Appendix C

Noise/Vibration Assessment

2376 SOUTH EVERGREEN LOOP MEDICAL OFFICE BUILDING NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The project proposes a four-story 150,000 square-foot medical office building at 2376 South Evergreen Loop in the City of San José. The project would include a four-story parking garage and surface parking lot within the Arcadia Property of the Evergreen Visioning Project. The site is currently vacant and has been previously studied as part of the Evergreen Visioning Project EIR[1] for noise impacts related to temporary construction noise, permanent traffic noise, and aircraft noise exposure.

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 criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency Section discusses noise and land use compatibility utilizing policies in the City's General Plan; and, 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents 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

[1] Illingworth & Rodkin, Inc., "Evergreen Visioning Project EIR Noise Report San Jose, California," Prepared for David J. Powers & Associates, September 9, 2005.

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

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

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

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA DNL. Typically, the highest steady traffic noise level during the daytime is about equal to the DNL and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA DNL with open windows and 65-70 dBA DNL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed; those facing major roadways and freeways typically need special glass windows.

Annoyance

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

Fundamentals of Groundborne Vibration

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

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

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from "Historic and some old buildings" to "Modern industrial/commercial buildings". Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

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

TABLE 1 Definition of Acoustical Terms Used in this Report

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

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

TABLE 2 Typical Noise Levels in the Environment

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

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

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

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

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

Regulatory Background - Noise

The State of California, Santa Clara County, and the City of San José have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, California Building Code, Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan, and the City of San José General Plan are used to assess the potential significance of impacts. A summary of the applicable regulatory criteria is provided below.

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

(a) 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 envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA DNL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

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

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-1.2 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.

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 continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited to: excavation equipment; static compaction equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

Existing Noise Environment

The project site is located at 2376 South Evergreen Loop in San José, California. The site is bounded by commercial land uses to the north, East Capitol Expressway to the east, and commercial land uses that are currently under construction to the west and south. Residential land uses are located as close as 150 feet to the east, across East Capitol Expressway, 870 feet to the south, and 1,230 feet to the west, as measured from the nearest property lines.

Due to regional shelter-in-place restrictions implemented by the State of California at the time of this study, traffic volumes along the surrounding roadways were reduced and not representative of typical conditions. Therefore, a noise monitoring survey was not completed to document ambient noise levels. Instead, noise data collected as part of previous projects were reviewed to establish the existing noise environment.

Noise data contained in the Evergreen Visioning Project EIR was used to quantify existing noise levels at the project site. A long-term measurement (LT-1) was made approximately 90 feet from the centerline of East Capitol Expressway. The predominant noise sources affecting the project site were found to include vehicular traffic along East Capitol Expressway and Quimby Road as well as occasional overhead aircraft associated with Reid-Hillview Airport. Hourly noise levels at LT-1 ranged from 72-74 dBA L_{eq} during the daytime and 59-72 dBA L_{eq} during the nighttime. The day-night average noise level was 75 dBA DNL on June 2, 2005.

Additional noise measurements made as part of the Evergreen Circle Mixed-Use Noise Assessment[2] were also used. Long-term measurements from this assessment were made near existing residential receptors to the south and west of the project site. LT-2 was made at the eastern terminus of Brahms Avenue, approximately 135 feet from the centerline of Chopin Road. Hourly average noise levels at this location typically ranged from 50 to 63 dBA L_{eq} during the day, and from 46 to 54 dBA L_{eq} at night. The day-night average noise level was 59 dBA DNL on Wednesday, January 25, 2017. LT-3 was made approximately 54 feet from the centerline of Quimby Road. Hourly average noise levels at this location typically ranged from 65 to 70 dBA L_{eq} during the day, and from 55 to 69 dBA L_{eq} at night. The day-night average noise level was 71 dBA DNL on Wednesday, January 25. LT-4 was made at Meadowfair Park, approximately 430 feet from the centerline of Chopin Road. Hourly average noise levels at this location typically ranged from 49 to 60 dBA L_{eq} during the day, and from 46 to 54 dBA L_{eq} at night. The day-night average noise level was 58 dBA DNL on Wednesday, January 25, 2017.

Traffic conditions were reviewed along Quimby Road and East Capitol Expressway in order to account for increased traffic volumes since measurements were conducted. Based on a comparison of existing traffic levels in 2005 from the Evergreen Visioning Project EIR and existing traffic levels in 2013 from the Communications Hill Residential and Industrial Buildout Traffic Impact Analysis,[3] noise levels along East Capitol Expressway did not measurably increase south of the intersection with Quimby Road. Noise levels along Quimby Road to the west of the intersection with East Capitol Expressway increased by approximately 1 dBA. Based on the location of the project site, traffic along East Capitol Expressway would continue to be the dominant noise source. Therefore, existing noise levels at the project site are not anticipated to have increased substantially from 2005 measurements.

Noise levels along the eastern property line of the project site would be up to approximately 76 dBA DNL. These noise levels would also be representative of noise levels at the residential receptors to the east of the project site, across East Capitol Expressway. Noise levels along the western property line of the project site would range from approximately 57 to 62 dBA DNL, depending on setback distance from East Capitol Expressway.

All measurement locations are shown in relation to the project site in Figure 1 and Table 4 summarizes the noise data. Trends for all long-term measurements are included in Appendix A.

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[2] Illingworth & Rodkin, Inc., "Evergreen Circle Mixed-Use Project Noise Assessment," Prepared for DeNova Homes, March 2017.

[3] Hexagon Transportation Consultants, "Communications Hill Residential and Industrial Buildout Traffic Impact Analysis," Prepared for David J. Powers & Associates, May 28, 2014.

FIGURE 1 Noise Measurements from Previous Studies in Relation to Project Site

Source: Google Earth 2020.

TABLE 4 Summaries of Long-Term Noise Data from Prior Studies

Measurement Description			Noise Level (dBA)		
Noise Measurement Location (Date/Time)	**Study**	**ID**	**Range of Daytime Hourly L_{eq}**	**Range of Nighttime Hourly L_{eq}**	**DNL**
90 feet from centerline of East Capitol Expressway (June 1-3, 2005)	Evergreen Visioning Project EIR 2005	LT-1	72-74	59-72	75
135 feet from centerline of Chopin Avenue (Jan 24-26, 2017)	Evergreen Circle Mixed-Use Noise Assessment	LT-2	50-63	46-54	59
54 feet from centerline of Quimby Road (Jan 24-26, 2017)	Evergreen Circle Mixed-Use Noise Assessment	LT-3	65-70	55-69	71
430 feet from centerline of Chopin Avenue (Jan 24-26, 2017)	Evergreen Circle Mixed-Use Noise Assessment	LT-4	49-60	46-54	58

PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

The future noise environment at the project site would continue to result primarily from vehicular traffic along East Capitol Expressway. Existing and background plus project conditions from the Evergreen Visioning Project's traffic study were compared to estimate future traffic noise increases within the project vicinity. The background plus project conditions represent future traffic conditions with the continual buildout of the Evergreen Visioning Project area. Based on these results, future noise levels attributable to traffic conditions are anticipated to increase by up to 2 dBA DNL in the project site vicinity.

Future Exterior Noise Environment

Formal outdoor use areas that could benefit from a lowered noise level are not proposed as a part of the project. Therefore, the noise and land use compatibility of exterior lawn areas and pathways were not assessed.

Future Interior Noise Environment

The performance method enforced in the Cal Green Code requires that interior noise levels be maintained at 50 dBA $L_{eq(1\text{-}hr)}$ or less during hours of operation at the proposed buildings.

The eastern building façade would be setback approximately 110 feet from the centerline of East Capitol Expressway. At this distance, and considering a future noise increase of up to 2 dBA DNL, future hourly average noise levels during daytime hours would range from approximately 72 to 75 dBA $L_{eq(1\text{-}hr)}$ at the building exterior.

Standard construction materials for commercial uses would provide about 25 dBA of noise reduction in interior spaces. The inclusion of adequate forced-air mechanical ventilation systems is normally required so windows may be kept closed at the occupant's discretion and would provide an additional 5 dBA reduction. The standard construction materials in combination with forced-air mechanical ventilation would satisfy the daytime threshold of 50 dBA $L_{eq(1\text{-}hr)}$.

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 along exterior façades.

For consistency with the Cal Green Code, the following Conditions of Approval will be implemented by the project applicant:

- Provide forced-air mechanical ventilation and sound rated windows to maintain interior noise levels at acceptable levels. A qualified acoustical specialist shall prepare a detailed analysis of interior noise levels resulting from all exterior sources during the final design phase of the project pursuant to requirements set forth in the General Plan and State

Building Code. The study will review the final site plan, building elevations, and floor plans prior to construction and confirm building treatments necessary to reduce interior noise levels to 50 dBA $L_{eq(1\text{-}hr)}$ or less. Treatments would include, but are not limited to, sound-rated windows and doors as specified above, acoustical caulking, protected ventilation openings, etc. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

NOISE IMPACTS AND MITIGATION MEASURES

Construction and traffic noise impacts, as well as aircraft noise exposure, were previously examined under the Evergreen Visioning Project EIR. These topics are not discussed further.

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 expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan.

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

Impact 1: **Noise Levels in Excess of Standards.** The proposed project could generate noise in excess of standards established in the City's General Plan at the nearest sensitive receptors. The incorporation of noise control as a project condition of approval would result in a **less-than-significant** noise impact.

Mechanical Equipment Noise

Under the City's Noise Element, noise levels from building equipment shall not exceed a noise level of 55 dBA DNL at receiving noise-sensitive land uses. Noise-sensitive receptors surrounding the site would include existing residences as close as 90 feet to the east of the project site, opposite East Capitol Expressway, 1,040 feet to the south of the project site, and 1,450 feet to the west of the project site. Commercial buildings would also be located as close as 20 feet to the north. Residential and commercial land uses are planned for future development as part of the Evergreen Visioning Project. Residential land uses would be as close as 600 feet to the west and commercial land uses would be as close as 110 feet to the south and west.

Various mechanical equipment for heating, ventilation, and cooling purposes (HVAC), exhaust fans, emergency generators, and other similar equipment could produce noise levels exceeding ambient levels when located near existing or proposed land uses.

Most of the equipment is anticipated to be located within the interior of the building or on the rooftop. Based on conversation with the project applicant, outdoor mechanical equipment would only consist of HVAC units. Noise levels from HVAC units at similar sized projects were measured to be up to 89 dBA at 1.2 feet. At a distance of 90 feet, which would represent the closest property line of a noise-sensitive land use, noise levels attributable to HVAC units would be up to 52 dBA DNL. Therefore, noise levels due to equipment are not expected to exceed 55 dBA DNL at the surrounding land uses. Operational noise levels would likely be 46 dBA L_{eq} or less, complying with the City of San Jose noise ordinance

It is expected that mechanical equipment noise for the proposed project would meet the City's applicable noise limits. However, noise levels from mechanical equipment should be examined once specific equipment has been selected to ensure compliance with the City's 55 dBA DNL threshold. A qualified acoustical consultant shall be retained to determine specific noise reduction measures necessary to reduce noise to comply with the City's General Plan and Municipal Code noise level requirements, as applicable. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and installation of noise barriers, such as enclosures and parapet walls, to block the line-of-sight between the noise source and the nearest receptors.

Mitigation Measure 1: **No further mitigation required.**

Impact 2: **Exposure to Excessive Groundborne Vibration due to Construction.** Construction-related vibration levels may produce vibration levels exceeding 0.2 in/sec PPV at the nearest commercial building. **This is a potentially significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include demolition, site preparation work, foundation work, and new building framing and finishing. While pile driving equipment can cause excessive vibration, it is not expected to be required for the proposed project.

According to Policy EC-2.3 of the City of San José General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historical structures, and a vibration limit of 0.20 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction. Based on the Historical Resources Inventory for the City of San José,[4] no buildings of historical significance are located within 500 feet of the project boundary. Therefore, a vibration limit of 0.20 in/sec PPV was used to evaluate damage at all buildings in the project vicinity.

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

[4] https://www.sanjoseca.gov/home/showpublisheddocument?id=24021

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.

Worst-case scenario vibration levels were calculated at the nearest buildings to the site, as measured from the shared property lines. The nearest existing structure to the project site would be the office building to the north. Located approximately 20 feet from the shared property line, the worst-case vibration levels at this structure would be up to 0.268 in/sec PPV. All other surrounding structures, including the commercial structures under construction to the south and west, would be subject to vibration levels at or below 0.051 in/sec PPV.

TABLE 5 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Vibration Levels at Nearest Buildings (in/sec PPV)			
			Commercial Structure North (20 feet)	Commercial Structure West (90 feet)	Commercial Structure South (105 feet)	Residential Structure East (150 feet)
Clam shovel drop		0.202	**0.258**	0.049	0.042	0.028
Hydromill (slurry wall)	in soil	0.008	0.010	0.002	0.002	0.001
	in rock	0.017	0.022	0.004	0.004	0.002
Vibratory Roller		0.21	**0.268**	0.051	0.043	0.029
Hoe Ram		0.089	0.114	0.022	0.018	0.012
Large bulldozer		0.089	0.114	0.022	0.018	0.012
Caisson drilling		0.089	0.114	0.022	0.018	0.012
Loaded trucks		0.076	0.097	0.019	0.016	0.011
Jackhammer		0.035	0.045	0.009	0.007	0.005
Small bulldozer		0.003	0.004	0.001	0.001	0.000

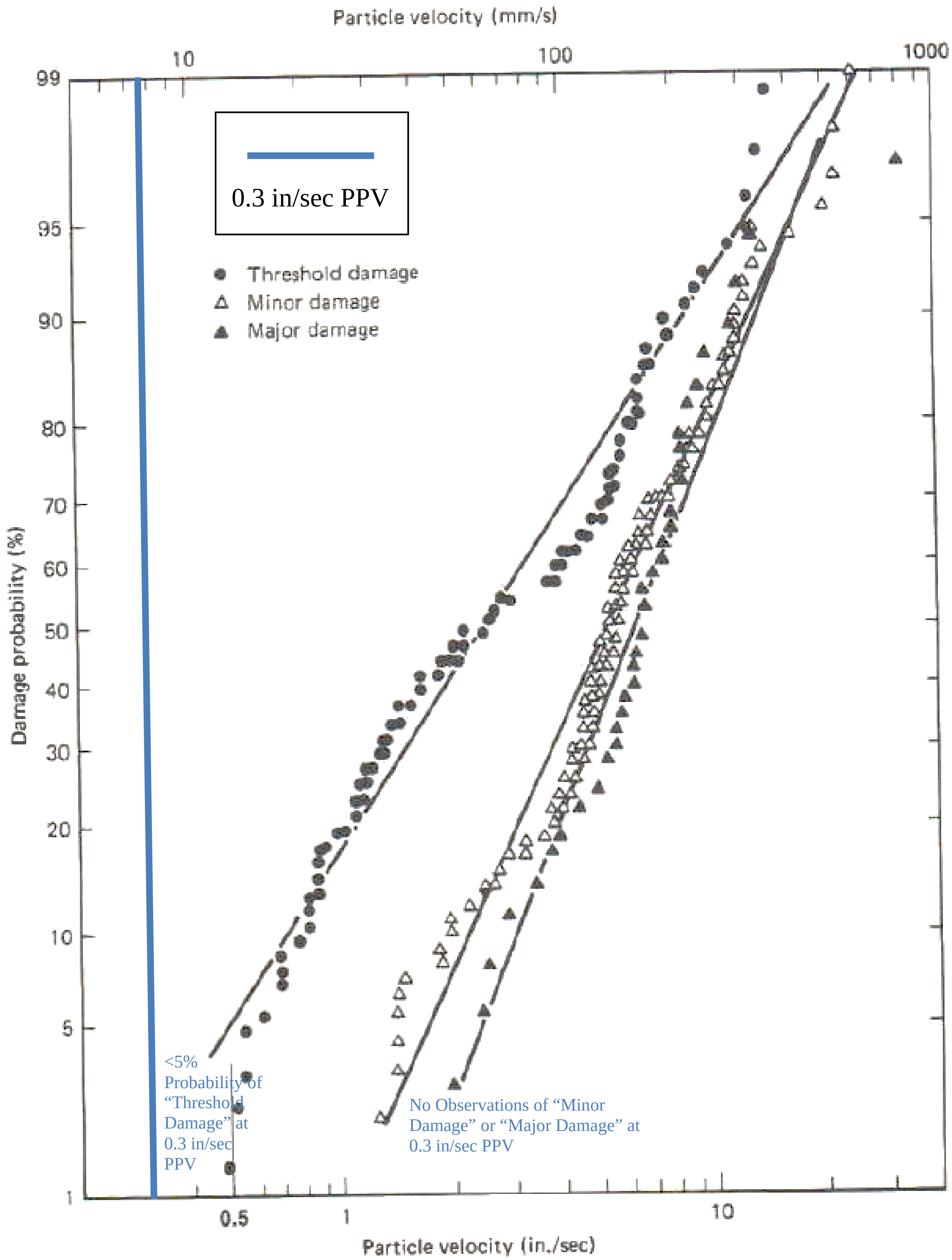
Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006, as modified by Illingworth & Rodkin, Inc., January 2021.

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[5] The findings of this study have been applied to buildings affected by construction-generated vibrations.[6] As reported in USBM RI 8507[6] and reproduced by Dowding,[7] Figure 2 presents the damage probability, in terms of "threshold damage," "minor damage," and "major damage," at varying vibration levels. Threshold damage, which is described as cosmetic damage in this report, would entail hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage would include hairline cracking in masonry or the loosening of plaster, and major structural damage would

[5] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.
[6] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

include wide cracking or shifting of foundation or bearing walls. As shown in Figure 2, cosmetic, minor, and major damage were not observed at vibration levels below 0.3 in/sec PPV.

FIGURE 2 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996 as modified by Illingworth & Rodkin, Inc., January 2021.

Vibratory construction equipment or the dropping of heavy objects would have the potential to produce vibration levels of 0.2 in/sec PPV or more at the nearest residential land use to the northwest. While no minor, or major damage would be expected to occur, there is a very small probability that cosmetic damage could occur. Therefore, this is a potentially significant impact.

At this location, and in other surrounding areas within 200 feet, vibration levels would potentially be perceptible. By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

Mitigation Measures:

The following measures shall be implemented where vibration levels due to construction activities would exceed 0.2 in/sec PPV at nearby buildings to reduce the impact to a less-than-significant level:

- Prohibit the use of heavy vibration-generating construction equipment within 30 feet of adjacent buildings.

- Use a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, when compacting materials within 30 feet of adjacent buildings. Only use the static compaction mode when compacting materials within 15 feet of buildings.

- Avoid dropping heavy equipment and use alternative methods for breaking up existing pavement, such as a pavement grinder, instead of dropping heavy objects, within 30 feet of adjacent buildings.

- The contractor shall alert heavy equipment operators to the close proximity of the adjacent structures so they can exercise extra care.

- Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.

APPENDIX A: Daily Trends in Noise Levels

LT-1 June 1-2, 2005

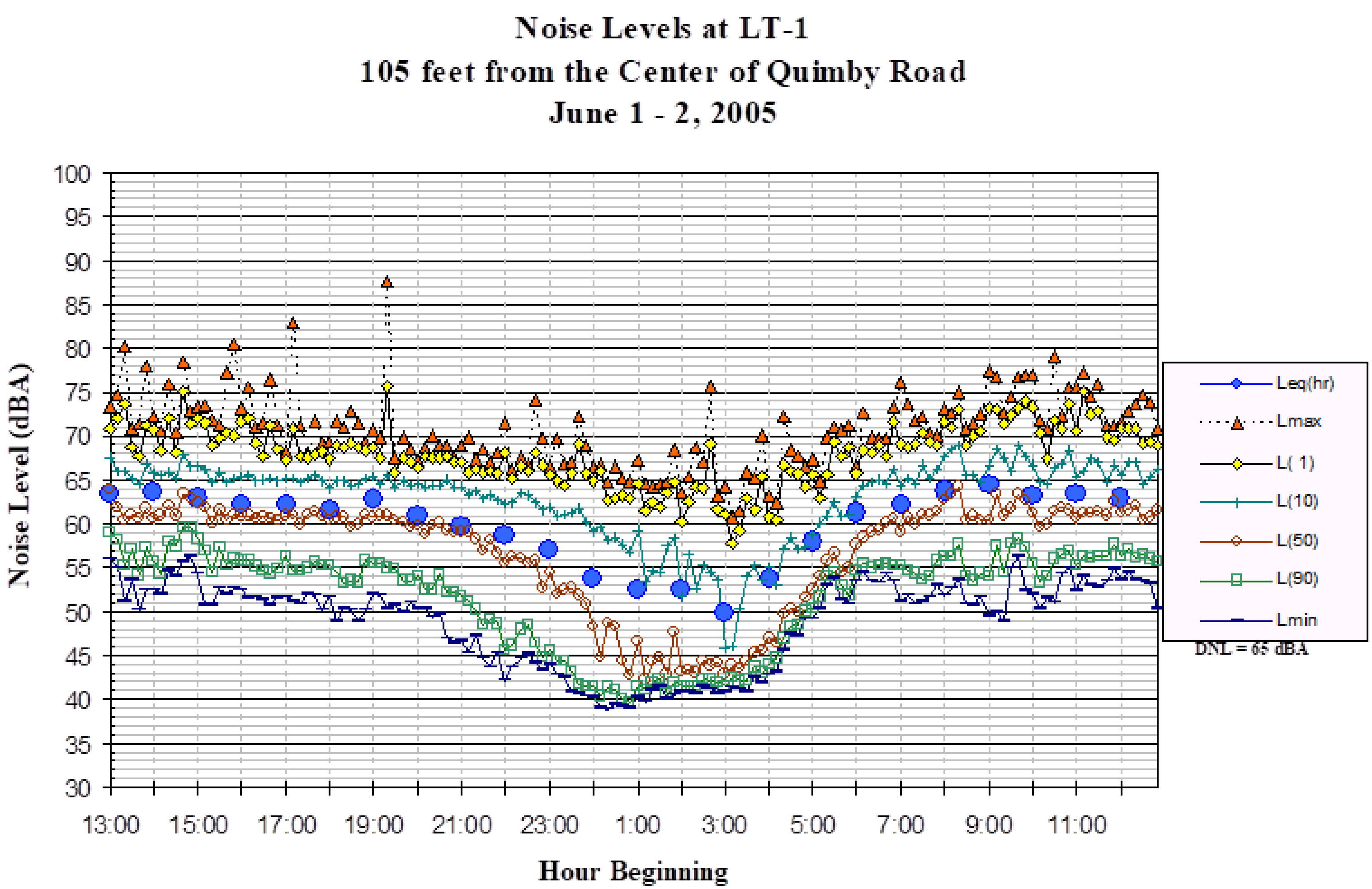


Figure A1

LT-1 June 2-3, 2005

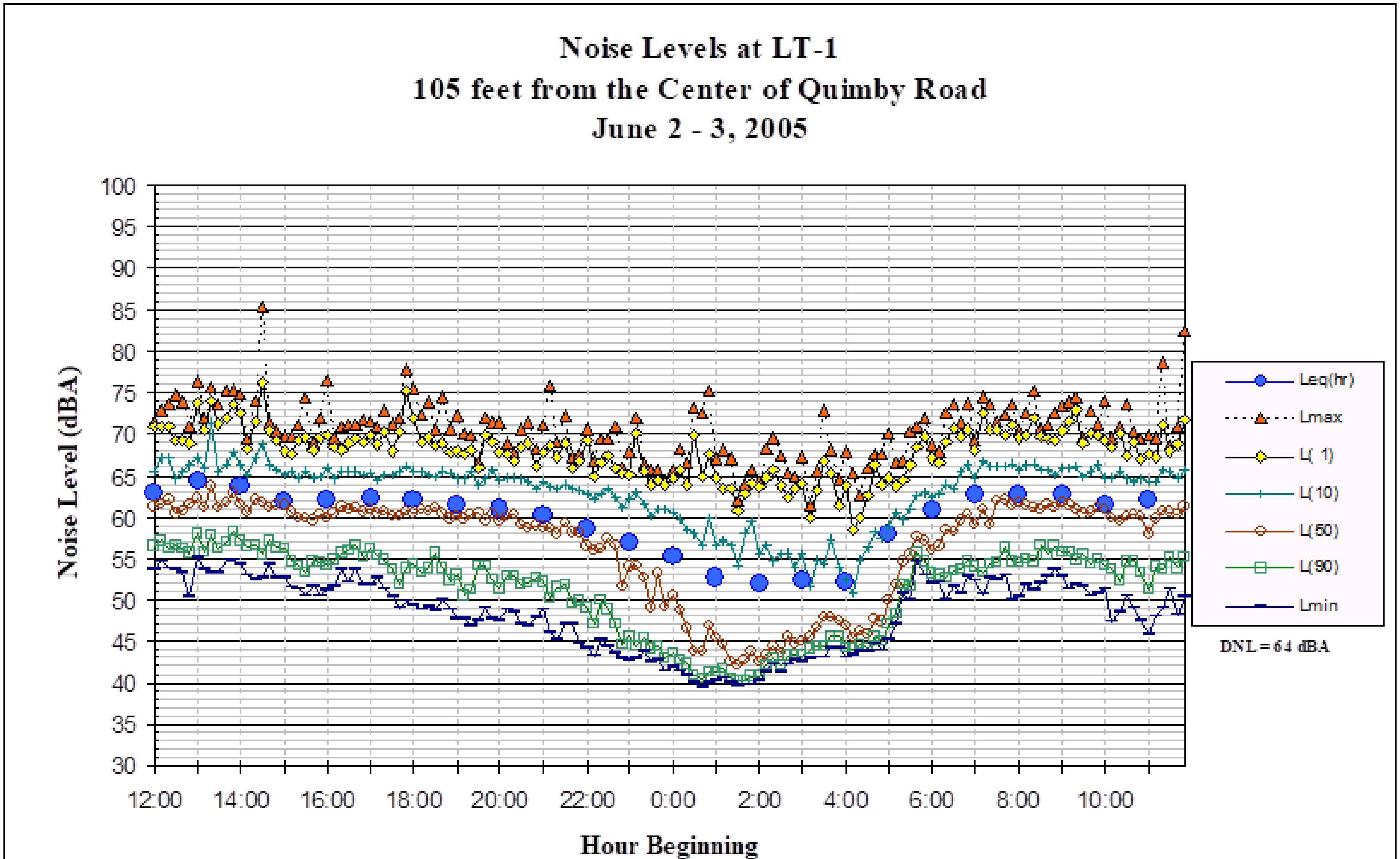
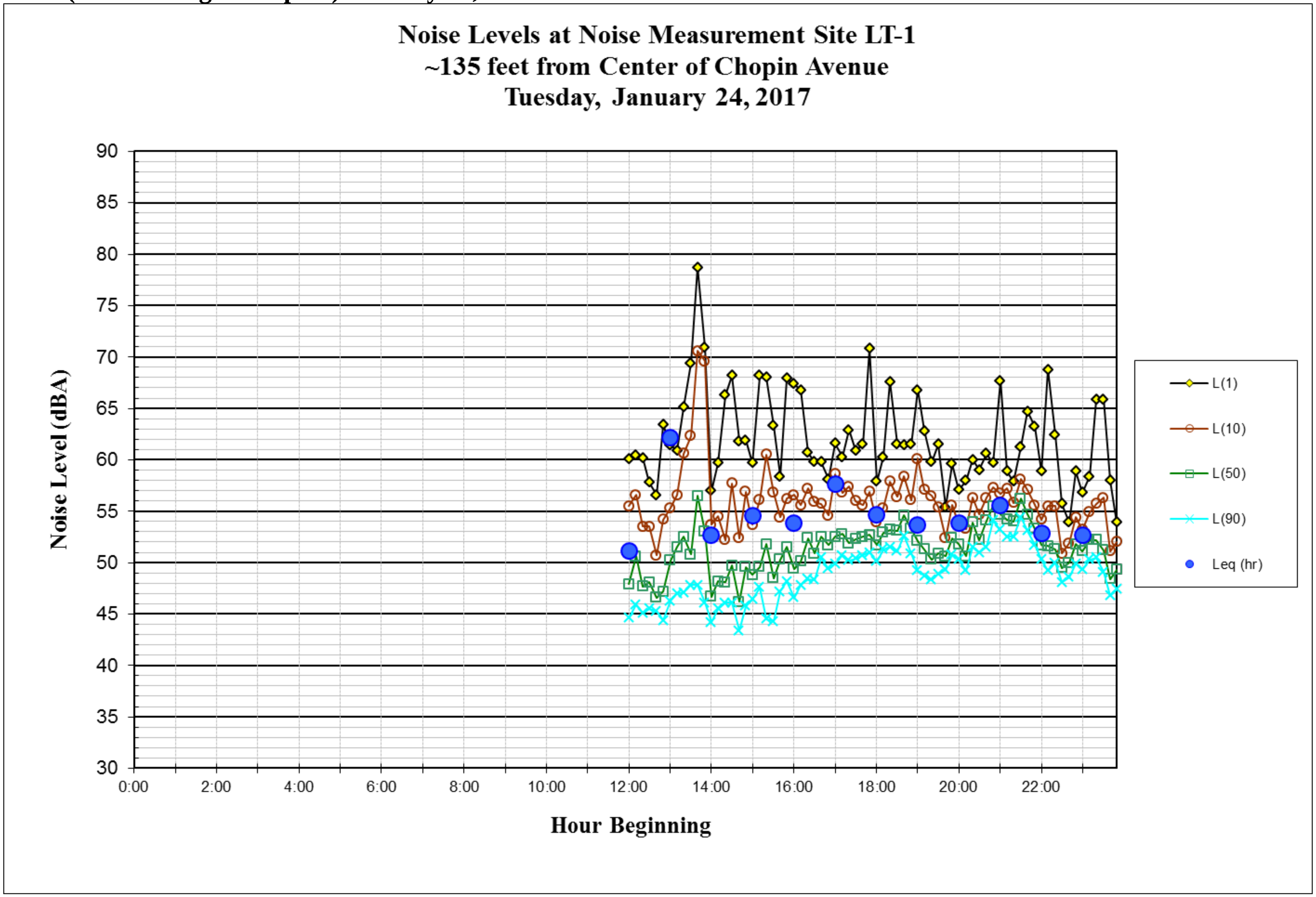
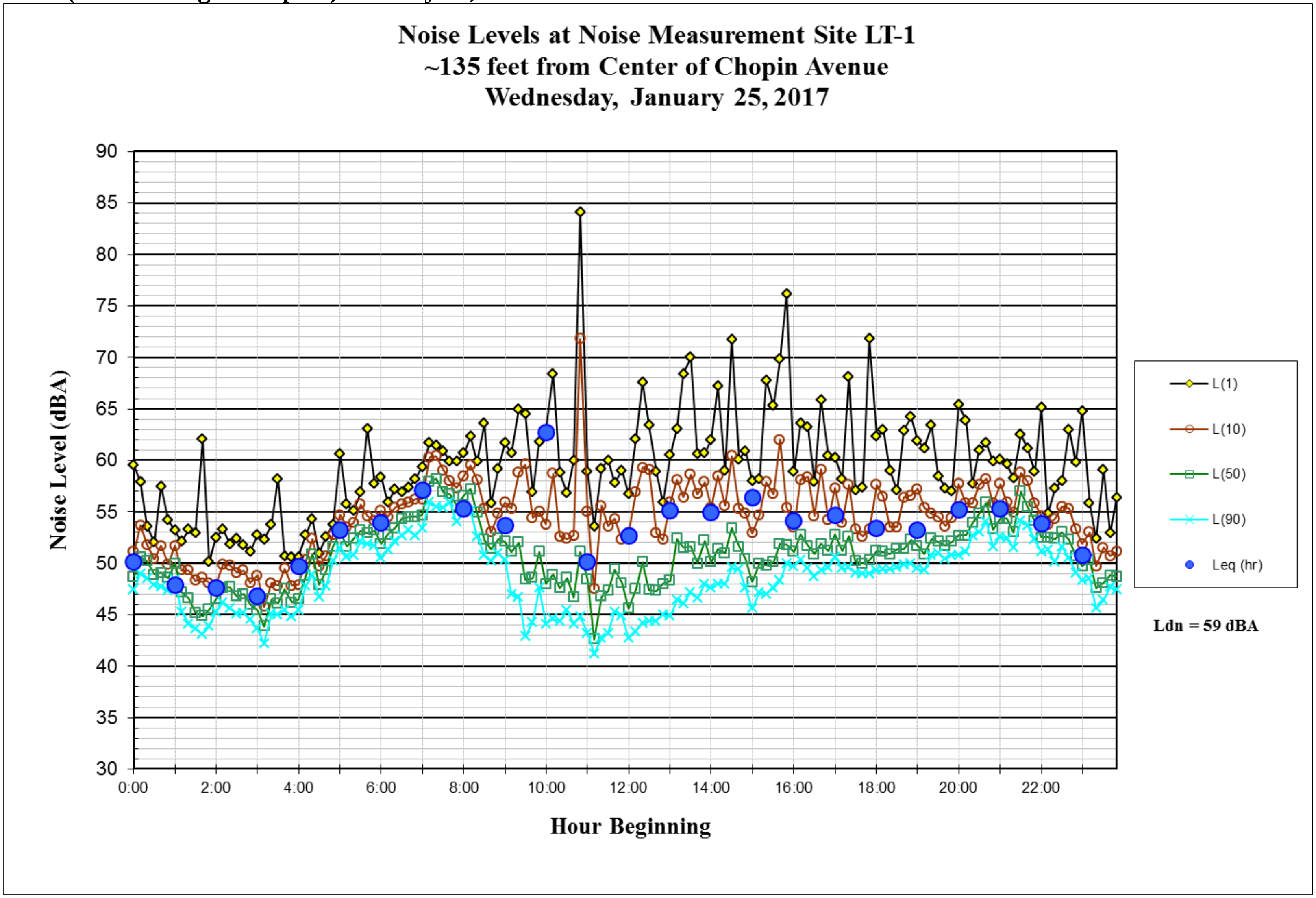


Figure A2

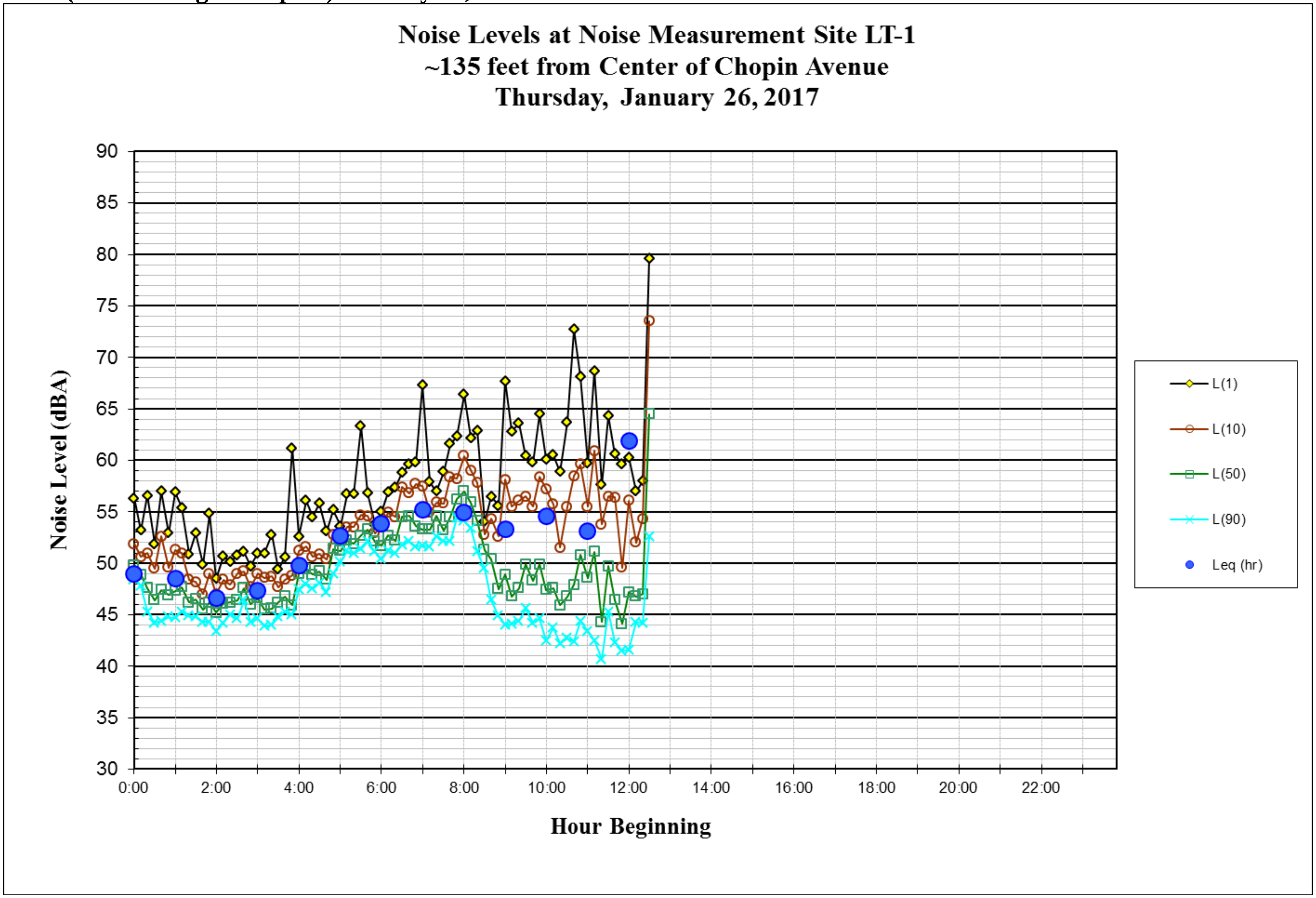
LT-2 (LT-1 in original report) January 24, 2017



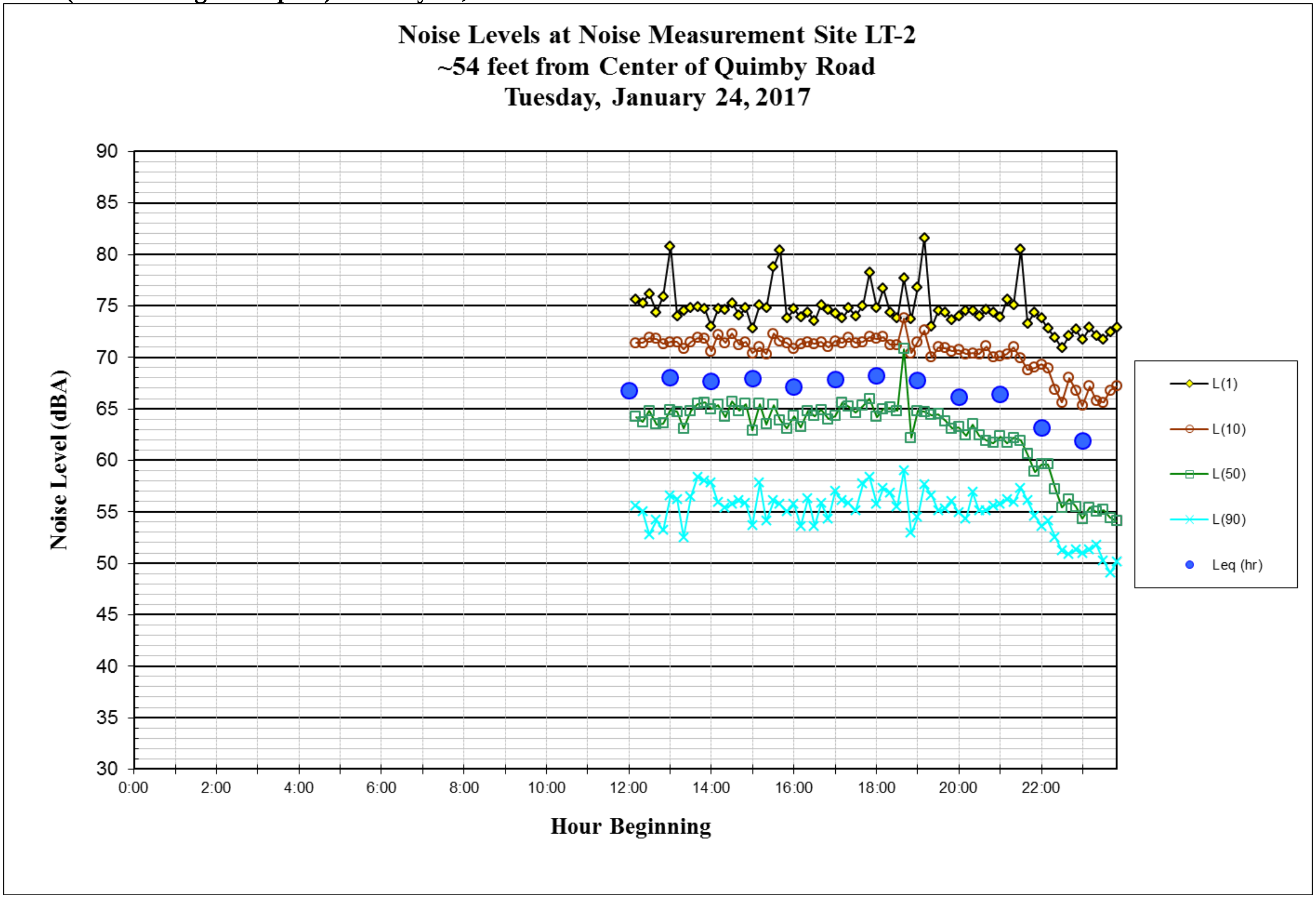
LT-2 (LT-1 in original report) January 25, 2017



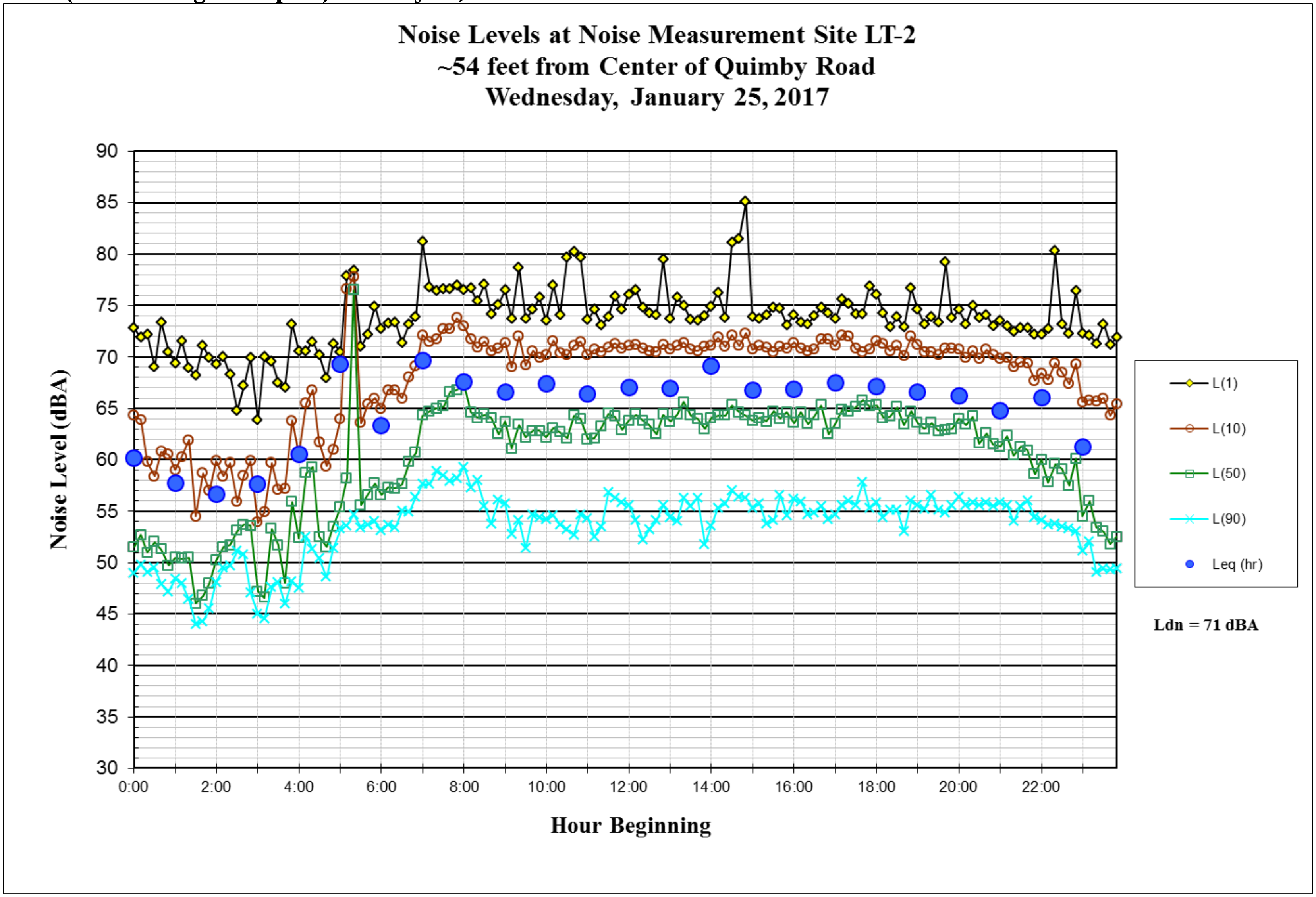
LT-2 (LT-1 in original report) January 26, 2017



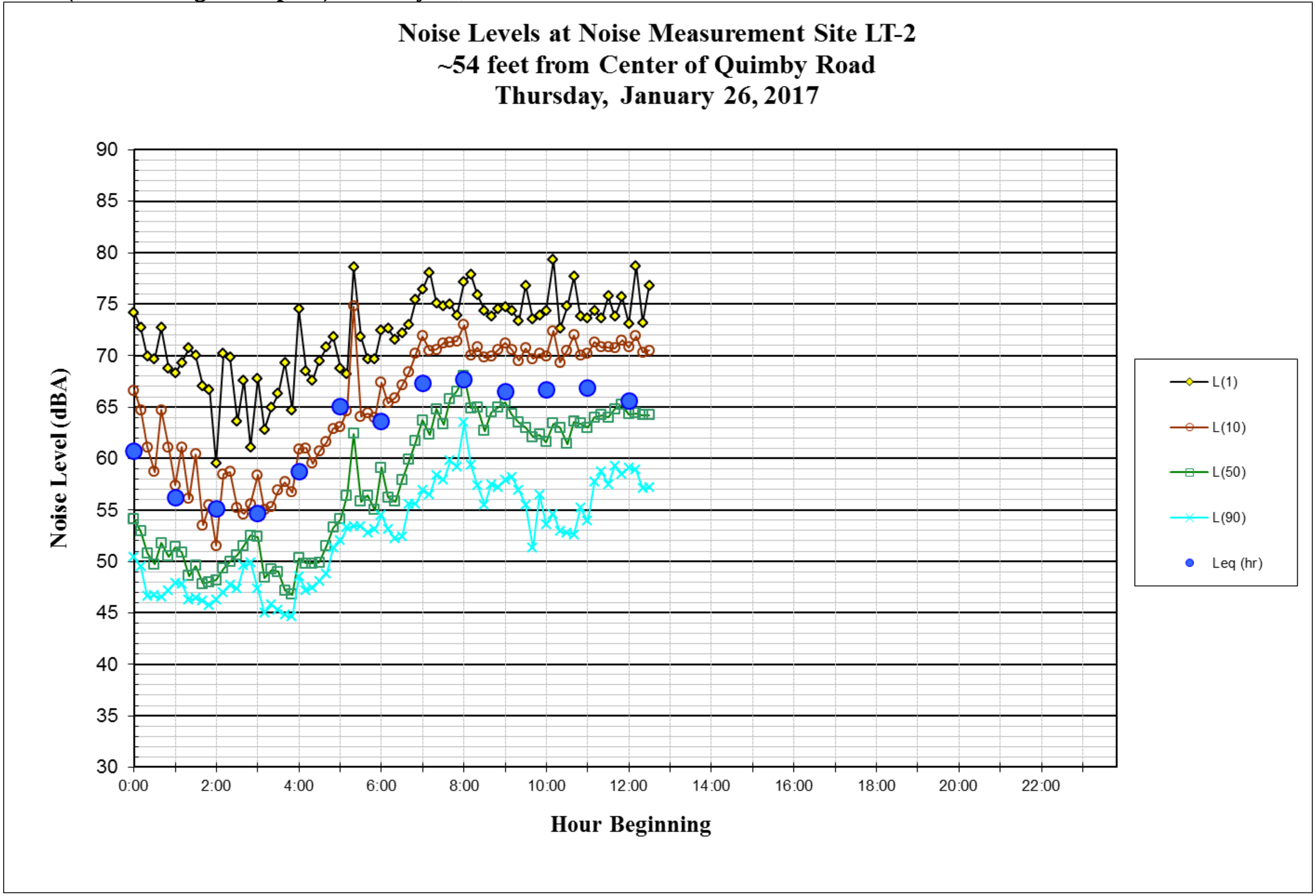
LT-3 (LT-2 in original report) January 24, 2017



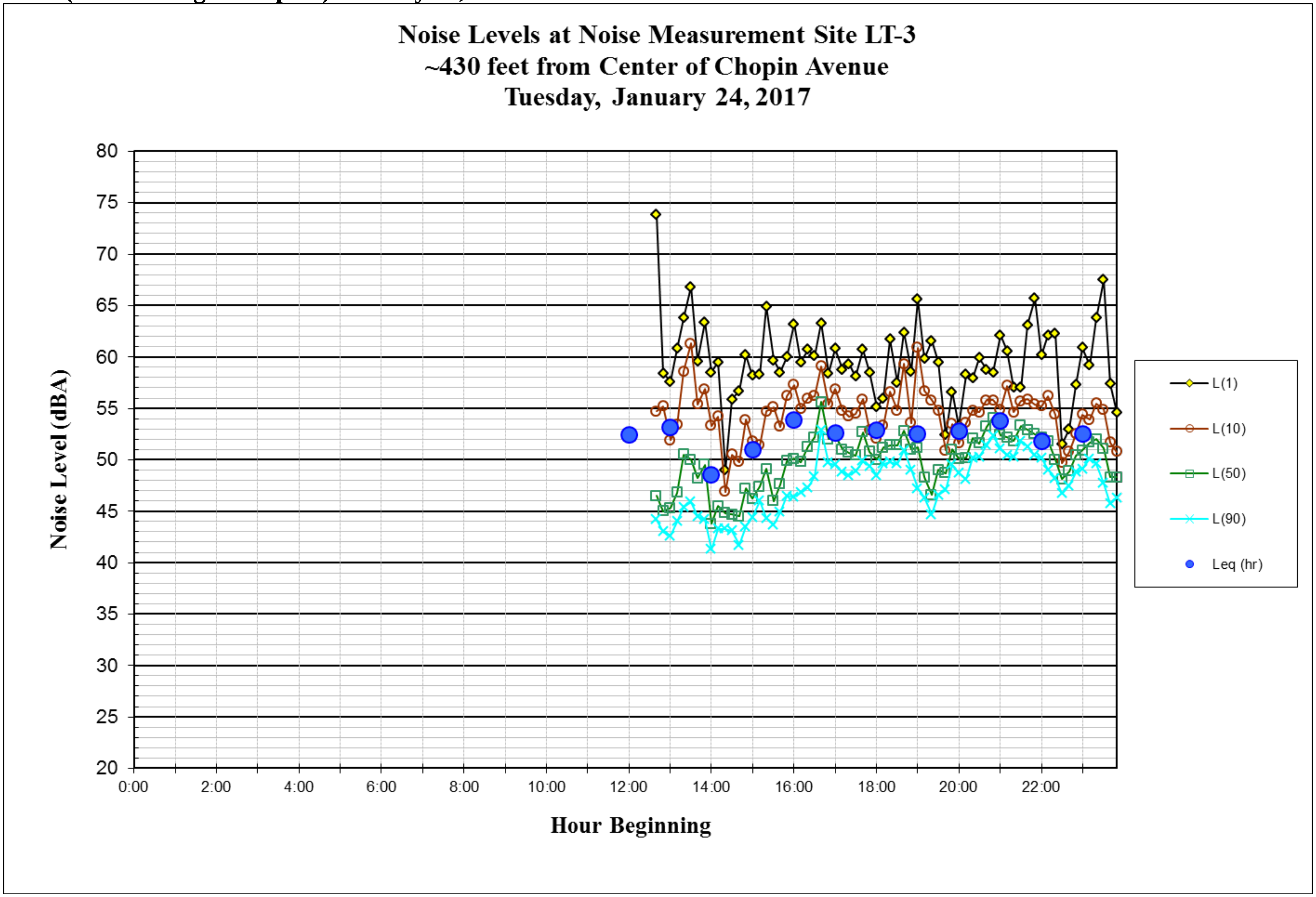
LT-3 (LT-2 in original report) January 25, 2017



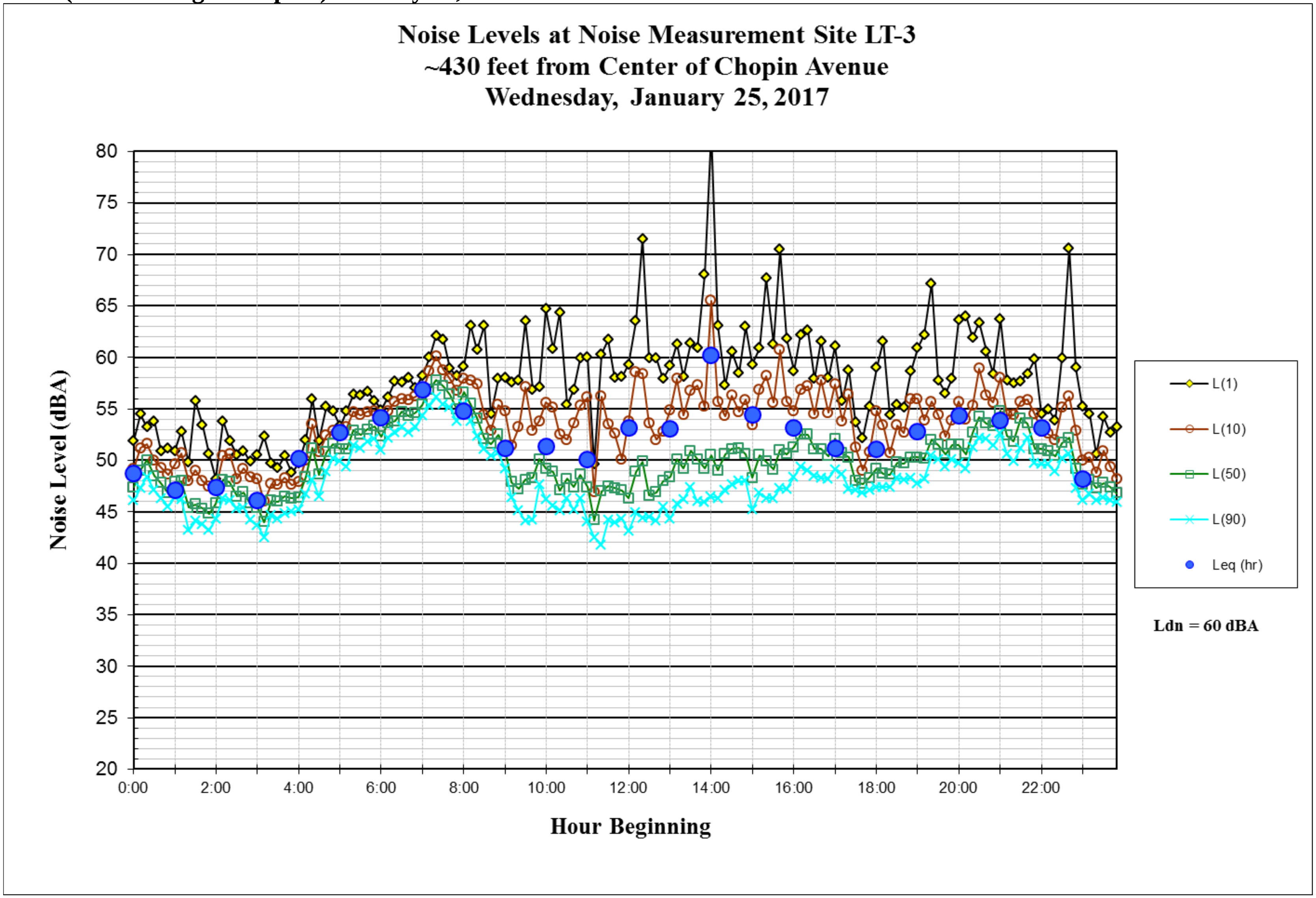
LT-3 (LT-2 in original report) January 26, 2017



LT-4 (LT-3 in original report) January 24, 2017



LT-4 (LT-3 in original report) January 25, 2017



LT-4 (LT-3 in original report) January 26, 2017