Appendix E: Noise and Vibration Assessment

295 EAST VIRGINIA STREET RESIDENTIAL PROJECT NOISE AND VIBRATION ASSESSMENT SAN JOSÉ, CALIFORNIA

October 27, 2017

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Prepared for:

Kristy Weis
Project Manager
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Michael S. Thill

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

Job No.: 14-091

Note: The following noise and vibration assessment analyzed the project's building height of up to 91 feet. The project proposes a maximum height of 87 feet.

INTRODUCTION

This report presents the results of the noise assessment completed for the residential project to be located at 295 E. Virginia Street in San José, California. The project proposes to rezone the site to PD – Planned Development to allow for the construction of 295 residential units. The existing development on-site, including existing trees, would be demolished and removed as a result of the project. The project proposes to obtain a street vacation from the City for the northern segment of S. 6th Street between I-280 and E. Virginia Street for parking for the project, as described below.

The project proposes to develop a five-story (up to 91 feet tall) residential building constructed on a podium above ground level parking. The residences would wrap around a central courtyard area. The courtyard would consist of approximately 16,300 square feet of common open space for residents and guests and include amenities such as landscaping, seating areas, and a barbecue area. Underneath the podium, a total of 150 vehicle parking spaces (including four accessible stalls), 29 motorcycle parking spaces, bicycle storage and workshop, additional storage space for tenants, a community room, and a fitness room would be provided at grade. Vehicle and cyclists would have access to the project via a driveway along E. Virginia Street.

The Setting section of this report presents the fundamentals of environmental noise and vibration, a discussion of policies and standards applicable to the project, and the results of ambient noise monitoring surveys made at the project site. The Impacts and Mitigation Measures section of the report provides an evaluation of the potential significance of project-related noise and vibration impacts, and where necessary, mitigation to reduce impacts to a less-than-significant level.

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* (*DNL* or L_{dn}) 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 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 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 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.

Damage caused by vibration can be classified as cosmetic or structural. Cosmetic damage includes minor cracking of building elements (exterior pavement, room surfaces, etc.). Structural damage includes threatening the integrity of the building. Damage resulting from construction related vibration is typically classified as cosmetic damage. 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. The 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 groundborne vibration or groundborne 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;

(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.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA DNL/CNEL in any habitable room.

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. Applicable standards and guidelines for land uses in San José include:

Interior Noise Levels

- The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

    - For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding

by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

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.

EC-1.11 Require safe and compatible land uses within the Mineta San José International Airport noise zone (defined by the 65 CNEL contour as set forth in State law) and encourage aircraft operating procedures that minimize noise.

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. This code is not explicit in terms of the acoustical descriptor associated with the noise level limit. However, a reasonable interpretation of this standard, which is based on policy EC-1.3 of the City's General Plan, would identify the ambient base noise level criteria as a day-night average noise level (DNL).

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.

Chapter 20.40.500 of the Municipal Code prohibits outdoor activity, including loading, sweeping, landscaping or maintenance, which occurs within 150 feet of any residentially zoned property, between the hours of 12:00 a.m. midnight and 6:00 a.m.

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 approximately 1.2 acres in size and is located just north of E. Virginia Street, west S. 7th Street and south of the I-280. Single-family housing bounds the project site to the west and east. Commercial uses bound the project site to the south. The existing noise environment at the site and in the vicinity results primarily from traffic on I-280, S. 7th Street, The S. 6th Street offramp, and E. Virginia Street.

A noise monitoring survey was conducted between June 24, 2014 and June 26, 2014 to document existing noise conditions at the project site. The noise monitoring survey included two long-term noise measurements (LT-1 and LT-2) and one short-term measurement (ST-1). Noise measurements locations are shown in Figure 1.

Long-term noise measurement LT-1 was located at the southern portion of the project site approximately 30 feet from the center of E. Virginia Street and about 12 feet above the ground. Noise levels measured at this site were primarily the result of traffic on E. Virginia Street and background noise from I-280. Hourly average noise levels typically ranged from 67 to 70 dBA L_{eq} during the day and from 57 to 67 dBA L_{eq} at night. The calculated day-night average noise level at this location was 71 dBA DNL. Long-term noise measurement LT-2 was located at the eastern portion of the project site on S. 7th Street and about 12 feet above the ground. Noise levels measured at this site were primarily the result of traffic on S. 7th Street and I-280. Hourly average noise levels typically ranged from 70 to 75 dBA L_{eq} during the day and 61 to 73 dBA L_{eq} at night. The calculated day-night average noise level at this location was 76 dBA DNL. Appendix 1 summarizes the data collected at the two long-term measurement sites.

Attended short-term noise measurements were made at one additional location (ST-1) to complete the June 2014 noise monitoring survey. Short-term noise measurement ST-1 was made at the approximate center of the project site. The ten-minute average noise level was 65 dBA L_{eq}. Table 4 summarizes the results of these measurements.

Table 4: Summary of Short-Term Noise Measurement Data

Noise Measurement Location	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}	DNL
ST-1: ~20 feet from the center of Laurel Grove Lane. (6/26/2014, 1:00 p.m.- 1:10 p.m.)	71	70	67	65	63	65	66

Note: DNL approximated by correlating to corresponding period at long-term site.

Figure 1: Noise and Vibration Measurement Locations

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Appendix G of the CEQA Guidelines states that a project would normally be considered to 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 receptors 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. For residential noise and land use compatibility, exterior noise levels must be maintained at or below 60 dBA DNL and interior noise levels must be maintained at or below 45 dBA DNL.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.2 in/sec

PPV (peak particle velocity) would have the potential to result in cosmetic damage to normal buildings located on parcels in the immediate site vicinity. For the nearest sensitive historic structures, a vibration limit of 0.08 in/sec PPV (peak particle velocity) is used to minimize the potential for cosmetic damage to the building.

- A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receptors 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 one year or more, constitute a significant temporary noise increase at adjacent residential land uses.

Impact 1: **Noise and Land Use Compatibility.** Residential uses developed at the project site would be exposed to exterior noise levels greater than 60 dBA DNL, which exceeds the noise and land use compatibility standards presented in the City of San Jose's General Plan. Interior noise levels would be expected to exceed 45 dBA DNL without the incorporation of noise insulation features into the project's design. **This is a significant impact.**

Future Exterior Noise Environment

The future noise environment at the project site will result primarily from vehicular traffic along I-280, E. Virginia Street, and S. Seventh Street. Future transportation-related noise levels at the project site were calculated based on adjustments made to existing noise level data assuming future increased traffic along area roadways. Noise levels throughout the project site would exceed the City of San José's "Normally Acceptable" noise and land use compatibility goal of 60 dBA DNL, but would vary depending upon the proximity of receptors to area roadways and the presence of shielding features (e.g., proposed buildings).

Future traffic noise levels along I-280 are calculated to increase by 1 dBA DNL, and day-night average noise levels from I-280 traffic are calculated to reach 78 dBA DNL at the proposed setback of residential land uses with line-of-sight to the roadway. The future exterior noise environment at residential land uses proposed adjacent to E. Virginia Street are calculated to reach 72 dBA DNL and 77 dBA DNL along S. Seventh Street.

The proposed project includes two common outdoor use areas. The future noise level at the unshielded rooftop deck located at the northeast corner of the building is calculated to range from 74 to 78 dBA DNL, and would fall into the "Unacceptable" noise and land use category as defined by the City of San Jose. Approximately 5 to 10 dBA of noise reduction would be expected at portions of the rooftop deck not having direct line-of-sight to I-280 traffic (i.e., areas away from the northernmost edge of the deck where the building edge and parapet walls would acoustically shield I-280 traffic noise); however, exterior noise levels at this rooftop deck would continue to exceed the City's "Normally Acceptable" threshold for exterior noise levels. A review of the site

plan indicates that one podium level common courtyard would be located in an area fully shielded by the residential buildings from I-280and S. Seventh Street. Exterior noise levels at the proposed podium level outdoor use area are calculated to be less than 60 dBA DNL and would meet the City's "Normally Acceptable" exterior noise level limit of 60 dBA DNL. Therefore, exterior noise levels at one of the two common outdoor use areas would meet the "Normally Acceptable" noise and land use compatibility standards as defined by the City of San Jose, resulting in a less-than-significant impact.

Future Interior Noise Environment

Interior noise levels within new residential units are required by the City of San Jose to be maintained at or below 45 dBA DNL. Perimeter residential units would be exposed to future noise levels greater than 60 dBA DNL with the highest future noise exposures occurring at unshielded residential facades nearest I-280. Future noise levels at these unshielded facades are calculated to reach 78 dBA DNL. Future noise levels at the unshielded facades along E. Virginia Street are calculated to reach 72 dBA DNL and 77 dBA DNL along S. Seventh Street.

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. Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. In exterior noise environments ranging from 60 dBA L_{dn} to 65 dBA DNL, interior noise levels can typically be maintained below City standards with the incorporation of an adequate forced air mechanical ventilation system in each residential unit, allowing the windows to be closed. In noise environments of 65 dBA DNL or greater, a combination of forced-air mechanical ventilation and sound-rated construction methods is often required to meet the interior noise level limit.

Mitigation Measure 1:

The following mitigation measures shall be incorporated into the project:

- A qualified acoustical consultant shall review final site plan, building elevations, and floor plans prior to construction to calculate expected interior noise levels as required by State noise regulations. Project-specific acoustical analyses are required to confirm that the design results in interior noise levels reduced to 45 dBA DNL or lower. Units facing I-280, E. Virginia Street, and S. Seventh Street would require analysis for potential sound-rated construction methods and building facade treatments to maintain interior noise levels at or below acceptable levels. These treatments would include, but are not limited to; sound rated windows and doors, sound rated wall constructions, acoustical caulking, protected ventilation openings, etc. A review of the building floor plans and elevations indicates that windows and doors with a minimum Sound Transmission Class (STC)[1] rating of 32 to 37 will be needed at units having direct line-of-sight to I-280, E. Virginia Street, and S.

[1] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

Seventh Street. The specific determination of what noise insulation treatments are necessary will be conducted on a unit-by-unit basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, will be submitted to the City along with the building plans and approved design prior to issuance of a building permit.

- Building sound insulation requirements would need to include the provision of forced-air mechanical ventilation for all perimeter residential units, so that windows could be kept closed at the occupant's discretion to control noise.

With the implementation of the above measure, the impact would be less-than-significant.

Impact 2: **Project-Generated Traffic Noise.** Project-generated traffic would not substantially increase ambient noise levels at receptors in the project vicinity. **This is a less-than-significant impact.**

Traffic data provided by Hexagon Transportation Consultants, Inc. was reviewed to calculate potential project-related traffic noise level increases at noise-sensitive receptors located along roadways serving the project site. These traffic data included turning movement counts at the nine study area intersections for existing conditions and projections for existing plus project, background, and background plus project traffic conditions. Roadway link volumes were calculated based on the turning movement data and compared to existing conditions in order to calculate the anticipated noise level increase under each scenario, and the project's relative contribution under each scenario. Based on these comparisons, traffic noise levels along roadways serving the project site are anticipated to increase by up to 0.4 dBA L_{eq} during the AM peak hour and by up to 0.5 dBA L_{eq} during the PM peak hour. The noise increases expected during the peak traffic hours would correlate to the change in noise levels expected on a daily average basis; therefore, the project would increase traffic noise levels at receptors along roadways serving the site by less than 1 dBA DNL. The project would not result in a measureable increase in noise at sensitive residential receivers in the project vicinity and the impact is less-than-significant.

Mitigation Measure 2: **None required.**

Impact 3: **Construction Vibration.** Vibration levels generated during demolition and construction activities may be perceptible at neighboring land uses, but would not be excessive or cause cosmetic or structural damage to 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, etc.) are used in areas adjoining developed properties. Construction activities would include demolition of existing structures, excavation, grading, 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.

The City of San José requires that new development minimize vibration impacts to adjacent uses during demolition and construction activities. General Plan Policy EC-2.3 establishes a vibration

limit of 0.08 in/sec PPV (peak particle velocity) for sensitive historic structures and 0.20 in/sec PPV for residential buildings of normal conventional construction.

Table 4 presents typical vibration levels that could be expected from construction equipment at 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 of the work area. 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. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

No sensitive historic buildings, buildings that are documented to be structurally weakened, or residential buildings adjoin the project site. The nearest sensitive historic building is located approximately 350 feet north of the site at 702 S. Seventh Street, and the nearest buildings of normal conventional construction are approximately 90 feet south of the site opposite E. Virginia Street. At 90 feet, groundborne vibration levels produced by project construction activities would have the potential to reach 0.031 in/sec PPV, and at 350 feet, groundborne vibration levels produced by project construction activities would have the potential to reach 0.004 in/sec PPV. Groundborne vibration levels would not exceed the 0.2 in/sec PPV threshold for normal conventional buildings in the project vicinity or the 0.08 in/sec PPV threshold for sensitive historic buildings in the project vicinity.

At affected locations, and in other surrounding areas where vibration would not be expected to cause structural 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 vibratory rollers 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.

TABLE 4 Vibration Source Levels for Construction Equipment[2]

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
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.

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

Mitigation Measure 3: **None Required.**

Impact 4: **Temporary Construction Noise.** Noise generated by construction activities at the site would not be expected to adversely affect adjacent land uses. **This is a less-than-significant impact.**

The City of San José requires construction operations 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.

Noise impacts resulting from construction depend on 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.

Construction activities generate considerable amounts of noise, especially during earth moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 90 to 95 dBA at a distance of 50 feet from the noise source. Typical hourly average construction generated noise levels are about 81 dBA to 88 dBA measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). Hourly average noise levels generated by the construction of residential units would range from about 65 dBA to 88 dBA measured at a distance of 50 feet depending on the amount of activity at the site. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

The nearest noise sensitive receptors are located approximately 200 feet east of the project site, on the northwest corner of E. Virginia Street and S. Seventh Street. Existing hourly average noise levels along this roadway resulting from traffic noise is approximately 75 dBA L_{eq} during the day. Hourly average noise levels generated by construction activities on site are calculated to range from approximately 69 dBA to 76 dBA and would be similar to existing noise levels resulting from local traffic noise. Noise generated by construction activities would temporarily elevate noise levels at adjacent noise sensitive receptors, but this would be considered a less-than-significant impact assuming that construction activities are conducted in accordance with the provisions of the City of San Jose and with the implementation of construction best management practices.

- 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.

- Permitted work activities shall be conducted exclusively within the interior of enclosed building structures provided that such activities are inaudible to existing adjacent residential uses. Exterior generators, water pumps, compressors and idling trucks are not permitted. The developer shall be responsible for educating all contractors and subcontractors of said construction restrictions. Rules and regulation pertaining to all construction activities and limitations identified in this permit, along with the name and telephone number of a developer appointed disturbance coordinator, shall be posted in a prominent location at the entrance to the job site. The Director of Planning, at his discretion, may rescind provisions to allow extended hours of construction activities on weekends upon written notice to the developer.

- 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 poor maintained engines or other components.

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

- The developer will implement the following measures to minimize construction noise impacts on the surrounding sensitive land uses to the fullest extent possible. The measures may include, but not be limited to, the following:
  - Early and frequent notification and communication with the neighborhood of the construction activities and construction schedule.
  - Prohibit unnecessary idling of internal combustion engines.
  - Best available noise control practices (including mufflers, intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds) shall be used for all equipment and trucks in order to minimize construction noise impacts.
  - If impact equipment (e.g., jack hammers, pavement breakers, rock drills) is needed during Project construction, hydraulically or electric-powered equipment shall be used wherever feasible to avoid the noise associated with compressed-air exhaust from pneumatically powered tools. However, where use of pneumatically powered tools is unavoidable, an exhaust muffler on the compressed-air exhaust shall be used. External jackets on the tools themselves shall also be used if available and feasible.
  - Locate equipment at the work area to maximize the distance to noise-sensitive receptors and to take advantage of any shielding that may be provided by other on-site equipment.
  - Designate a "noise disturbance coordinator" who would be responsible for responding 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.

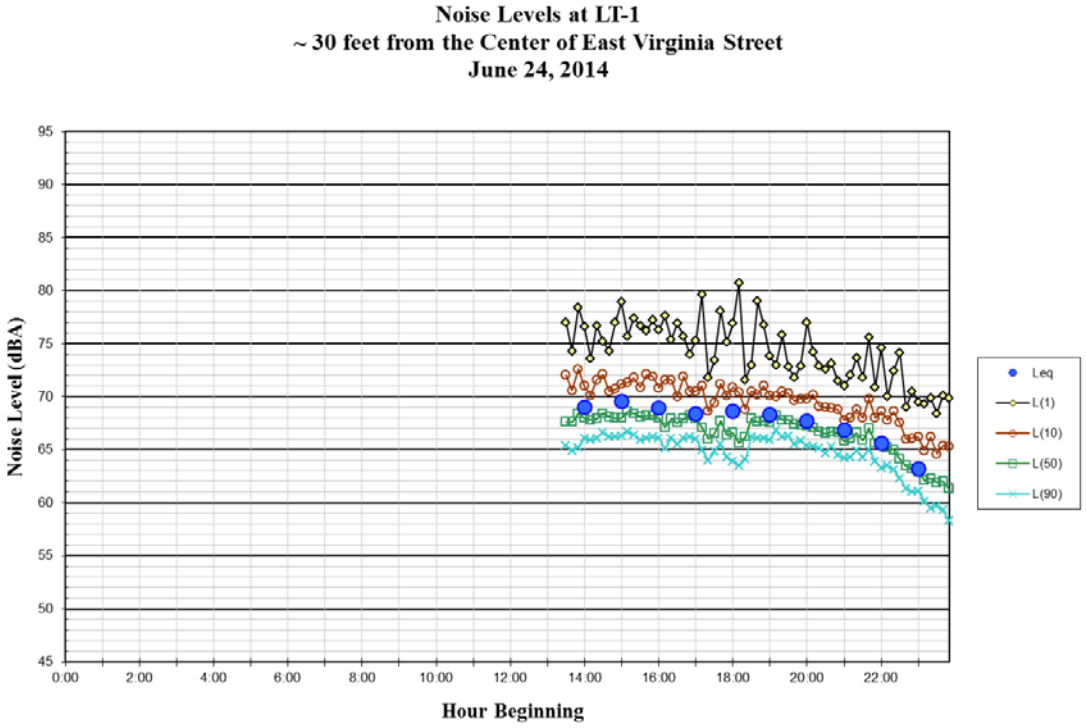
Mitigation Measure 4: **No additional measures are required.**

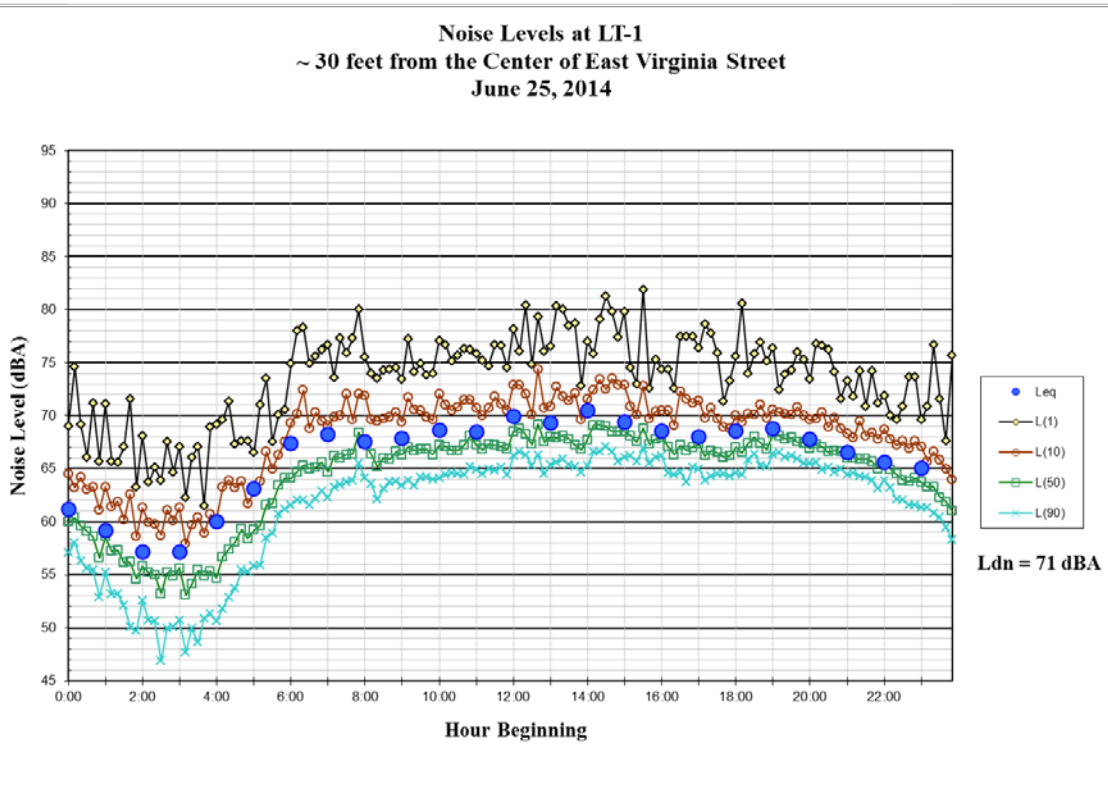
Impact 5: **Noise and Land Use Compatibility (Aircraft).** The project site is located approximately 2.7 miles southeast of Mineta San Jose International Airport, but outside of the 65 dBA CNEL aircraft noise contour. The noise environment due to aircraft would be compatible with the proposed residential land use. **This is a less-than significant impact.**

The Santa Clara County ALUC has jurisdiction over new land uses in the vicinity of airports, and establishes 65 dBA CNEL as the maximum allowable noise level considered compatible with residential uses. The project site is located approximately 2.7 miles southeast of San Jose Mineta International Airport; however, a review of the Santa Clara County Comprehensive Land Use Plan indicates that the project site is located outside the 65 dBA CNEL noise contour line for aircraft activities. Residential land uses are considered compatible in noise environments due to aircraft that are 65 dBA CNEL or less. This would be considered a less-than-significant impact.

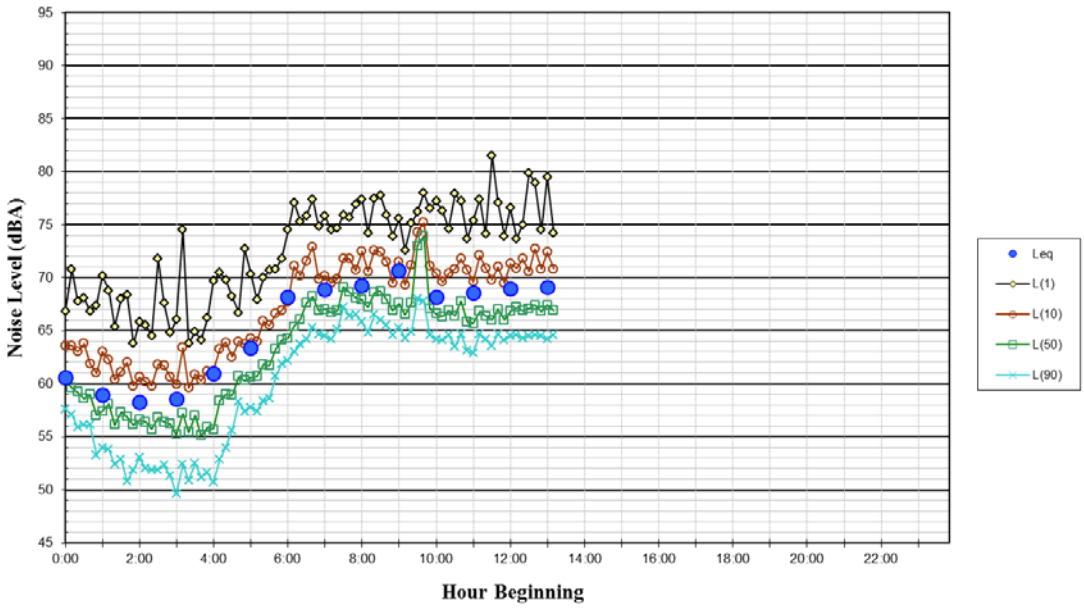
Mitigation Measure 5: **None Required.**

Appendix 1: Daily Trend in Noise Levels

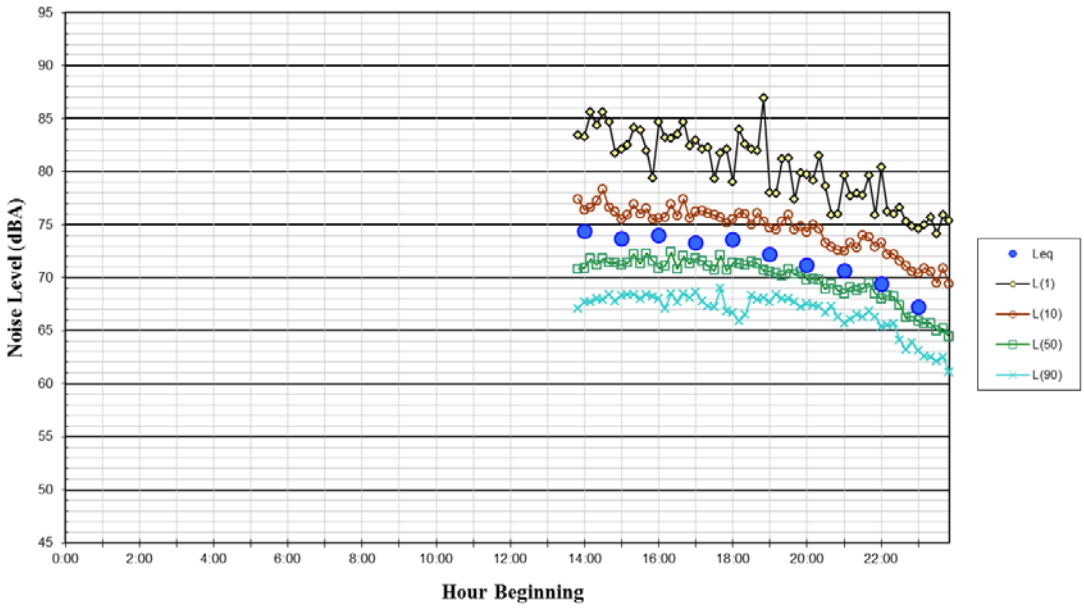




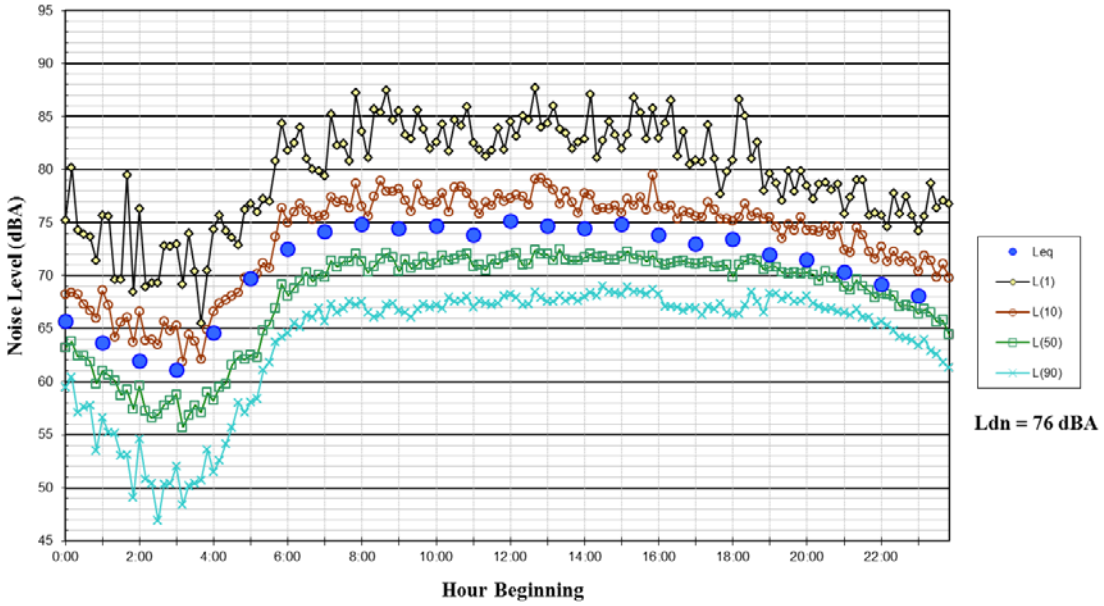
Noise Levels at LT-1
~ 30 feet from the Center of East Virginia Street
June 26, 2014



Noise Levels at LT-2
~ 21 feet from the Center of South Seventh Street
June 24, 2014



Noise Levels at LT-2
~ 21 feet from the Center of South Seventh Street
June 25, 2014



Ldn = 76 dBA

Noise Levels at LT-2
~ 21 feet from the Center of South Seventh Street
June 26, 2014