

Appendix E
Noise and Vibration Assessment

Great America Parkway and Tasman Drive Office Project

GREAT AMERICA PARKWAY AND TASMAN DRIVE PROJECT NOISE AND VIBRATION ASSESSMENT

Santa Clara, California

September 24, 2021

Prepared for:

Amber Sharpe
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Carrie J. Janello
Michael S. Thill

ILLINGWORTH & RODKIN, INC.
/// Acoustics • Air Quality ///

429 East Cotati Avenue
Cotati, CA 94931
(707) 794-0400

Project: 20-120

INTRODUCTION

An office development project is proposed at two parcels (APNs 104-49-025 and -026), which are located at 2901 Tasman Drive, 5155 Old Ironsides Drive, 2952 Bunker Hill Drive, and 5150 Great America Parkway in Santa Clara, California. The site is currently developed with four two-story office buildings that would be demolished as part of the proposed project. The project would construct two 12-story office buildings, totaling 1,031,455 square feet. Additionally, the project would construct a two-story amenity building (approximately 38,185 square feet) and structured parking.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory background, and describes the existing ambient noise environment at the project site; 2) the Plan Consistency Analysis Section discusses noise/vibration and land use compatibility utilizing applicable regulatory background; 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 measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

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.

Railroad and light rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People’s response to ground vibration from rail vehicles has been correlated best with the average, root mean square (RMS) velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1×10^{-6} in/sec RMS, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation “VdB” is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates some common sources of vibration and the association to human perception or the potential for 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 p.m. and 7:00 a.m.
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 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
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	
	10 dBA	Broadcast/recording studio
	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, April 2020.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
Lower limit for equipment ultra-sensitive to vibration	50	Background vibration in residential settings in the absence of activity

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, September 2018.

Regulatory Background - Noise

The State of California and the City of Santa Clara have established noise criteria, and the Federal Transit Administration (FTA) and the California Department of Transportation (Caltrans) have established vibration criteria that are applicable in this assessment. The State of California Environmental Quality Act (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) 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; or
- (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.

2019 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings, as set forth in the 2010 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). These standards were not altered in the 2019 revisions. 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. Both of 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 or additional envelope or altered 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 within the 65 dBA CNEL or DNL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the Noise Element of the General Plan.

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 or addition envelope or altered envelope shall be constructed to provide an

interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq}(1-hr)$) of 50 dBA in occupied areas during any hour of operation.

City of Santa Clara General Plan. The City of Santa Clara's General Plan identifies noise and land use compatibility standards for various land uses and establishes policies to control noise within the community. Table 5.10-2 from the General Plan shows acceptable noise levels for various land uses. Commercial land uses are considered compatible in noise environments of 65 dBA $L_{dn}/CNEL$ or less. The guidelines state that where the exterior noise levels are greater than 65 dBA $L_{dn}/CNEL$ and less than 75 dBA $L_{dn}/CNEL$, the design of the project should include measures to reduce noise levels to acceptable levels. Noise levels exceeding 75 dBA $L_{dn}/CNEL$ at commercial land uses are considered incompatible.

TABLE 5.10-2: GENERAL PLAN NOISE STANDARDS

Noise and Land Use Compatibility (L_{dn} & CNEL)												
Land Use	50	55	60	65	70	75	80	85				
Residential	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible
Educational	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible
Recreational	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible
Commercial	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible
Industrial	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible
Open Space	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible	Compatible
	Compatible											
	Require Design and insulation to reduce noise levels											
	Incompatible. Avoid land use except when entirely indoors and an interior noise level of 45 L_{dn} can be maintained											

Applicable goals and policies presented in the General Plan are as follows:

- 5.10.6-G1 Noise sources restricted to minimize impacts in the community.
- 5.10.6-G2 Sensitive uses protected from noise intrusion.
- 5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.
- 5.10.6-P1 Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 5.10-1.
- 5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan "normally acceptable" levels, as defined on Table 5.10-1.
- 5.10.6-P3 New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding),

building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).

- 5.10.6-P4 Encourage the control of noise at the source through site design, building design, landscaping, hours of operation and other techniques.
- 5.10.6-P5 Require noise-generating uses near residential neighborhoods to include solid walls and heavy landscaping along common property lines, and to place compressors and mechanical equipment in sound-proof enclosures.
- 5.10.6-P7 Implement measures to reduce interior noise levels and restrict outdoor activities in areas subject to aircraft noise in order to make Office/Research and Development uses compatible with the Norman Y. Mineta International Airport land use restrictions.

City of Santa Clara Municipal Code. The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at commercial office buildings to 65 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 60 dBA at night (10:00 p.m. to 7:00 a.m.). The noise limits are not applicable to emergency work, licensed outdoor events, City-owned electric, water, and sewer utility system facilities, construction activities occurring within allowable hours, permitted fireworks displays, or permitted heliports. Construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

The City Code does not define the acoustical time descriptor such as L_{eq} (the average noise level) or L_{max} (the maximum instantaneous noise level) that is associated with the above limits. A reasonable interpretation of the City Code would identify the ambient base noise level criteria as an average or median noise level (L_{eq}/L_{50}).

Regulatory Background – Vibration

Federal Transit Administration. FTA has identified vibration impact criteria for sensitive buildings, residences, and institutional land uses near rail transit and railroads. These criteria are shown in Table 5. The thresholds for residences and buildings where people normally sleep (e.g., nearby residences) are 72 VdB for frequent events (more than 70 events of the same source per day), 75 VdB for occasional events (30 to 70 vibration events of the same source per day), and 80 VdB for infrequent events (less than 30 vibration events of the same source per day).

TABLE 5 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 μinch/sec, RMS)		
	Frequent Events¹	Occasional Events²	Infrequent Events³
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.

California Department of Transportation. To avoid damage to buildings, Caltrans recommends that construction vibration levels are limited to 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, to 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and to 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened (see Table 3).

Existing Noise Environment

The project site is located northwest of the Tasman Drive and Great America Parkway intersection in the City of Santa Clara. Currently, two office buildings occupy the site. The site is bound by Tasman Drive to the south, Great America Parkway to the east, Bunker Hill Lane to the north, and Old Ironsides Drive to the west. Existing commercial uses are located to the north, to the west, and to the south, and commercial uses and a hotel are located to the east. An additional hotel is located southeast of the project site.

The noise environment at the site and in the surrounding areas results primarily from vehicular traffic along Tasman Drive and Great America Parkway. Local traffic along the other surrounding roadways, VTA light rail train pass-bys, and aircraft associated with the Mineta San José International Airport also contribute to the noise environment.

A noise monitoring survey was performed at the site beginning on Friday September 10, 2021 and concluding on Tuesday September 14, 2021. The monitoring survey included two long-term and two short-term noise measurements, which are shown in Figure 1.

Long-term noise measurement LT-1 was made along Tasman Drive, approximately 75 feet from the roadway centerline. Due to the location of the VTA tracks running parallel to the roadway between the eastbound and westbound directions, LT-1 also documented noise from light rail train pass-bys. Hourly average noise levels at LT-1 typically ranged from 59 to 68 dBA L_{eq} during the day and from 50 to 64 dBA L_{eq} at night. The average community noise equivalent level (CNEL) for 24-hour periods occurring between Friday September 10, 2021 and Tuesday September 14, 2021 ranged from 64 to 67 dBA CNEL. The daily trends in noise levels at LT-1 are shown in Figures A1 through A5 in the Appendix of this report.

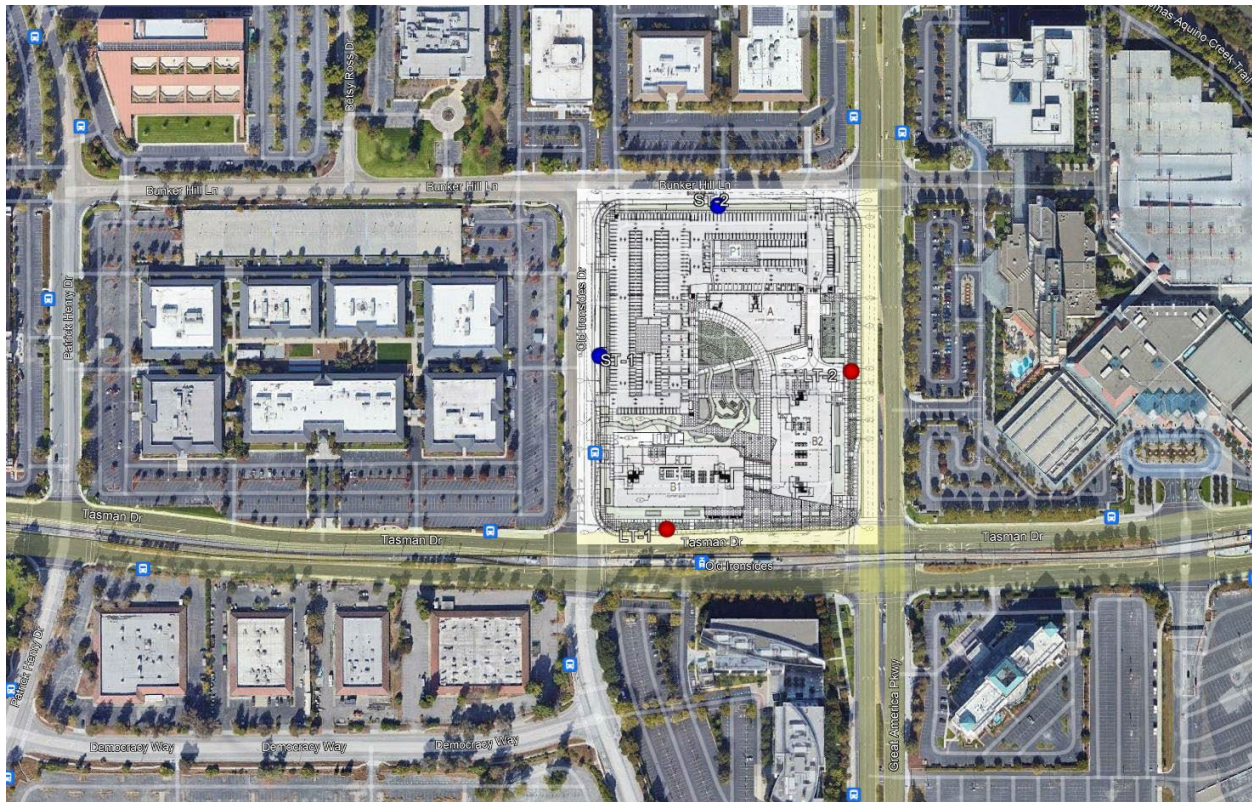
LT-2 was made approximately 65 feet from the centerline Great America Parkway. Hourly average noise levels at LT-2 typically ranged from 60 to 67 dBA L_{eq} during the day and from 51 to 64 dBA L_{eq} at night. The average CNEL between Friday September 10, 2021 and Tuesday September 14, 2021 was 66 dBA. The daily trends in noise levels at LT-2 are shown in Figures A6 through A10. It should be noted that unusually high noise levels occurred on Monday September 13, 2021 during the 6:00 a.m. hour and during the 8:00 p.m. hour. These data were not representative of typical diurnal noise level behavior at LT-2, and therefore, were excluded from the calculated CNEL noise levels.

Both short-term noise measurements were made on Tuesday September 14, 2021 in 10-minute intervals between 11:20 a.m. and 11:50 a.m. ST-1 was made approximately 50 feet from the centerline of Old Ironsides Drive. During this measurement, three passenger cars and three buses passed along the roadway. The passenger vehicles generated noise levels ranging from 52 to 69 dBA, and the buses generated noise levels of 62 to 75 dBA. Aircraft were observed to produce noise levels of 67 to 69 dBA. Additionally, mechanical equipment located at nearby buildings produced noise levels of 61 dBA. The 10-minute average noise level at ST-1 was 60 dBA $L_{eq(10-min)}$.

ST-2 was made at 2952 Bunker Hill Lane, approximately 45 feet from the centerline of the roadway. Vehicle counts along Bunker Hill Lane during this 10-minute period included 11 passenger cars, which generated noise levels of 48 to 70 dBA, and two heavy trucks, which generated noise levels of 75 to 77 dBA. One jet was observed at ST-2, which generated noise levels of 71 dBA. The 10-minute average noise level at ST-2 was 60 dBA $L_{eq(10-min)}$.

Table 6 summarizes the results of the 10-minute noise measurements made at ST-1 and ST-2.

FIGURE 1 Noise Measurement Locations



Source: Google Earth, 2021.

TABLE 6 Summary of Short-Term Noise Measurement Data (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$
ST-1: 5155 Old Ironsides Drive, ~50 feet from the roadway centerline (9/14/2021, 11:20-11:30 a.m.)	75	69	63	55	53	60
ST-2: 2952 Bunker Hill Lane, ~45 feet from the roadway centerline (9/14/2021, 11:40-11:50 a.m.)	78	72	64	50	47	60

Existing Vibration Environment

Due to the location of the tracks between the eastbound and westbound lanes of Tasman Drive, train vibration measurements were not made at the project site. The heavy vehicular traffic along Tasman Drive made it difficult to isolate vibration levels due solely to light rail trains. However, vibration measurements were made as part of the Tasman East Focus Area Plan EIR in 2016.¹ Since vibration levels for individual train pass-bys would not change between 2016 and 2021, the 2016 measurements would adequately represent existing vibration levels due to light rail train pass-bys.

Observed and recorded vibration measurements of individual train activity through Lick Mill Station were conducted on March 9, 2016. The instrumentation used to conduct the measurements included an Edirol model R-09HR solid state recorder and seismic grade, low noise accelerometers firmly fixed to the ground. This system is capable of accurately measuring very low vibration levels. Vibration levels were measured at ground level.

A total of 10 individual light rail train pass-bys were observed and recorded at two locations within the Tasman East plan area. Light rail trains were monitored at distances of 55 to 88 feet (V-1 and V-2, respectively) north from the nearest track on Tasman Drive. Vibration levels were measured in the vertical axis because ground vibration is typically most dominant on this axis. Single light rail train events at Lick Mill Station produced overall vibration levels reaching 54 VdB at a distance of 55 feet from the tracks. Vibration levels measured at each measurement position during train pass-by events can be seen in Figures A11 through A14 in the Appendix.

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Noise levels in outdoor use areas that are affected by transportation noise are required to be maintained at or below 65 dBA CNEL to be considered normally acceptable for commercial land uses, according to the City's General Plan. Additionally, nonresidential interiors are required to meet the performance standard of 50 dBA $L_{eq}(1-hr)$, as stated in the Cal Green Code.

The future noise environment at the project site would continue to be dominated by traffic along Tasman Drive and Great America Parkway, light rail trains, and aircraft. A traffic study was completed for the proposed project, which showed a 4 dBA CNEL noise level increase along both Tasman Drive and Great America Parkway under cumulative plus project conditions as compared to existing conditions.

Future Exterior Noise Environment

The project's site plan shows an outdoor common use area in the central portion of the site that would be partially shield by proposed buildings. The center of the common use area would be approximately 400 feet north of the centerline of Tasman Drive and approximately 355 feet from

¹ Illingworth & Rodkin, Inc., "Tasman East Focus Area Plan Environmental Noise and Vibration Report," December 14, 2018.

the centerline of Great America Parkway. At these distances and assuming partial shielding from the surrounding project buildings, the future exterior noise levels at the center of the common use area would be below 65 dBA CNEL.

A roof terrace connecting both buildings would be located on level 12. The center of the roof terrace would be approximately 155 feet from the centerline of Tasman Drive. The center of the roof terrace would be shielded because of the elevation of this space with respect to the roadways below. Assuming partial shielding, the future exterior noise levels at the center of the roof terrace would be below 65 dBA CNEL.

The amenity building (identified as Building A in the site plan) would also include a rooftop terrace. This space would be mostly shielded from traffic noise along Tasman Drive; however, this terrace would have direct line-of-sight to Great America Parkway. At a distance of approximately 260 feet from the centerline of Great America Parkway, and assuming partial shielding due to the elevation of the terrace with respect to the roadways below, future exterior noise levels would be below 65 dBA CNEL.

Common outdoor use areas proposed by the project would be compatible with the City's exterior noise limits.

Future Interior Noise Environment

The southern façades of the proposed office buildings would be set back approximately 100 to 155 feet from the centerline of Tasman Drive. At the exterior facades, the highest hourly average noise levels would range from 58 to 71 dBA $L_{eq(1-hr)}$ during future daytime hours. The eastern façades of the office and amenity buildings nearest to Great America Parkway would be set back approximately 120 feet from the centerline of the roadway. At this distance, hourly average noise levels would range from 61 to 68 dBA $L_{eq(1hr)}$ during future daytime hours of operation.

Standard construction materials and methods for commercial uses would provide about 25 to 30 dBA of noise reduction in interior spaces. Standard office construction materials and methods, assuming the implementation of forced-air mechanical ventilation, would reduce noise levels indoors to between 28 to 41 dBA, which would satisfy the interior threshold of 50 dBA $L_{eq(1-hr)}$ established by the Cal Green Code.

Spaces where lower noise levels would be desired, such as private offices and conference rooms, may benefit from additional noise control in order to meet a lower, more desirable interior noise level. Additional noise control could be accomplished by selecting higher sound-rated windows (STC 34 to STC 38) along exterior façades.

Vibration and Land Use Compatibility

The FTA vibration impact assessment criteria (summarized in Table 5) were used to evaluate vibration levels produced by light rail trains passing the project site. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria in Table 5 provide thresholds based on the number of train pass-bys in a given day: 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).

Prior measurements of light rail trains resulted in vibration levels up to 54 VdB at a distance of 55 feet from the tracks. Since the nearest buildings at the project site would be 100 feet or more from the nearest light rail tracks, vibration levels would be below 54 VdB. According to Table 5, light rail train vibration levels would not exceed any of the FTA thresholds. This is not expected to change under future conditions. Therefore, the proposed project is expected to be compatible with the future vibration environment at the project site.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

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 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.
 - Hourly average noise levels during construction that would exceed 60 dBA L_{eq} at residential land uses or exceed 70 dBA L_{eq} at commercial land uses and exceed the ambient noise environment by at least 5 dBA L_{eq} for a period of more than one year would constitute a significant temporary noise increase in the project vicinity.
 - A significant permanent noise level increase would occur if project-generated traffic generated by the project or project improvements/operations would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA CNEL or greater, with a future noise level of less than the “normally acceptable” standard, or b) the noise level increase is 3 dBA CNEL or greater, with a future noise level equal to or greater than the “normally acceptable” standard.
 - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.
- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.
- 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. The incorporation of construction best management practices as project conditions of approval would result in a **less-than-significant** temporary noise impact.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

The City's Municipal Code limits construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays. While residentially zoned property would not be located within 300 feet of the project site, there are two hotels, which would be considered noise-sensitive uses to the east and southeast of the project site.

As discussed in the Fundamentals section of this report, thresholds for speech interference indoors is 45 dBA. Assuming a 15 dBA exterior-to-interior reduction for standard residential construction and a 25 dBA exterior-to-interior reduction for standard commercial construction, this would correlate to an exterior threshold of 60 dBA L_{eq} at residential land uses, which would include hotels, and 70 dBA L_{eq} at commercial land uses. Additionally, temporary construction would be annoying to surrounding land uses if the ambient noise environment increased by at least 5 dBA L_{eq} for an extended period of time. Therefore, the temporary construction noise impact would be considered significant if project construction activities exceeded 60 dBA L_{eq} at the nearby hotels or exceeded 70 dBA L_{eq} at nearby commercial land uses and exceeded the ambient noise environment by 5 dBA L_{eq} or more for a period longer than one year.

Ambient noise levels at noise-sensitive receptors in the vicinity of the project site range from 59 to 68 dBA L_{eq} during daytime hours, based on the existing noise measurements made along Tasman Drive and Great America Parkway (LT-1 and LT-2, respectively).

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The typical range of maximum instantaneous noise levels for the proposed project would be 70 to 90 dBA L_{max} at a distance of 50 feet (see Table 7). Table 8 shows typical hourly average construction-generated noise levels 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.). As shown in Table 8, typical commercial office buildings generate construction noise levels ranging from 75 to 89 dBA L_{eq} at a distance of 50 feet from the center of the active site. For garage structures, typical hourly average noise levels would range from 71 to 89 dBA L_{eq} at a distance of 50 feet from the center of the site during busy construction periods. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels

at distant receptors; however, for purposes of assessing a worst-case scenario, construction noise levels in this report are estimated assuming no attenuation due to intervening buildings or structures.

Construction for the proposed project is expected to last for approximately 25 months. Construction activities for the proposed project would be completed in phases. During each phase of construction, there would be a different mix of equipment operating, and noise levels would vary by phase and vary within phases, based on the amount of equipment in operation and the location at which the equipment is operating. Equipment expected to be used in each construction phase are summarized in Table 9, along with the quantity of each piece of equipment, the duration of each phase, and the estimated noise levels projected from the center of the project site to the property lines of the surrounding land uses. For the purposes of assuming worst-case conditions, all pieces of equipment shown per phase are assumed to be operating simultaneously. The range of levels shown for various phases represents noise levels for that individual phase and noise levels during the overlapping periods with other phases.

FHWA's Roadway Construction Noise Model (RCNM) was used to calculate the hourly average noise levels for each phase of construction, assuming every piece of equipment would operate simultaneously, which would represent the worst-case scenario. Based on the hourly average noise levels calculated with RCNM, construction noise levels for each construction phase were propagated from the center of the project site, which represents the geometrical center of the active construction site, to the property lines of the receiving land uses surrounding the site.

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

Equipment Category	L _{max} Level (dBA) ^{1,2}	Impact/Continuous
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 Estimated Construction Noise Levels at Nearby Land Uses

Phase	Phase Duration	Construction Equipment (Quantity)	Calculated Hourly Average L_{eq} at Noise-Sensitive Receptors, dBA				
			East Hotel & Convention Center (460 feet)	Southeast Hotel (730 feet)	South Commercial (535 feet)	West Commercial (360 feet)	North Commercial (465 feet)
Demolition	3/1/2022-6/21/2022	Concrete/Industrial Saw (2) Excavator (4) Tractor/Loader/Backhoe (4)	71 dBA L_{eq}	67 dBA L_{eq}	69 dBA L_{eq}	73 dBA L_{eq}	70 dBA L_{eq}
Site Preparation	7/1/2022-7/15/2022	Grader (2) Rubber-Tired Dozer (2) Tractor/Loader/Backhoe (2)	68 dBA L_{eq}	64 dBA L_{eq}	67 dBA L_{eq}	70 dBA L_{eq}	68 dBA L_{eq}
Grading/Excavation	7/15/2022-7/29/2022	Grader (2) Rubber-Tired Dozer (2)	66 dBA L_{eq}	62 dBA L_{eq}	65 dBA L_{eq}	69 dBA L_{eq}	66 dBA L_{eq}
Trenching/Foundation	7/29/2022-9/23/2022	Tractor/Loader/Backhoe (6) Bore/Drill Rig (2)	69 dBA L_{eq}	65 dBA L_{eq}	68 dBA L_{eq}	71 dBA L_{eq}	69 dBA L_{eq}
Garage Structure	9/23/2022-1/21/2024	Crane (1) Forklift (2) Generator Set (1)	60 dBA L_{eq}	56 dBA L_{eq}	59 dBA L_{eq}	62 dBA L_{eq}	60 dBA L_{eq}
Building Structure	9/23/2022-6/30/2023	Crane (2) Forklift (4) Generator Set (1) Welder (4)	63 to 65 dBA L_{eq}^a	59 to 61 dBA L_{eq}^a	61 to 63 dBA L_{eq}^a	65 to 67 dBA L_{eq}^a	63 to 65 dBA L_{eq}^a
Building Exterior	6/30/2023-3/8/2024	Crane (2) Forklift (4) Welder (2)	79 to 82 dBA L_{eq}^b	56 to 59 dBA L_{eq}^b	58 to 62 dBA L_{eq}^b	62 to 65 dBA L_{eq}^b	60 to 63 dBA L_{eq}^b
Building Interior/Architectural Coating	12/30/2022-7/28/2023	Air Compressor (10) Aerial Lift (10)	65 to 68 dBA L_{eq}^c	61 to 64 dBA L_{eq}^c	64 to 67 dBA L_{eq}^c	68 to 70 dBA L_{eq}^c	65 to 68 dBA L_{eq}^c
Paving	3/8/2024-4/19/2024	Cement and Mortar Mixer (1) Paver (1) Paving Equipment (1) Roller (1)	65 dBA L_{eq}	61 dBA L_{eq}	64 dBA L_{eq}	67 dBA L_{eq}	65 dBA L_{eq}

^a The range of construction noise levels represents the levels during the Building Structure phase only and combined with the Garage Structure phase.

^b The range of construction noise levels represents the levels during the Building Exterior phase only and combined with the Garage Structure phase.

^c The range of construction noise levels represents the levels during the Building Interior/Architectural Coating phase only and combined with the Garage Structure, Building Structure, and Building Exterior phases.

The predicted construction noise levels in Table 9 indicate that project construction could potentially generate noise levels exceeding 60 dBA L_{eq} at the nearby hotels and exceeding 70 dBA L_{eq} at the nearby commercial uses. At times, the existing ambient noise levels would potentially be exceeded by 5 dBA L_{eq} or more. Since project construction is expected to last for a period exceeding one year, this is conservatively considered a significant impact.

Mitigation Measure 1a:

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. The construction crew shall adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity.

Construction Best Management Practices

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

- Ensure that excavating, grading and filling activities, and other construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property, including hotel properties, are limited to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.
- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.
- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- Unnecessary idling of internal combustion engines should be strictly prohibited.
- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used to reduce noise levels at the adjacent sensitive receptors. Any enclosure openings or venting shall face away from sensitive receptors.
- Utilize "quiet" air compressors and other stationary noise sources where technology exists.
- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate material stockpiles, as well as maintenance/equipment staging and parking areas, as far as feasible from residential receptors.
- Route construction-related traffic along major roadways and as far as feasible from sensitive receptors.
- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.
- The contractor shall prepare a detailed construction schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.
- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures and recognizing that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels would be less-than-significant.

Impact 1b: Permanent Noise Level Increase. The proposed project would not result in a substantial permanent noise level increase due to project-generated traffic at the existing noise-sensitive land uses in the project vicinity. **This is a less-than-significant impact.**

A significant impact would occur if the permanent noise level increase due to project-generated traffic was 3 dBA CNEL or greater for future ambient noise levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future ambient noise levels at or below 60 dBA CNEL. Existing ambient measurements made in the project site vicinity indicate that existing and future ambient noise levels at the noise-sensitive receptors in the project site vicinity would result in noise levels over 60 dBA CNEL. Therefore, a significant impact would occur if project-generated traffic increased levels by 3 dBA CNEL or more. For reference, a 3 dBA CNEL noise increase would be expected if the project would double existing traffic volumes along a roadway.

The traffic study prepared for the proposed project included existing peak hour traffic volumes and peak hour trips. When the trips were added to the existing volumes, an existing plus project traffic scenario was calculated. Comparing the existing plus project volumes to the existing volumes resulted in a 2 dBA CNEL noise level increase along all segments included in the traffic study, except for three segments: along Old Ironsides Drive, north of Tasman Drive; along Old Glory Lane, east of Old Ironsides Drive; and along Bunker Hill Lane, west of Great America

Parkway. However, none of these segments include residential land uses. Therefore, the project-generated traffic would not cause a substantial permanent noise increase at the surrounding noise-sensitive receptors. This impact is a less-than-significant impact.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project is not expected to generate noise levels exceeding the City's residential or commercial noise thresholds at the existing land uses surrounding the project site. **This is a less-than-significant impact.**

Under the City of Santa Clara Municipal Code, noise generated by fixed sources of noise would be restricted to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 50 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) at residentially zoned land uses. At existing commercial land uses, noise would be restricted to 65 dBA during daytime hours and to 60 dBA during nighttime hours.

Mechanical Equipment

Various mechanical equipment for heating, ventilation, and cooling purposes, exhaust fans, emergency generators, and other similar equipment could produce noise levels exceeding the City's thresholds when located near existing land uses. The roof plans for both proposed buildings show cooling towers at the center of each roof. Additionally, the emergency generator rooms would be located on the ground-level along the northern façades of each building.

The manufacturer of the cooling tower equipment provided noise level specifications for an unobstructed environment, which would represent noise levels within the cooling tower. The dominant source of noise at the cooling tower would be the fan operations. At 50 feet, noise levels would be up to 74 dBA under worst-case conditions. While the top of the cooling tower area would be open for ventilation, these areas are typically surrounded by mechanical screening, which would provide a minimum of 10 dBA reduction assuming no cracks or gaps from base to top of the screen.

The property line of the hotel to the east would be by 175 feet from the nearest project building façade. At this distance, noise levels due to the cooling tower would be up to 54 dBA at the property plane; however, the area adjacent to Great America Parkway on the existing hotel and convention center land use would consist of parking spaces, which would not typically be considered noise sensitive. When propagated to sidewalk in front of the hotel, which would be approximately 355 feet from the nearest building façade, the noise levels due to the cooling tower would be 47 dBA. Since these would be the levels to which hotel occupants would be exposed, this would be considered a less-than-significant impact for being below the City's nighttime threshold of 50 dBA for residential land uses.

The property line of the hotel to the southeast would be 295 feet from the nearest project building façade, with the hotel structure set back 425 feet from the nearest building façade. Mechanical equipment noise due to the cooling tower operations would be at or below 49 dBA. This would meet the City's requirements for both residential and commercial properties.

The commercial property lines to the west (approximately 130 feet from the nearest project building façade), to the south (approximately 200 feet from the nearest project building façade), and to the southwest (approximately 245 feet from the nearest project building façade) would have direct line-of-sight to the proposed office buildings, which would include rooftop cooling towers. At these commercial land uses, the mechanical equipment noise due to the cooling tower operations would be 51 dBA or lower. The commercial properties to the north would be shielded by the proposed parking garage and would be located 490 feet or more from the nearest office façade. The cooling tower would generate noise levels of 40 dBA or below at these distances. This would satisfy the City's requirements for commercial properties.

Two Cummins emergency generators have been selected for the proposed project: 1) Tier 4 final compliant after treatment generator with a capacity of 1,250 kW (1,563 kVA); and 2) Tier 4 certified diesel generator with a standby rating of 1,000 kW (1,250 kVA). After treatment specifications of the 1,250 kW generator provides maximum average sound levels of 75 dBA at a distance of 23 feet. While the diesel generator specifications do not include sound levels, the after-treatment information does indicate insulated ducts and other similar items, which would help to reduce noise levels. For purposes of this study, noise levels generated at both office buildings are assumed to be 75 dBA at 23 feet. Emergency generators are typically tested monthly for a period of one hour between 7:00 a.m. and 10:00 p.m.

Due to the location of both generator rooms being on the northern façades of the buildings, the existing land uses to the south would not be exposed to generator noise. Additionally, the parking structure would shield the existing land uses to the north from potential generator noise.

The hotel and convention center to the east would potentially be exposed to generator noise from the eastern project building located along Great America Parkway. The generator room would be approximately 220 feet from the nearest property line of the hotel and convention center and approximately 405 feet from the sidewalk in front of the hotel where noise-sensitive receptors would be located. Assuming a conservative 20 dBA reduction due to the eastern façade of the proposed office building, emergency generator noise would be approximately 42 dBA during the one-hour testing period each month at the property line of the hotel and convention center and would be 37 dBA at the front sidewalk. These levels would meet the City's commercial and residential daytime noise limits.

The nearest property line of the existing commercial use to the west would be approximately 175 feet generator room located in the western project office building. At this distance and assuming a conservative 20 dBA reduction from the western façade of the building, emergency generator noise would be 44 dBA during the one-hour testing period each month. This would satisfy the City's requirements for commercial properties.

Daily operational equipment and monthly emergency generator testing proposed at the project site is not expected to result in daytime or nighttime noise levels exceeding the City's Municipal Code thresholds at the property lines of the surrounding commercial land uses. While mechanical equipment noise would potentially exceed the daytime and nighttime thresholds at the property line of the hotel east of the project site when compared to the City's residential thresholds, a parking lot, which is not noise-sensitive, is located along this receiving property line. When

propagated to the nearest receiving noise-sensitive area at the hotel, mechanical equipment noise generated at the project site would not exceed the daytime or nighttime thresholds. This is a less-than-significant impact.

Truck Loading and Unloading

Details regarding the two-story amenity building were not available at the time of this study; however, for purposes of this study, commercial retail uses, which would require weekly truck deliveries is assumed. Potential delivery zones would be located along the northern façades of each proposed office building, which would be the location of the trash enclosures. Due to the size of the proposed project, one to two deliveries per week would be expected. For purposes of this analysis, it is assumed that deliveries would be limited during daytime hours between 7:00 a.m. and 10:00 p.m.

Vendor delivery trucks typically generate maximum noise levels of 60 to 65 dBA L_{max} at a distance of 50 feet. Low speed truck noise results from a combination of engine, exhaust, and tire noise, as well as the intermittent sounds of back-up alarms and releases of compressed air associated with truck/trailer air brakes. The noise levels produced by backup alarms can vary depending on the type and directivity of the sound, but maximum noise levels are typically between 65 to 75 dBA L_{max} at a distance of 50 feet. Assuming a typical delivery would take about 15 to 20 minutes, the hourly average noise level from a delivery would be about 67 to 68 dBA L_{eq} at a distance of 50 feet.

The loading zones are assumed to be located on the ground-level just north of each proposed office building. Due to the location of the loading zones, the existing land uses to the south and to the north of the project site would be shielded from truck delivery noise associated with the proposed project.

The hotel and convention center to the east would have direct line-of-sight to truck deliveries occurring at the eastern office building and at the amenity building. The center of the loading zone would be approximately 255 feet from the nearest property line of the hotel and convention center and approximately 440 feet from the sidewalk in front of the hotel where noise-sensitive receptors would be located. Assuming no shielding due to project buildings, truck deliveries would generate maximum instantaneous noise levels ranging from 51 to 56 dBA L_{max} and hourly average noise levels of 53 to 54 dBA L_{eq} at the property line of the hotel and convention center. At the front sidewalk of the hotel, estimated noise levels would be 46 to 51 dBA L_{max} and 48 to 49 dBA L_{eq} . Truck deliveries would not exceed the City's daytime residential noise limits at the nearest hotel. The nearest property line of the existing commercial use to the west would be approximately 160 feet from the center of the delivery zone located at the western office building. Assuming no shielding due to project buildings, truck deliveries would generate maximum instantaneous noise levels ranging from 55 to 60 dBA L_{max} and hourly average noise levels of 57 to 58 dBA L_{eq} at the property line of the existing commercial building to the west of the project site. This would satisfy the City's requirements for commercial properties.

Truck deliveries at the proposed project site would not result in noise levels exceeding the City's Municipal Code thresholds during daytime hours. This would be a less-than-significant impact.

Mitigation Measure 1c: None required.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction.
Construction-related vibration levels resulting from activities at the project site would not exceed 0.3 in/sec PPV at the existing structures surrounding the project site. **This is a less-than-significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include grading, foundation work, paving, and new building framing and finishing. According to the equipment list provided at the time of this study, drilling activities are expected to be conducted in place of impact or vibratory pile driving activities, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No known ancient buildings or buildings that are documented to be structurally weakened adjoin the project area. Therefore, conservatively, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 10 presents typical vibration levels that could be expected from construction equipment, as measured at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

Table 10 also summarizes the estimated vibration levels at the nearest existing buildings surrounding the project site. Construction vibration levels would depend on the specific location of individual pieces of equipment. That is, equipment scattered throughout the site would not generate a collective vibration level, but a vibratory roller, for instance, operating near the project site boundary would generate the worst-case vibration levels for the receptor sharing that property line. Further, construction vibration impacts are assessed based on the potential for damage to buildings on receiving land uses, not at receptors at the nearest property lines. Therefore, the distances used to propagate construction vibration levels (as shown in Table 10), which are different than the distances used to propagate construction noise levels (as shown in Table 9), were estimated under the assumption that each piece of equipment was operating along the nearest boundary of the project site, which would represent the worst-case scenario.

While vibration levels would not be expected to cause cosmetic damage to any nearby buildings, 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.

Since vibration levels are expected to be below 0.3 in/sec PPV at all surrounding building façades during project construction and no historical buildings are located within 200 feet of the project site, this would be a less-than-significant impact.

Mitigation Measure 2: None required.

TABLE 10 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Estimated Vibration Levels at Structures Surrounding the Project Site, in/sec PPV				
			East Hotel & Convention Center (310 feet)	Southeast Hotel (390 feet)	South Commercial (210 feet)	West Commercial (200 feet)	North Commercial (230 feet)
Clam shovel drop		0.202	0.013	0.010	0.019	0.021	0.018
Hydromill (slurry wall)	in soil	0.008	0.001	0.0004	0.001	0.001	0.001
	in rock	0.017	0.001	0.001	0.002	0.002	0.001
Vibratory Roller		0.210	0.013	0.010	0.020	0.021	0.018
Hoe Ram		0.089	0.006	0.004	0.009	0.009	0.008
Large bulldozer		0.089	0.006	0.004	0.009	0.009	0.008
Caisson drilling		0.089	0.006	0.004	0.009	0.009	0.008
Loaded trucks		0.076	0.005	0.004	0.007	0.008	0.007
Jackhammer		0.035	0.002	0.002	0.003	0.004	0.003
Small bulldozer		0.003	0.0002	0.0001	0.0003	0.0003	0.0003

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 2021.

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

Norman Y. Mineta San José International Airport is a public-use airport located approximately 2.8 miles southeast of the project site. According to the new Airport Master Plan Environmental Impact Report,² the 60 dBA CNEL contour line (see Figure 2) falls on the site. Aircraft noise would result in exterior noise levels below the City's requirements for commercial land uses. Therefore, the proposed project would be compatible with the City's exterior noise standards for aircraft noise.

Mitigation Measure 3: None required.

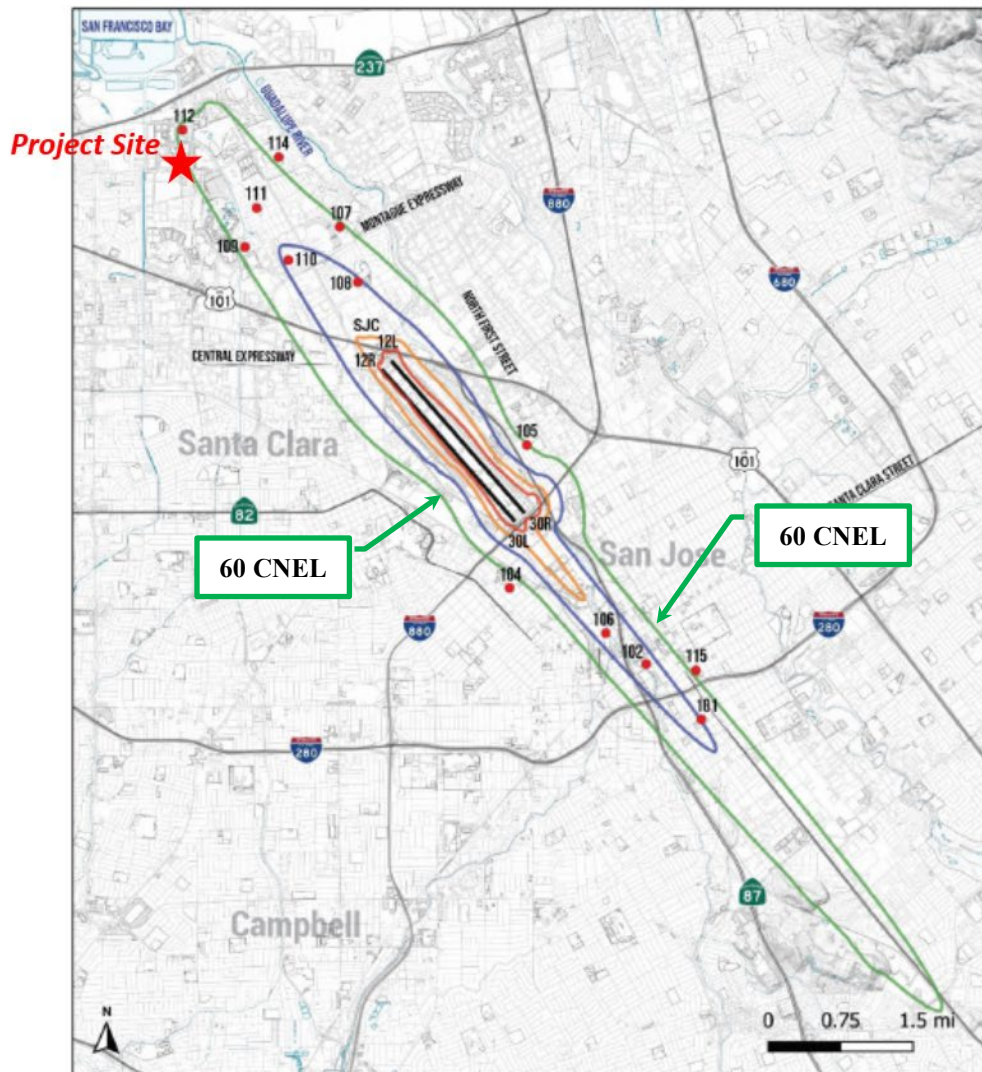
² David J. Powers & Associates, Inc., Integrated Final Environmental Impact Report, Amendment to Norman Y. Mineta San Jose International Airport Master Plan, April 2020.

FIGURE 2 2037 CNEL Noise Contours for SJIA Relative to Project Site

Figure 5
Scenario 2: With Project 2037 Noise Contour Map

SAN JOSE INTERNATIONAL AIRPORT | Environmental Impact Report

FINAL | October 2019



NORMAN Y. MINETA
SAN JOSE
INTERNATIONAL
AIRPORT

- Noise Monitoring Station
- 101 Site ID
- Runway
- 75 dBA and Greater CNEL Contour
- 70 dBA and Greater CNEL Contour
- 65 dBA and Greater CNEL Contour
- 60 dBA and Greater CNEL Contour

Figure 5 Scenario 2:
With Project 2037
Noise Contour Map

Source: BridgeNet International 2019

Cumulative Impacts

Cumulative noise impacts would include either cumulative traffic noise increases under future conditions or temporary construction noise from cumulative construction projects.

A significant cumulative traffic noise increase would occur if two criteria are met: 1) if the cumulative traffic noise level increase was 3 dBA CNEL or greater for future levels exceeding 60 dBA CNEL or was 5 dBA CNEL or greater for future levels at or below 60 dBA CNEL; and 2) if the project would make a “cumulatively considerable” contribution to the overall traffic noise increase. A “cumulatively considerable” contribution would be defined as an increase of 1 dBA CNEL or more attributable solely to the proposed project.

The traffic study included cumulative traffic volumes, with and without the project. When both of these scenarios were compared to the existing traffic volumes, a noise level increase of 3 dBA CNEL or more was calculated along multiple segments under both conditions (with and without the project). There were four segments, however, that did result in significant increases in the cumulative plus project scenario, which were 1 dBA CNEL or more greater than the increases calculated under the cumulative no project scenario: along Old Ironsides Drive, north of Tasman Drive and north of Old Glory Lane; along Old Glory Lane, between Old Ironsides Drive and Great America Parkway; and along Bunker Hill Lane, west of Great America Parkway. However, none of these segments include residential land uses. Therefore, the project would not result in a cumulatively considerable contribution along any roadway segments with noise-sensitive receptors. Therefore, the project would not result in a cumulative noise increase due to traffic.

There are no known approved projects surrounding the project site that would be constructed during the same timeframe as the proposed project. Therefore, the noise-sensitive receptors surrounding the project site would not be subject to cumulative construction impacts.

APPENDIX

FIGURE A1 Daily Trend in Noise Levels at LT-1, Friday, September 10, 2021

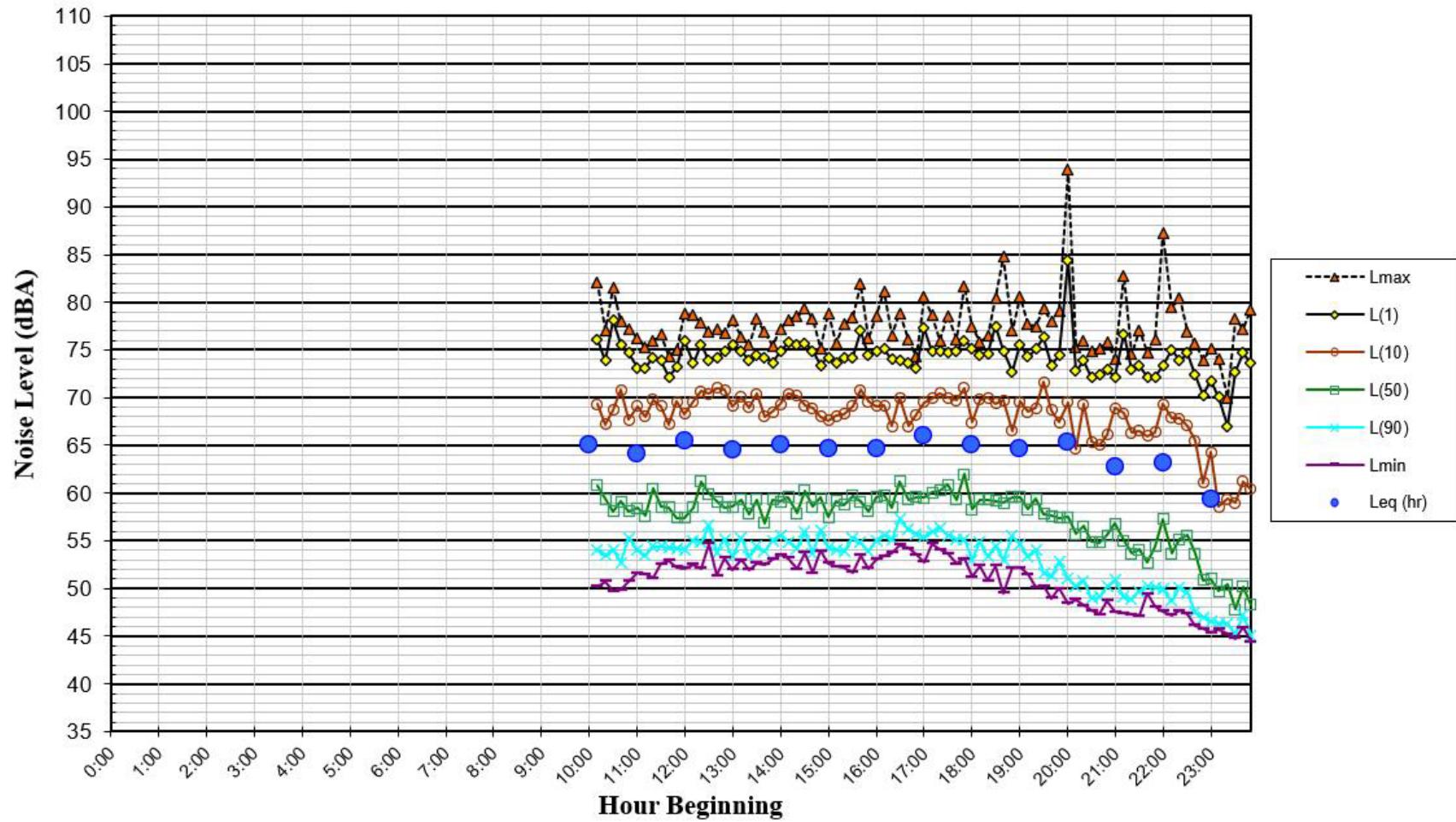


FIGURE A2 Daily Trend in Noise Levels at LT-1, Saturday, September 11, 2021

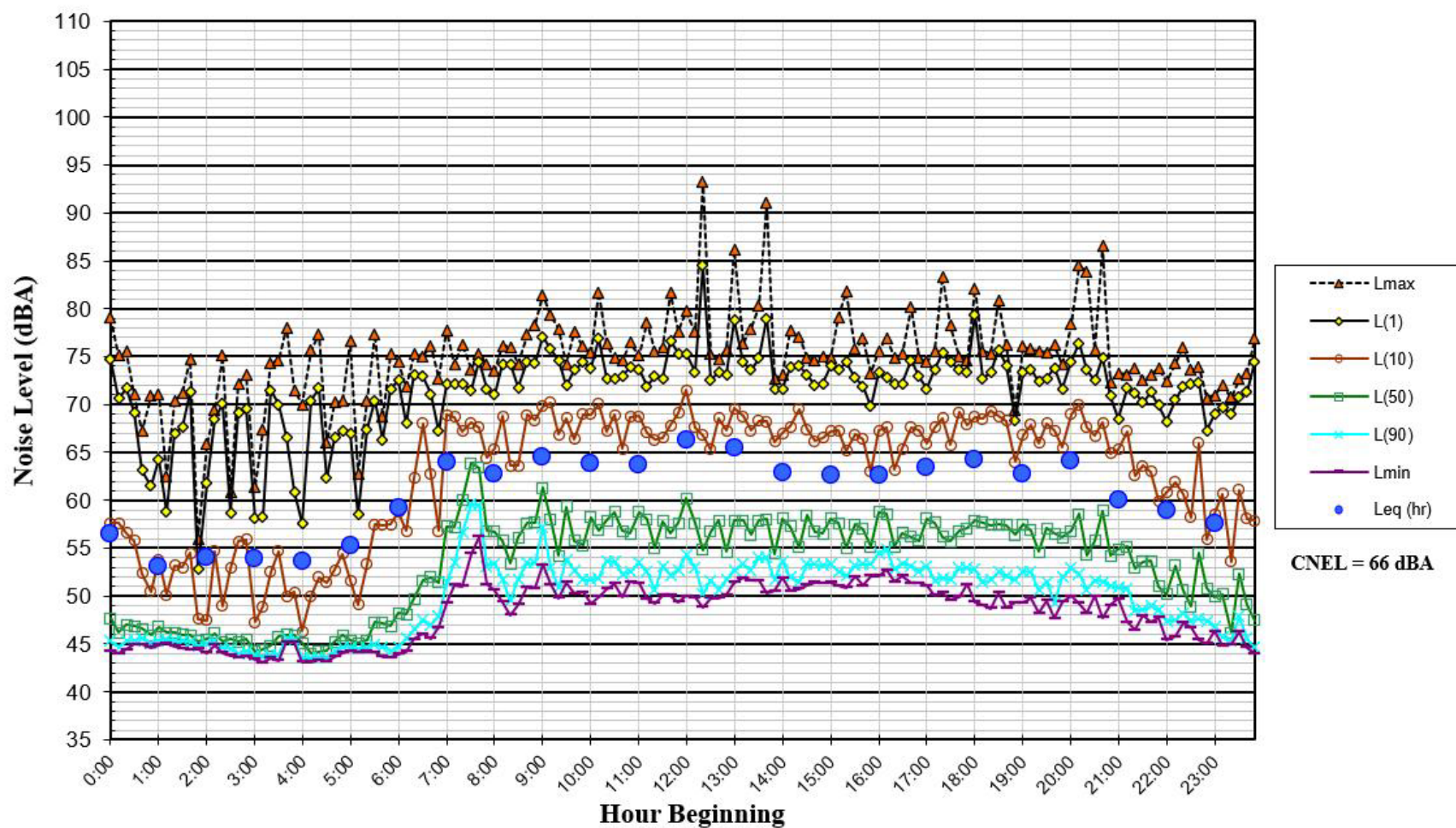


FIGURE A3 Daily Trend in Noise Levels at LT-1, Sunday, September 12, 2021

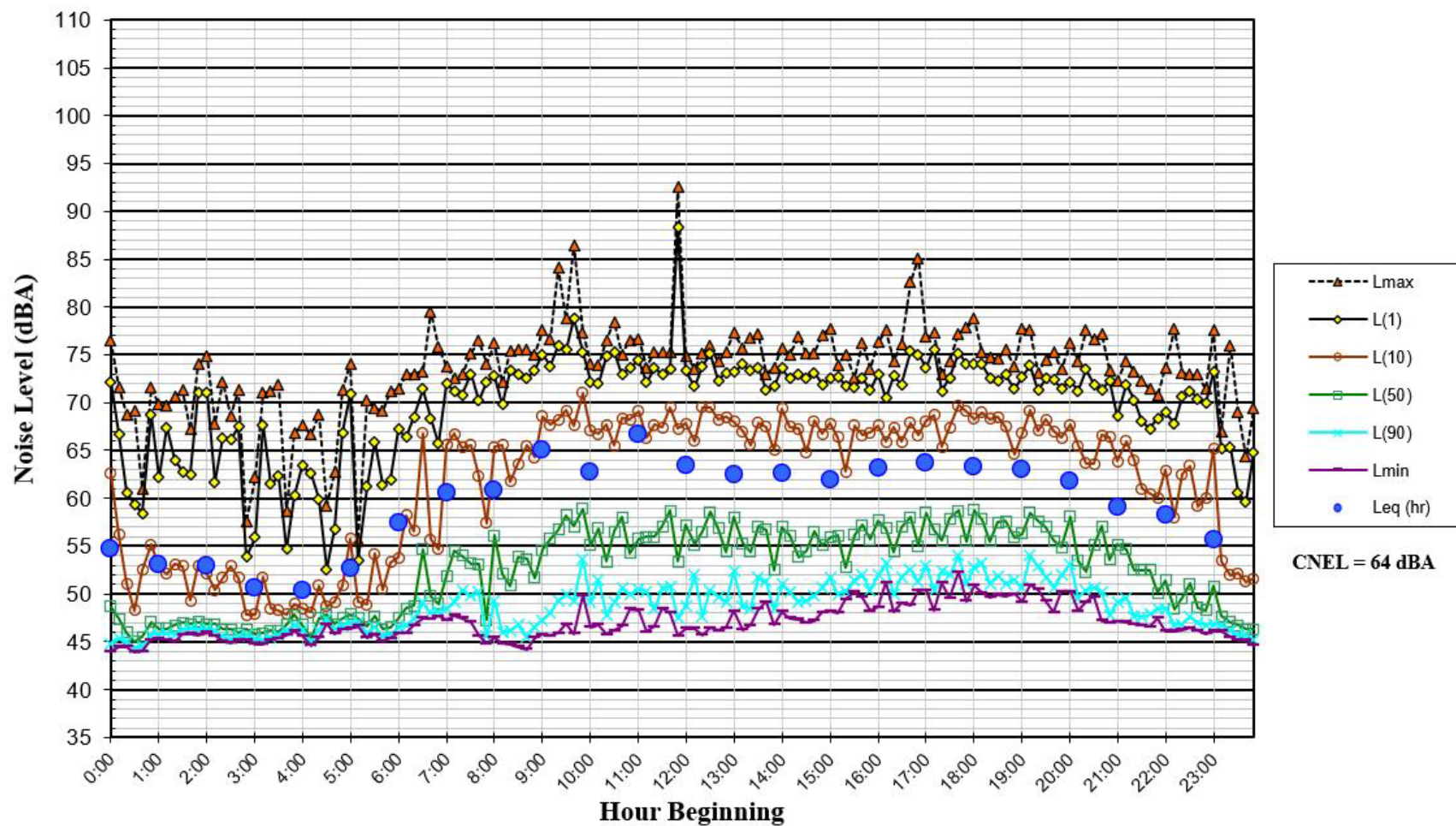


FIGURE A4 Daily Trend in Noise Levels at LT-1, Monday, September 13, 2021

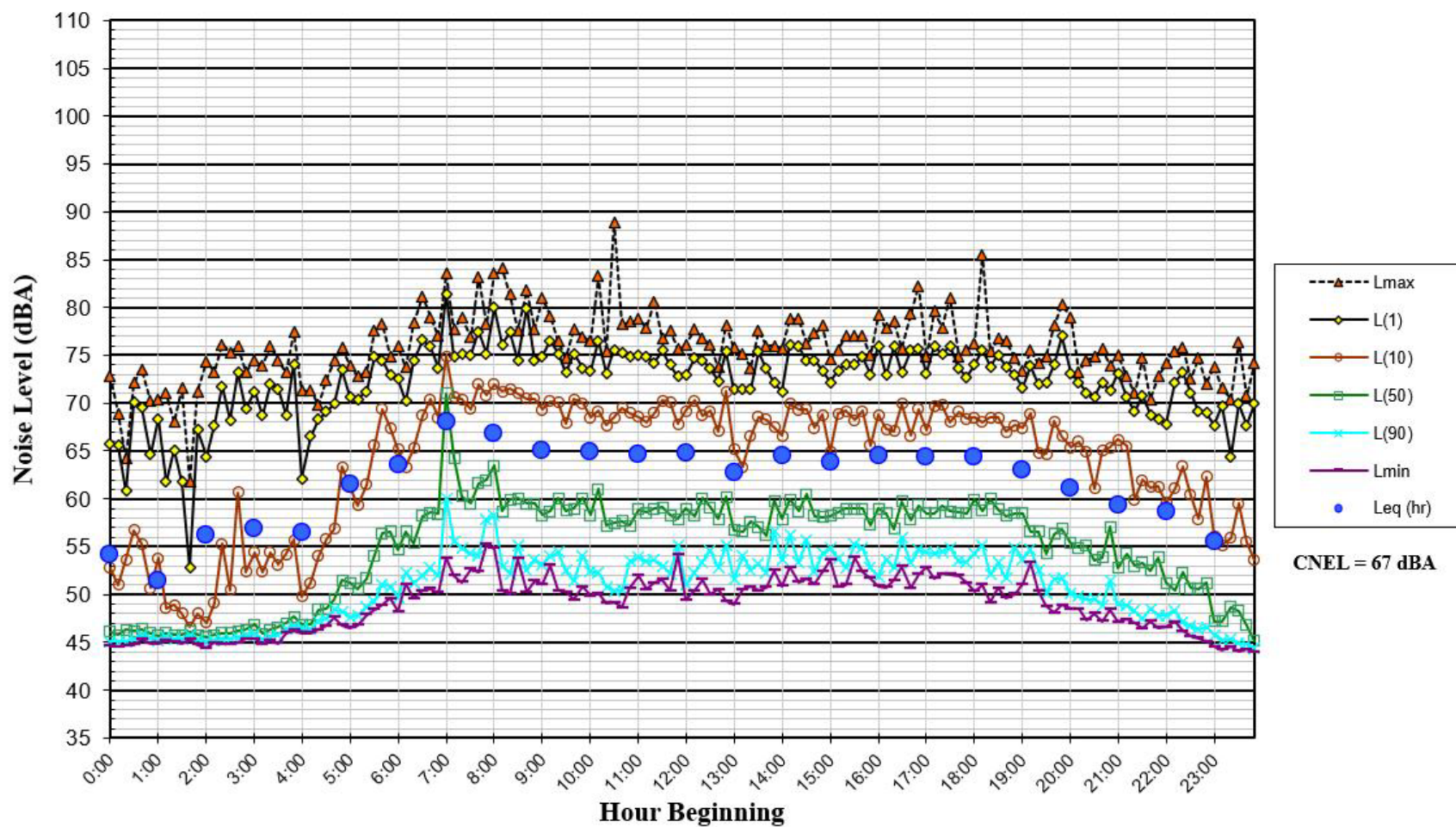


FIGURE A5 Daily Trend in Noise Levels at LT-1, Tuesday, September 14, 2021

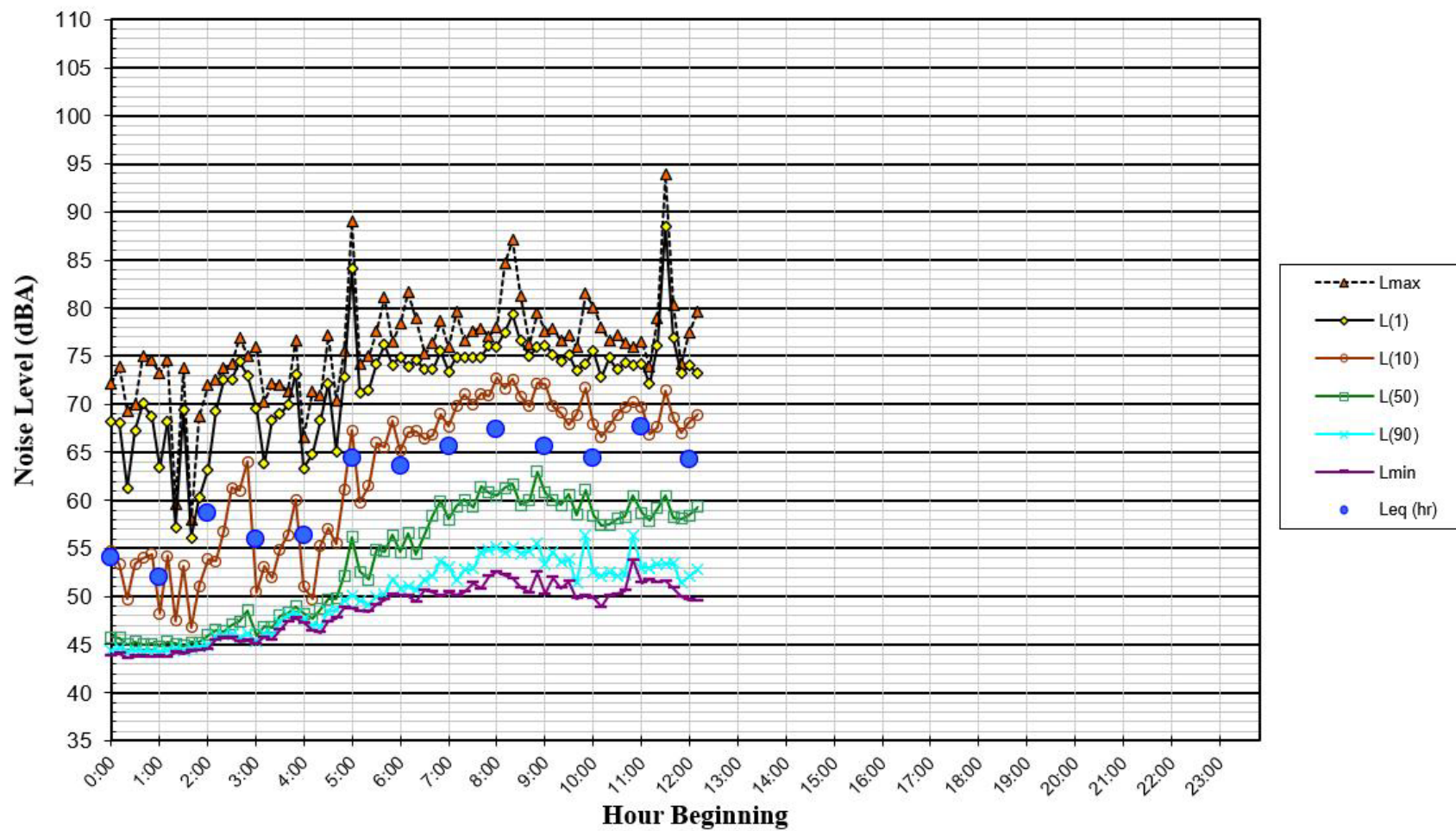


FIGURE A6 Daily Trend in Noise Levels at LT-2, Friday, September 10, 2021

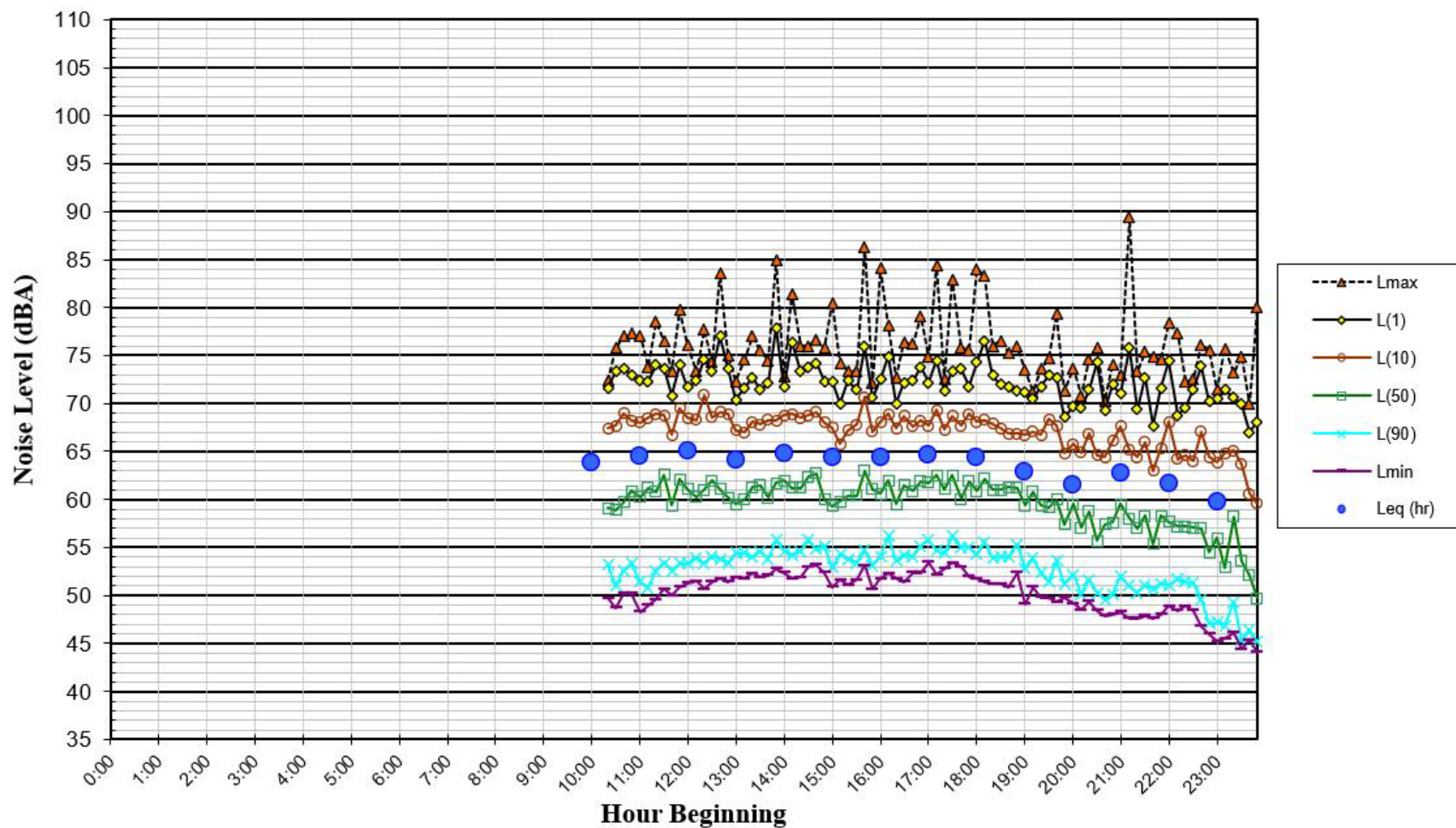


FIGURE A7 Daily Trend in Noise Levels at LT-2, Saturday, September 11, 2021

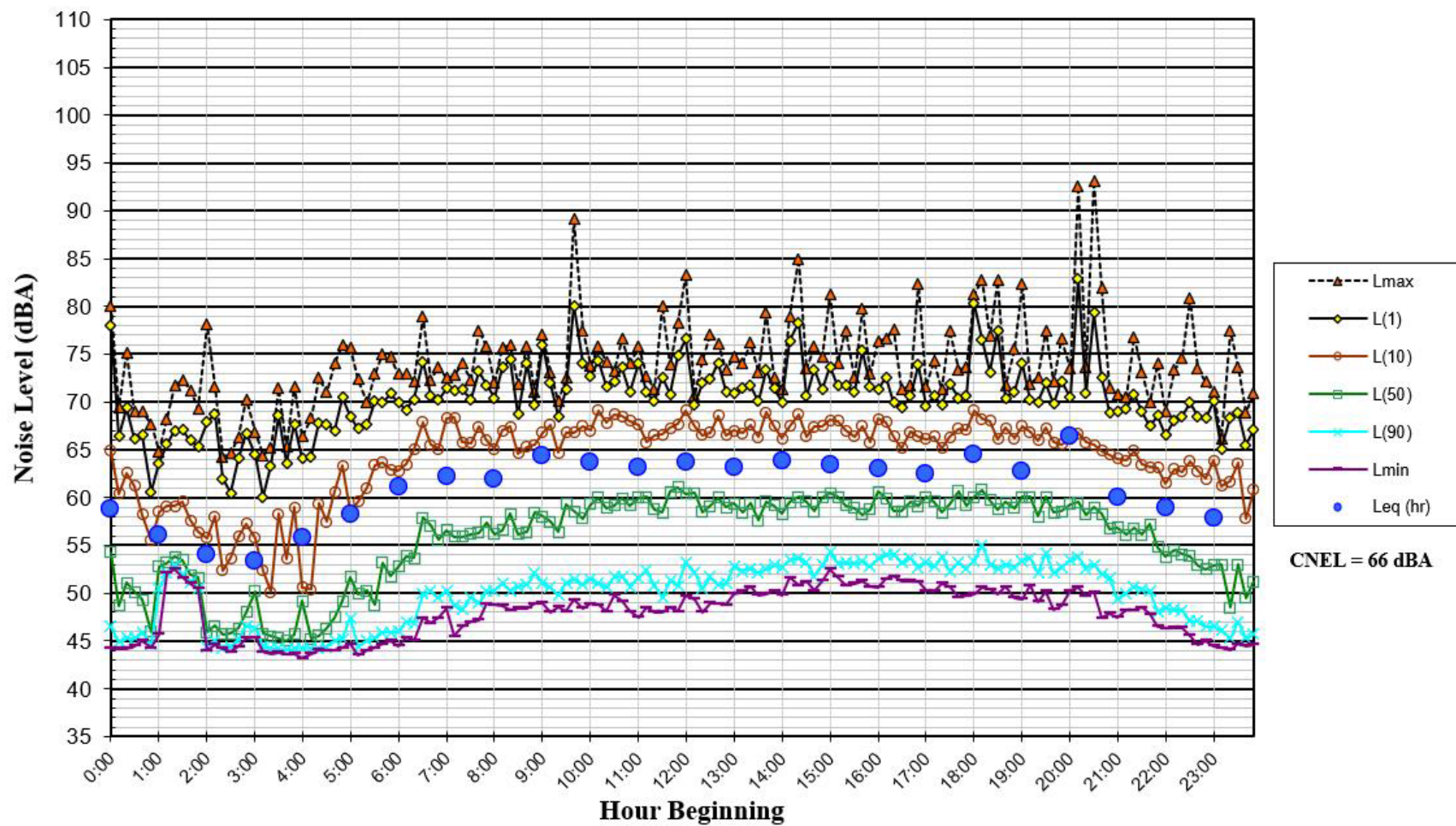


FIGURE A8 Daily Trend in Noise Levels at LT-2, Sunday, September 12, 2021

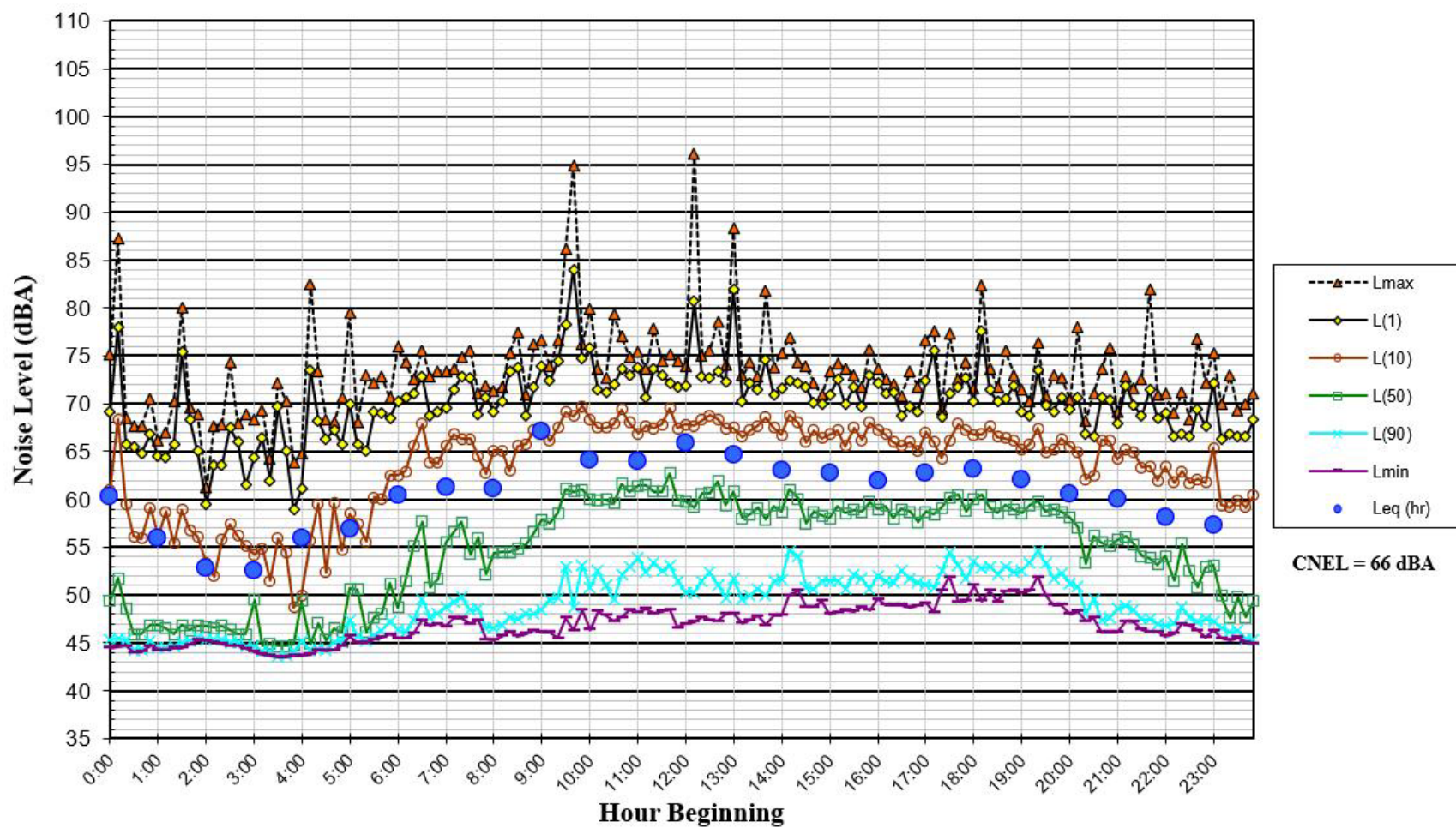


FIGURE A9 Daily Trend in Noise Levels at LT-2, Monday, September 13, 2021

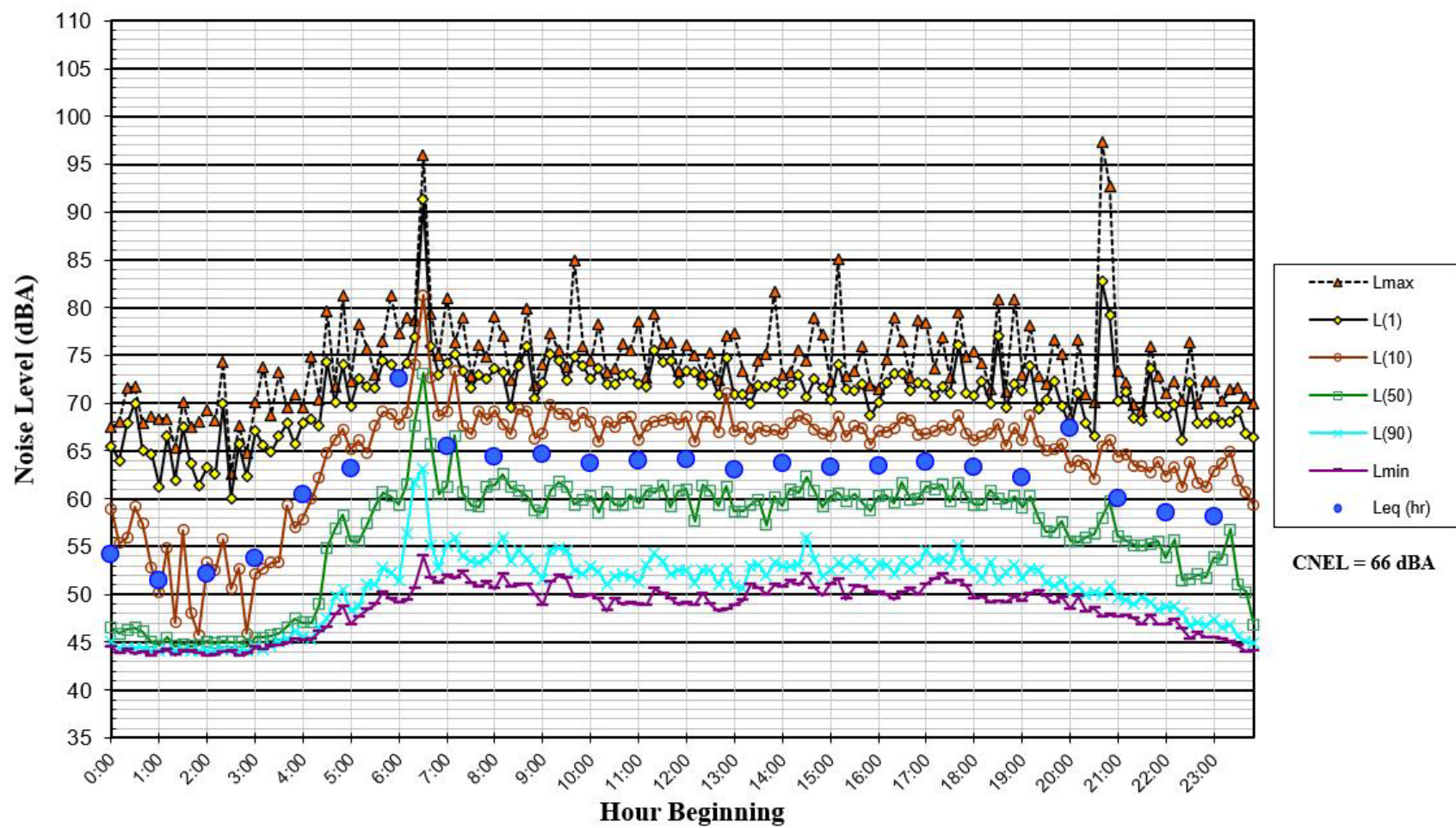


FIGURE A10 Daily Trend in Noise Levels at LT-2, Tuesday, September 14, 2021

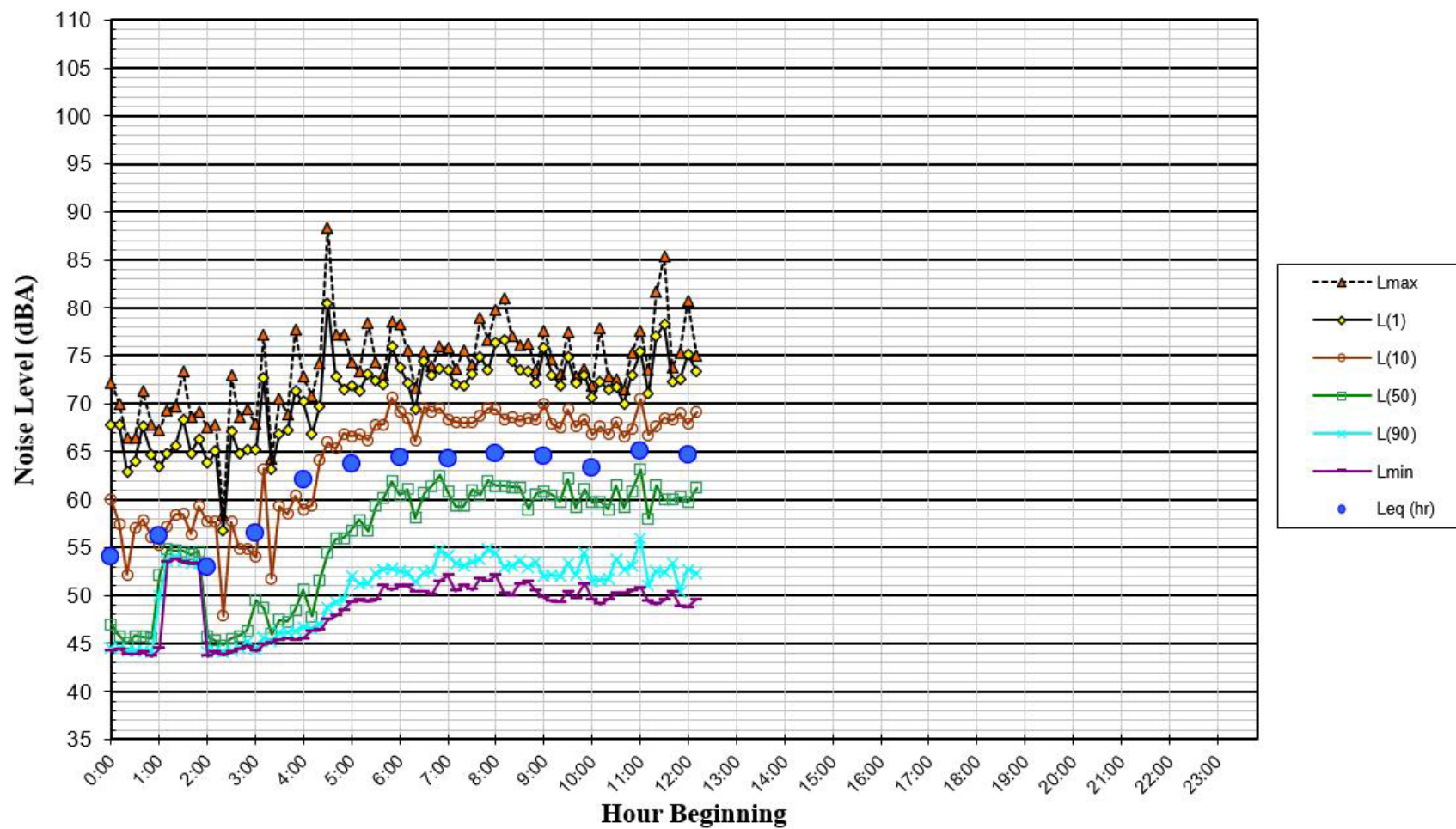


FIGURE A11 Train Vibration Levels at V-1 During Eastbound Traveling Trains

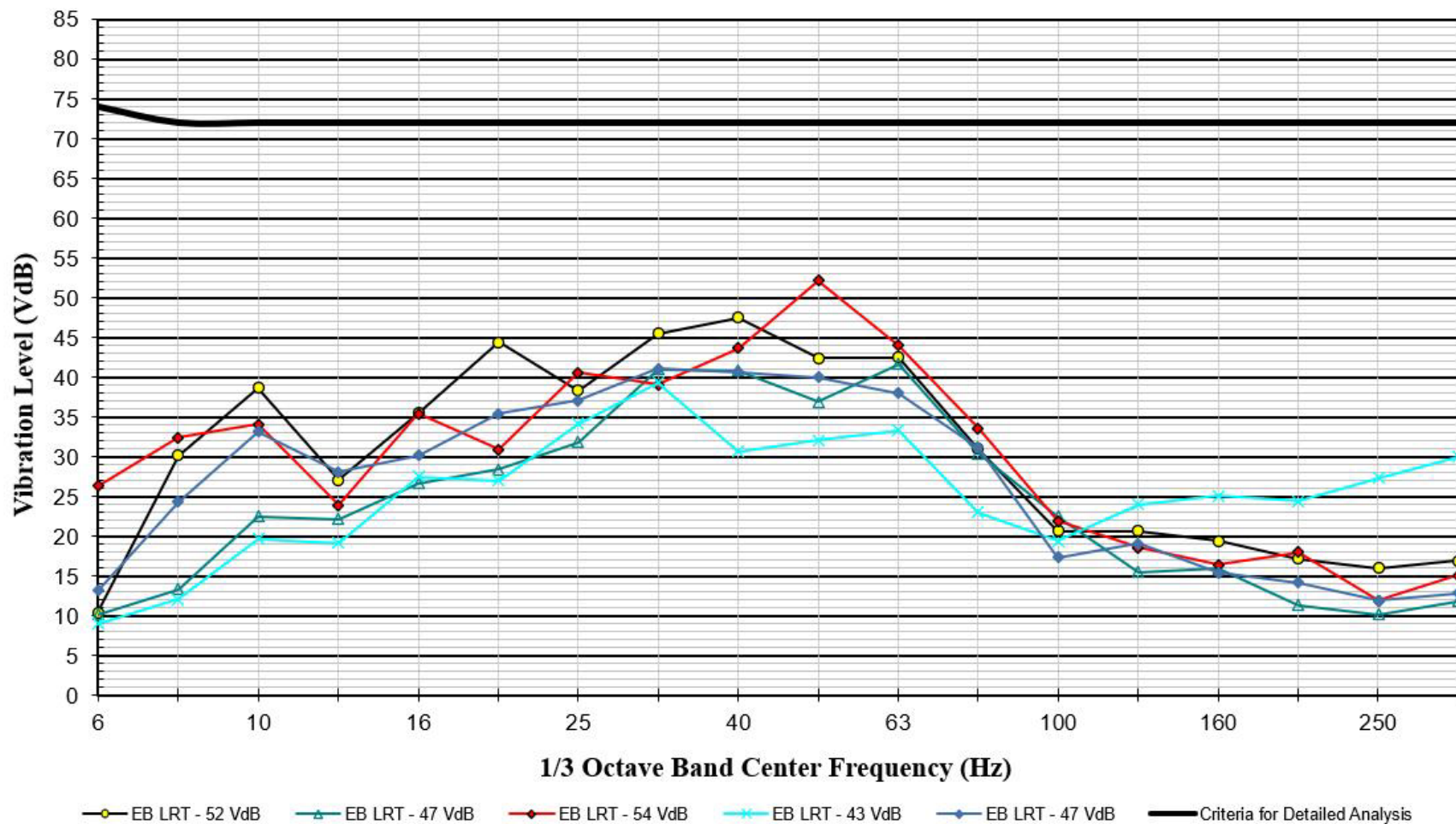


FIGURE A12 Train Vibration Levels at V-2 During Eastbound Traveling Trains

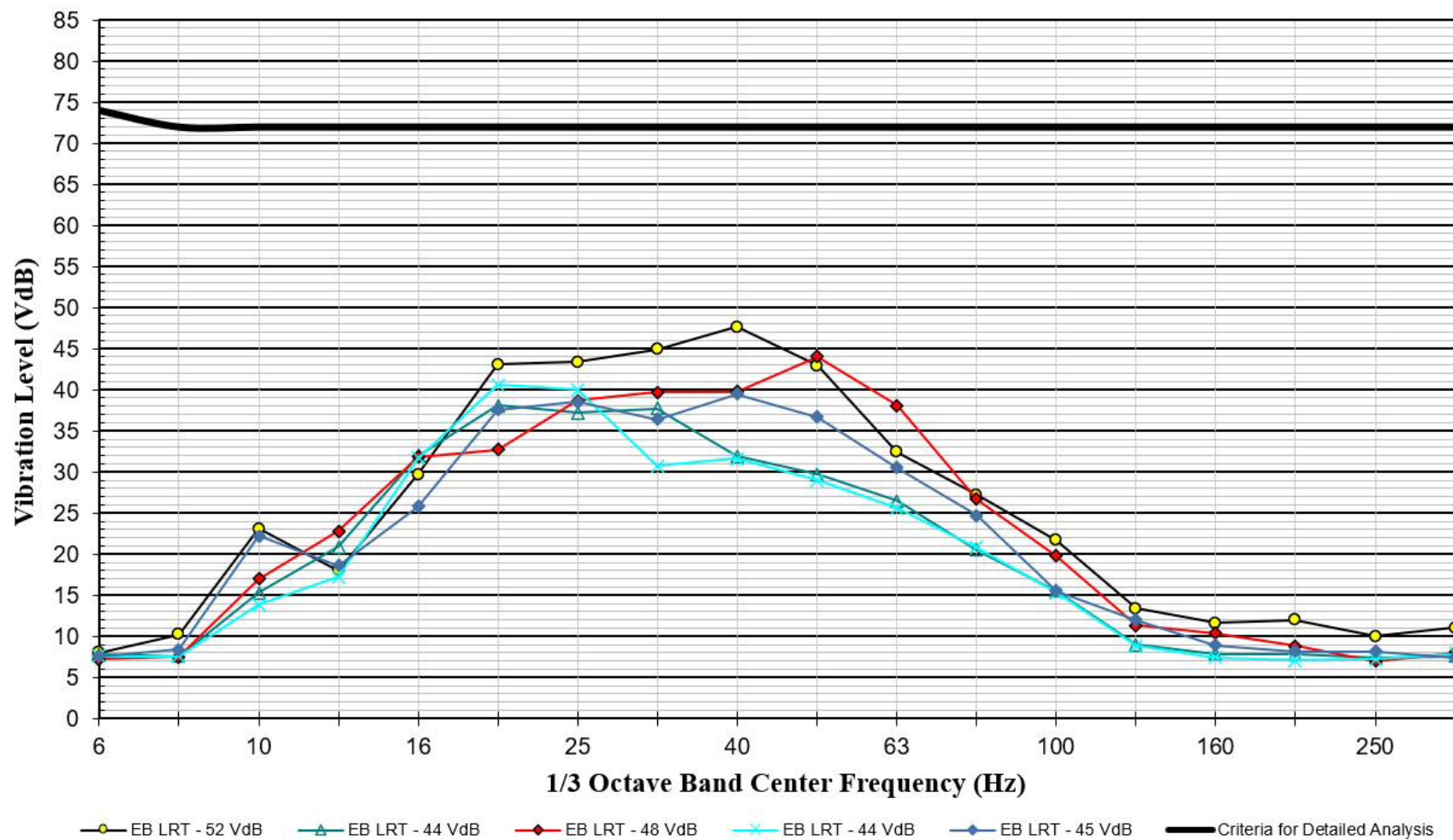


FIGURE A13 Train Vibration Levels at V-1 During Westbound Traveling Trains

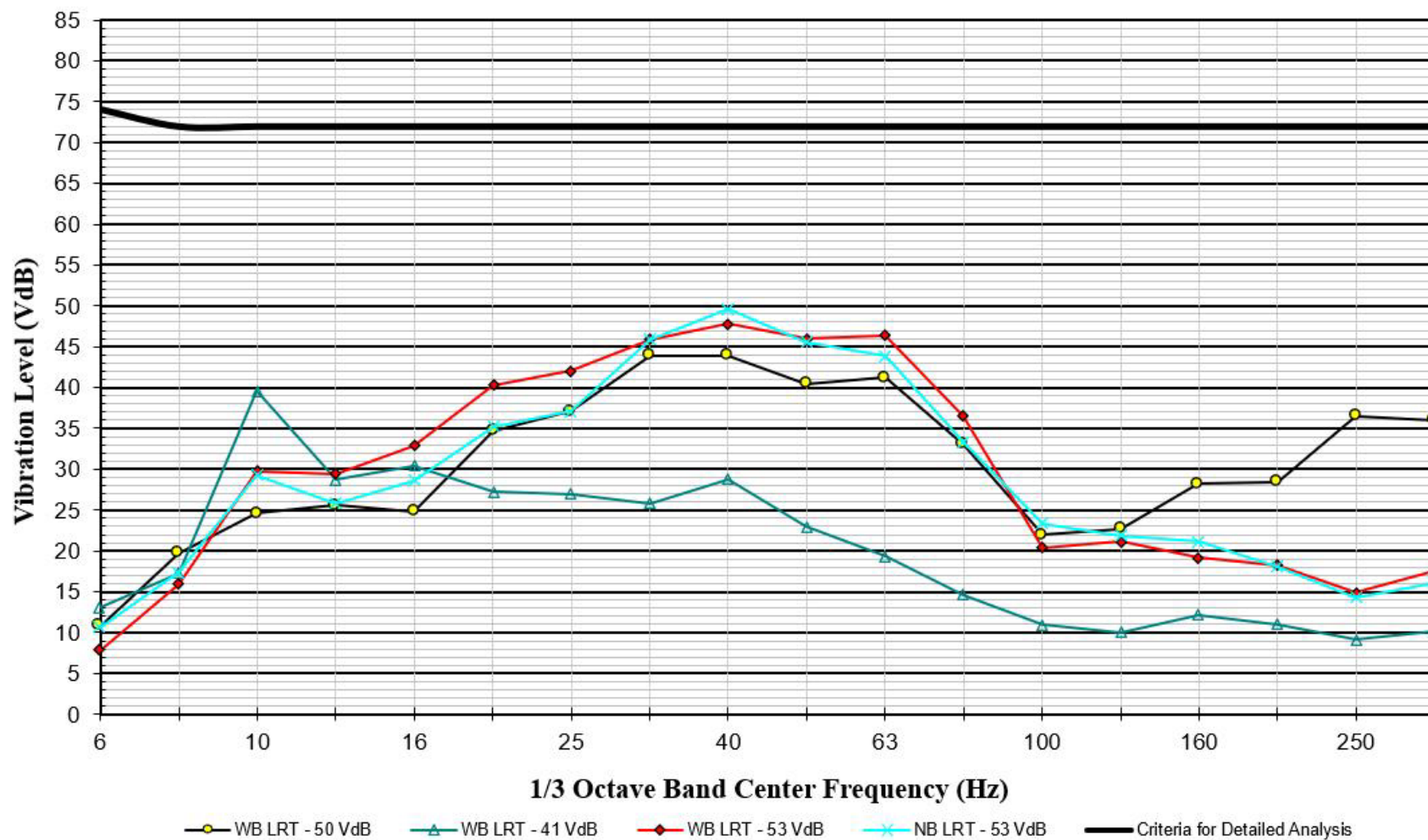


FIGURE A14 Train Vibration Levels at V-2 During Westbound Traveling Trains

