-site work within 500 feet of any residential unit. Construction outside of these hours may be approved through a development permit based on a site-specific "construction noise mitigation plan" and a finding by the Director of Planning, Building and Code Enforcement that the construction noise mitigation plan is adequate to prevent noise disturbance of affected residential uses.

- The contractor shall use "new technology" power construction equipment with state-of-the-art noise shielding and muffling devices. All internal combustion engines used on the project site shall be equipped with adequate mufflers and shall be in good mechanical condition to minimize noise created by faulty or poorly maintained engines or other components.

- The unnecessary idling of internal combustion engines shall be prohibited.

- Staging areas and stationary noise-generating equipment shall be located as far as possible from noise-sensitive receptors such as residential uses (a minimum of 200 feet).

- The surrounding neighborhood shall be notified early and frequently of the construction activities.

- A "noise disturbance coordinator" shall be designated to respond to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaints (e.g., beginning work too early, bad muffler, etc.) and institute reasonable measures warranted to correct the problem. A telephone number for the disturbance coordinator would be conspicuously posted at the construction site.

A "construction noise logistics plan," in accordance with Policy EC-1.7, would be required. Typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Utilize 'quiet' models of air compressors and other stationary noise sources where technology exists.

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.

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

- If stationary noise-generating equipment must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used. Any enclosure openings or venting shall face away from sensitive receptors.

- Ensure that generators, compressors, and pumps are housed in acoustical enclosures.

- Locate cranes as far from adjoining noise-sensitive receptors as possible.

- During final grading, substitute graders for bulldozers, where feasible. Wheeled heavy equipment are quieter than track equipment and should be used where feasible.

- Substitute nail guns for manual hammering, where feasible.

- Substitute electrically-powered tools for noisier pneumatic tools, where feasible.

- The Construction Noise Logistic Plan, inclusive of the above shall be signed by a qualified acoustical specialist verifying that the implementation measures included in this Plan meets the reduction to noise levels as required by this mitigation measure.

With the implementation of GP Policy EC-1.7, Municipal Code requirements, and the above measures, the temporary construction noise impact would be reduced to a **less-than-significant** level.

Impact 1b: **Permanent Noise Level Increase.** Traffic generated by the proposed project is not expected to cause a substantial permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

According to Policy EC-1.2 of the City's General Plan, 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. The City's General Plan defines the "normally acceptable" outdoor noise level standard for the residential land uses to be 60 dBA DNL. Existing ambient levels, based on the measurements made in the project vicinity, exceed 60 dBA DNL at receptors along roadways serving the site. 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 due to project traffic would occur if the project would double existing traffic volumes along a roadway over a daily basis.

The project's traffic study[4] provided existing AM and PM peak hour turning movement data for 24 study area intersections. Additionally, the traffic study calculated trip generation information, which were 1,741 net additional trips during the AM peak hour and 680 net additional trips during the PM peak hour. The largest increases in traffic noise levels due to the project would occur during the AM peak hour along Race Street, between Auzerais Avenue and Parkmoor Avenue, Saddle Rack Street, between Meridian Avenue and Race Street, Parkmoor Avenue, between Meridian Avenue and Race Street, and Harmon Avenue, east of Meridian Avenue. Noise-sensitive receptors do not exist along Parkmoor Avenue. Additionally, the segment of Harmon Avenue that would experience additional project trips is bordered by a motorcycle dealership. Harmon Avenue residences are located approximately 100 feet east of the driveway that would be used by slow moving vehicles to access the parking structure and main drop off lane.

Based on the results of the traffic noise modeling, project generated trips would increase hourly average noise levels at noise-sensitive land uses along Saddle Rack Street and Race Street by 3 to 4 dBA L_{eq} during the AM peak traffic hour and by less than 2 dBA during the PM peak traffic hour. Congestion occurring during the AM and PM peak traffic hours often results in even lower levels of traffic noise. During the remaining hours of the school day and during hours of the day when school is not in session, project generated traffic volumes would be low or negligible. On a daily average basis, the project traffic during the peak traffic hours would cause a permanent noise level increase of up to 1 dBA DNL at receptors along Saddle Rack Street, and a 0 to 1 dBA DNL noise increase at receptors along Race Street and all other roadways serving the project area. Although there would be a noticeable increase in traffic noise levels during the peak traffic hours, the comparison of the existing and existing plus project traffic scenarios revealed that the project's contribution to permanent noise level increases along roadways serving the site would

[4] Hexagon Transportation Consultants, Inc., Avenues the World School Draft Traffic Analysis, September 16, 2019.

be 1 dBA DNL or less. The proposed project would not result in a permanent noise increase of 3 dBA DNL or more and the impact is **less-than-significant** impact.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project could generate noise in excess of standards established in the City's General Plan at the nearby sensitive receptors. This is a **potentially significant** impact.

Outdoor Activity Areas

Outdoor learning activities and outdoor play occurring in the playground north of Building 1 would have the potential to increase ambient noise levels at nearby residential land uses. The playground southwest of Building 2, artificial turf sports field just north of Parkmoor Avenue, and a rooftop playspace south of the existing parking structure are not located in the vicinity of noise-sensitive residential land uses and/or are shielded from noise-sensitive residential land uses by intervening structures. These outdoor activity areas would not be expected to produce noise levels that would measurably increase ambient noise levels at noise-sensitive land uses in the project vicinity.

This analysis assumes that the playground north of Building 1 would be used by approximately 15 to 20 students at a time. The timing of outdoor use would vary, but most activity would occur between 11:00 a.m. and noon and between 1:30 p.m. and 2:30 p.m. Lunch and recess would likely occur between noon and 1:00 p.m. over a period of a half an hour each.

Illingworth & Rodkin, Inc. has measured noise generated by outdoor activities at similar schools in the Bay Area. The noise level produced by small group conversations would be expected to reach 69 dBA L_{eq} at a distance of 10 feet. Measurements show that the average noise levels from outdoor play activities typically range from 66 to 68 dBA L_{eq} at a distance of 50 feet. Maximum noise levels from outdoor play typically result from whistles and voices, and can reach 75 dBA L_{max} at a distance of 50 feet.

The center of the playground north of Building 1 would be located approximately 220 feet from the nearest Meridian Avenue residence to the northwest and about 250 feet from the nearest Harmon Avenue residences to the northeast. Outdoor play activities would produce noise levels ranging from 54 to 55 dBA L_{eq} at the nearest residential properties. Outdoor play noise levels would typically be 15 dBA less than the noise levels produced by traffic along Meridian Avenue; therefore, outdoor play, while intermittently audible, would not measurably increase ambient DNL noise levels at Meridian Avenue residences northwest of the site. Noise generated by outdoor play at the playground north of Building 1 would produce noise levels within the lower range of typical daytime noise levels (51 to 66 dBA L_{eq}) currently experienced by Harmon Avenue residences to the northeast. The DNL noise level attributable to outdoor play would reach 47 dBA at the nearest receptor to the northeast assuming a worst-case sound level of 54 dBA L_{eq} produced over a period of five daytime hours (10:00 a.m. to 3:00 p.m.). Outdoor learning/play noise would not measurably increase existing DNL noise levels, which currently

range from 59 to 60 dBA CNEL. The noise produced by outdoor learning/play activities associated with the project would not permanently increase ambient noise levels at nearby noise-sensitive receptors resulting in a **less-than-significant** impact.

Prior to the construction of the buildings proposed during Phases II-IV of the project, the turf sports field would have the greatest potential of all proposed outdoor activity areas to generate noise levels that could affect the noise environment of nearby residential land uses. Based on I&R data, average hourly noise levels resulting from soccer games or lacrosse matches are about 60 dBA L_{eq} at a distance of 100 feet from the center of the field, with maximum noise levels from cheering and whistles as high as 67 dBA L_{max}. At the nearest residences along Race Street, located over 500 feet from the center of the turf sports field and assuming unshielded conditions during Phase I of the project, average hourly noise levels due to the use of the turf sports field would be 46 dBA L_{eq} or less, with maximum instantaneous noise levels up to 53 dBA L_{max}. These noise levels would be more than 10 dBA below existing ambient levels produced by Race Street traffic during daytime and evening hours. This would represent a **less-than-significant** impact as operational noise levels would not contribute to existing hourly average or daily average noise levels at the nearest residential land uses. Once the future buildings proposed as part of Phases II-IV of the project are constructed, operational noise levels produced by the turf sports field would be even less at nearby residential land uses.

Loading Dock

The proposed project would modify the area located to the north of the existing parking structure to accommodate a small loading dock. The raised loading dock with service lift would allow for access to the trash and recyclables area located on the first floor of the garage. Typical noise levels generated by loading and unloading during trash and recyclables pickup and truck deliveries would be similar to the noise levels produced by existing trash/recyclables pickup at other area land uses, truck passbys along local roadways, and by similar commercial activities at surrounding uses. Maximum instantaneous noise levels from truck activities would be infrequent and would therefore not increase the day-night average noise level assuming typical daytime delivery schedules. Infrequent, daytime deliveries are not anticipated to substantially increase ambient noise levels at the nearby noise-sensitive land uses resulting in a **less-than-significant** impact.

Standby Generators

Two standby generators would be relocated on site in order to provide standby power in case of power outages. Each standby generator would be screened by an 8-foot masonry wall.

The existing Olympian XQ105 would be relocated from an area north of Building 1 (550 Meridian Avenue) to the northwest corner of the building, approximately 200 feet from the nearest residential land use to the northwest and 175 to 200 feet from the nearest commercial land uses to the west. According to manufacturer's specifications, the generator produces a sound level of 69 dBA at 23 feet with the enclosure. The testing schedule is not known at this time but typically takes place monthly for approximately one hour. The generator would produce noise levels of approximately 50 to 51 dBA at the nearest residential and commercial land uses

located to the northwest and west assuming the attenuation with distance from the noise source. The noise level produced by the generator would fall 5 to 10 dBA below typical daytime background noise levels produced by traffic along Meridian Avenue. Testing of the generator would likely occur once per month, during the daytime, and last one hour or less. Based on the above testing assumptions, the generator would produce a DNL noise level of 36 to 37 dBA at the nearest residential and commercial land uses.

The Olympian D80P4 standby generator that currently serves Building 2 would also be relocated with the proposed project. The existing generator would be relocated near the southwest corner of Building 2, approximately 350 feet from the nearest commercial land uses. According to manufacturer's specifications, the generator produces a sound level of 96 dBA at 3 feet without additional attenuation from an enclosure. When considering the attenuation with distance from the noise source, noise levels produced by the testing of this generator would reach 55 dBA, which would fall 2 to 5 dBA below typical daytime background noise levels produced by traffic along Meridian Avenue and Parkmoor Avenue. Following the testing assumptions described above, the generator would produce a DNL noise level of 41 dBA at the nearest commercial land uses located to the northwest, southwest, and southeast.

The DNL noise levels produced by the standby generators would not measurably increase ambient DNL noise levels due to traffic along Meridian Avenue and Parkmoor Avenue, which currently are 73 dBA and 72 dBA DNL, respectively. The DNL produced by monthly testing operations would not increase ambient noise levels by 3 dBA DNL or more at noise sensitive receptors in the project vicinity, consistent with the requirements of General Plan Policy EC-1.2. Similarly, monthly testing would not produce noise levels that would regularly exceed the 55 dBA DNL guideline established in General Plan Policy EC-1.3. This is a **less-than-significant** impact.

Rooftop Mechanical Equipment

Various mechanical equipment for heating, ventilation, and air-conditioning, and solar power systems, would likely be installed on the rooftops of the proposed buildings causing most of the operational noise to be projected upward and away from neighboring properties. However, at the time of this analysis, the specific mechanical equipment has not been selected, nor were specific details such as manufacturer's noise data for such equipment available.

Given the close proximity of noise-sensitive uses to the project site and lack of sufficient details about the mechanical equipment, mechanical rooms, and rooftop screen walls, there is the potential for noise from mechanical equipment to exceed 55 dBA DNL at noise-sensitive land uses in the immediate project vicinity. However, no equipment is anticipated for a project of this scale that would make meeting the applicable noise limits with standard noise control measures difficult. During final design of the mechanical systems, the noise levels from the various pieces of equipment on the rooftop should be calculated to ensure compliance with the City's 55 dBA DNL threshold. Design planning should consider the noise criteria associated with such equipment and utilize site planning to locate equipment in less noise-sensitive areas. Other controls could

include, but shall not be limited to, fan silencers, enclosures, and mechanical screening. This is a **potentially significant** impact.

Mitigation Measure 1c:

Mechanical equipment shall be selected and designed to reduce excessive noise levels at the surrounding uses to meet the City's 55 dBA DNL noise level requirement at the nearby noise-sensitive land uses. A qualified acoustical consultant shall be retained to review mechanical noise as these systems are selected to determine specific noise reduction measures necessary to reduce noise to comply with the City's noise level requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and installation of noise barriers, such as enclosures and parapet walls, to block the line-of-sight between the noise source and the nearest receptors. Other alternate measures may be optimal, such as locating equipment in less noise-sensitive areas, such as along the building façades farthest from adjacent neighbors, where feasible. The noise exposure of neighboring properties would be reduced to meet the General Plan thresholds resulting in a **less-than-significant** impact.

Impact 2: **Generation of Excessive Groundborne Vibration.** Construction-related vibration levels would not exceed 0.2 in/sec PPV at adjacent buildings of normal conventional construction or 0.08 in/sec PPV at the nearest sensitive historic structures. **This is a less-than-significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools are used. Construction activities would include the demolition of existing structures, site preparation work, excavation of the below-grade parking level, foundation work, and new building framing and finishing. Piles have not yet been ruled out as a foundation system for the Fitness Facility (Building 4) due to its proximity to the garage structure and piles may also be considered for Building 7.

Policy EC-2.3 of the City of San José General Plan establishes a vibration limit of 0.08 in/sec PPV to minimize the potential for cosmetic damage to sensitive historic structures, and a vibration limit of 0.2 in/sec PPV to minimize damage at buildings of normal conventional construction. The vibration limits contained in this policy are conservative and designed to provide the ultimate level of protection for existing buildings in San José. As discussed in detail below, vibration levels exceeding these thresholds would be capable of cosmetically damaging adjacent buildings. Cosmetic damage (also known as threshold damage) is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage is defined as hairline cracking in masonry or the loosening of plaster. Major structural damage is defined as wide cracking or the shifting of foundation or bearing walls.

Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 10 presents typical vibration levels from construction equipment, other than pile driving equipment, at 25 feet. Jackhammers typically generate vibration levels of 0.035 in/sec PPV and drilling typically generates vibration levels of 0.09 in/sec PPV at 25 feet. Table 10 also

presents construction vibration levels at a distance of 60 feet from the construction equipment to represent the nearest buildings to the site. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.

TABLE 10 Vibration Levels for Typical Construction Equipment at Various Distances

Equipment		PPV at 25 ft. (in/sec)	PPV at 60 ft. (in/sec)
Clam shovel drop		**0.202**	0.077
Hydromill (slurry wall)	in soil	0.008	0.003
	in rock	0.017	0.006
Vibratory Roller		**0.210**	0.080
Hoe Ram		0.089	0.034
Large bulldozer		0.089	0.034
Caisson drilling		0.089	0.034
Loaded trucks		0.076	0.029
Jackhammer		0.035	0.013
Small bulldozer		0.003	0.001

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., September 2019.

Table 11 presents vibration levels from pile driving equipment at 25 feet. Both upper range and typical vibration levels are presented for impact and vibratory pile driving activities. Vibration levels are also presented at distances of 185 feet to represent the nearest off-site buildings of conventional construction and 1,000 feet to represent the nearest sensitive historic structures.

TABLE 11 Vibration Levels for Pile Driving Equipment at Various Distances

Equipment		PPV at 25 ft. (in/sec)	PPV at 185 ft. (in/sec)	PPV at 1,000 ft. (in/sec)
Pile Driver (Impact)	upper range	1.158	0.128	0.020
	typical	0.644	0.071	0.011
Pile Driver (Sonic)	upper range	0.734	0.081	0.013
	typical	0.17	0.019	0.003

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., January 2020.

According to Policy EC-2.3 of the City of San José General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historic structures, and a vibration limit of 0.20 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction. A review of the City of San José Historic Resource Inventory[5]

[5] City of San José Historic Resources Inventory, https://www.sanjoseca.gov/DocumentCenter/View/35475

identified the residence located at 1425 Douglas Street, over 1,000 feet from the project site, as the only historic resources in the site vicinity. Groundborne vibration levels due to typical construction activities would not exceed 0.08 in/sec PPV at distances greater than 60 feet, and groundborne vibration levels due to pile driving activities would not exceed 0.08 in/sec PPV at distances greater than 300 feet. Therefore, the impact to historic structures in the site vicinity is **less-than-significant**.

A significant impact would result at nearby buildings of normal conventional construction if groundborne vibration levels attributable to project construction would exceed 0.20 in/sec PPV. Project-generated vibration levels from typical construction equipment would fall below the General Plan threshold of 0.20 in/sec PPV at other surrounding conventional buildings located 30 feet or more from the project site. Neither cosmetic, minor, or major damage would occur at conventional buildings located 60 feet or more from the project site. Similarly, vibration levels produced by pile driving activities would fall below the General Plan threshold of 0.20 in/sec PPV at conventional buildings located 125 feet or more from the project site and no damage of any kind would be expected. This is a **less-than-significant** impact.

At these locations, and in other surrounding areas where vibration would not be expected to cause cosmetic damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration (use of jackhammers and other high-power tools). By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

Mitigation Measure 2: **None required.**

Impact 3: **Excessive Aircraft Noise.** The project site is located approximately 2.2 miles from a public airport or public use airport, but would not expose people residing or working in the project area to excessive aircraft noise. **This is a less-than-significant impact.**

Norman Y. Mineta San José International Airport is a public-use airport located approximately 2.2 miles north of the project site. The project site lies outside the 60 dBA CNEL 2027 noise contour of the airport, according to the Norman Y. Mineta San José International Airport Master Plan Update Project[6] report published in February 2010 as an addendum to the Environmental Impact Report (see Figure 21). This means that future exterior noise levels due to aircraft from Norman Y. Mineta San José International Airport are compatible with the proposed use. This is a **less-than-significant** impact.

Mitigation Measure 3: **None required.**

[6] 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.

FIGURE 21 2027 CNEL Noise Contours for SJIA Relative to Project Site