PAYPAL PARK STADIUM CONCERT NOISE ASSESSMENT

San Jose, California

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Prepared for:

Jed Mettee
San Jose Earthquakes
1123 Coleman Ave
San Jose, CA 95110

Prepared by:

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

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

Project: 25-046

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INTRODUCTION

This report summarizes Illingworth & Rodkin, Inc.'s evaluation of noise levels resulting from proposed concerts at PayPal Park Stadium in San Jose, California. The report first describes the project proposal and then summarizes the applicable regulatory criteria used in the assessment. Ambient noise levels in the project vicinity are described, followed by a summary of additional noise measurements made during a typical soccer match and during simulated concert conditions. The methodology describing the noise modeling is then presented, and the results of the noise modeling of concerts follow. The report then describes the assessment of noise levels with respect to those thresholds and makes recommendations for noise control.

A brief discussion of the fundamentals of environmental noise is presented in Appendix A for those unfamiliar with acoustical terms or concepts. Appendix B displays the long-term (LT) noise data collected to represent ambient noise levels in the project vicinity.

PROJECT DESCRIPTION

The existing PayPal Park Stadium is an open-roof facility with 18,000 seats that primarily serves Major League Soccer's (MLS) San José Earthquakes. The project would utilize the existing stadium for up to 15 concerts per year. For this assessment, concerts are assumed to be held for up to 4 hours per day and end by 11:00 p.m.

REGULATORY CRITERIA

The noise assessment prepared for the Airport West Stadium Development identified a significant and unavoidable noise impact from concerts held at the stadium because they would substantially increase hourly average and daily average noise levels at nearby receivers. As a project design alternative, the following measure could be considered:

- *Conduct project-level analyses to determine the appropriate noise level limit to be applied to concerts, or other methods of reducing noise levels emanating from the stadium (e.g., enclosure of stadium), such that operational noise levels are reduced below existing conditions at nearby sensitive land uses. Preliminary calculations indicate that the noise level limit should not exceed 85 dBA L_{eq} at a distance of 100 feet from the stage/speakers. The final noise level limit would depend on the actual realized attenuation provided by the stadium (currently estimated to be 5 to 10 dBA).*

This project-level analysis determines the appropriate noise level limit to be applied to concerts such that operational noise levels are reduced below ambient conditions at nearby sensitive land uses.

AMBIENT NOISE ENVIRONMENT

Long-Term Noise Measurements

Illingworth & Rodkin, Inc. (I&R) quantified the existing noise environment in the project vicinity from Thursday, April 17, 2025, through Sunday, April 20, 2025. Six long-term noise measurements (LT-1 through LT-6) were made to quantify the daily trends in noise levels at selected locations in the vicinity of PayPal Park Stadium. The long-term noise measurement locations were chosen to quantify noise levels at the source (LT-1) and at representative locations of a hotel/offices (LT-2) and nearby residences (LT-3, LT-4, LT-5, and LT-6). Figure 1 shows the distribution of long-term measurement locations in and around the stadium.

Noise measurements were made using Larson-Davis Laboratories Model LxT1 precision Type 1 sound level meters fitted with ½-inch pre-polarized condenser microphones and windscreens. The sound level meters were calibrated before and after installation with an LDL acoustical calibrator. Weather conditions were generally good for the purposes of noise monitoring.

The long-term noise measurement data is graphically summarized in Appendix B. The measured ambient noise data were summarized in hourly average (L_{eq}) and daily average (DNL) noise levels to establish existing conditions. The hours of 7:00 p.m. to 11:00 p.m. were of particular interest because proposed concerts would likely occur at these times.

Table 1 summarizes the average L_{eq} noise levels measured at off-site sensitive receptor locations during the 7:00 p.m. to 11:00 p.m. period between Thursday, April 17, 2025, and Sunday, April 20, 2025. Note that a soccer match occurred at the stadium on Saturday, April 19, 2025. The soccer match increased average ambient evening noise levels by up to 7 dBA L_{eq} at the adjacent hotel/office (LT-2) and by 1 to 3 dBA at the nearest residences (LT-3, LT-4, LT-5, and LT-6).

Table 2 summarizes the day-night average noise levels measured at off-site sensitive receptor locations between Friday, April 18, 2025, and Sunday, April 20, 2025. The soccer match increased the day-night average noise levels by 2 dBA DNL at the adjacent hotel/office (LT-2) and by 0 to 2 dBA at the nearest residences (LT-3, LT-4, LT-5, and LT-6).

FIGURE 1 Noise Monitoring Locations

Source: Google Earth, 2025

TABLE 1 Average Hourly Noise Levels at Long-Term Sites (7 p.m. to 11 p.m.)

Site	Location	L_{eq}, dBA			
		Ambient	Ambient	Ambient + Soccer Match	Ambient
		Thursday 4/17/25	Friday 4/18/25	Saturday 4/19/25	Sunday 4/20/25
LT-2	Hotel/Offices	59	59	65	57
LT-3	Waco Street	60	61	62	60
LT-4	San Juan Avenue	59	60	60	59
LT-5	De Altura Common	59	59	59	57
LT-6	O'Brien Court	47	50	54	56

TABLE 2 Day Night Average Noise Levels at Long-Term Sites

Site	Location	DNL, dBA		
		Ambient	Ambient + Soccer Match	Ambient
		Friday 4/18/25	Saturday 4/19/25	Sunday 4/20/25
LT-2	Hotel/Offices	62	64	61
LT-3	Waco Street	66[1]	66	64[1]
LT-4	San Juan Avenue	63	63	62
LT-5	De Altura Common	62[2]	61	60[2]
LT-6	O'Brien Court	54	56	53

1. Note that the ambient DNL measured by our firm in 2008 at this location was 66 dBA DNL.
2. Note that the ambient DNL measured by our firm in 2008 at this location was 62 dBA DNL.

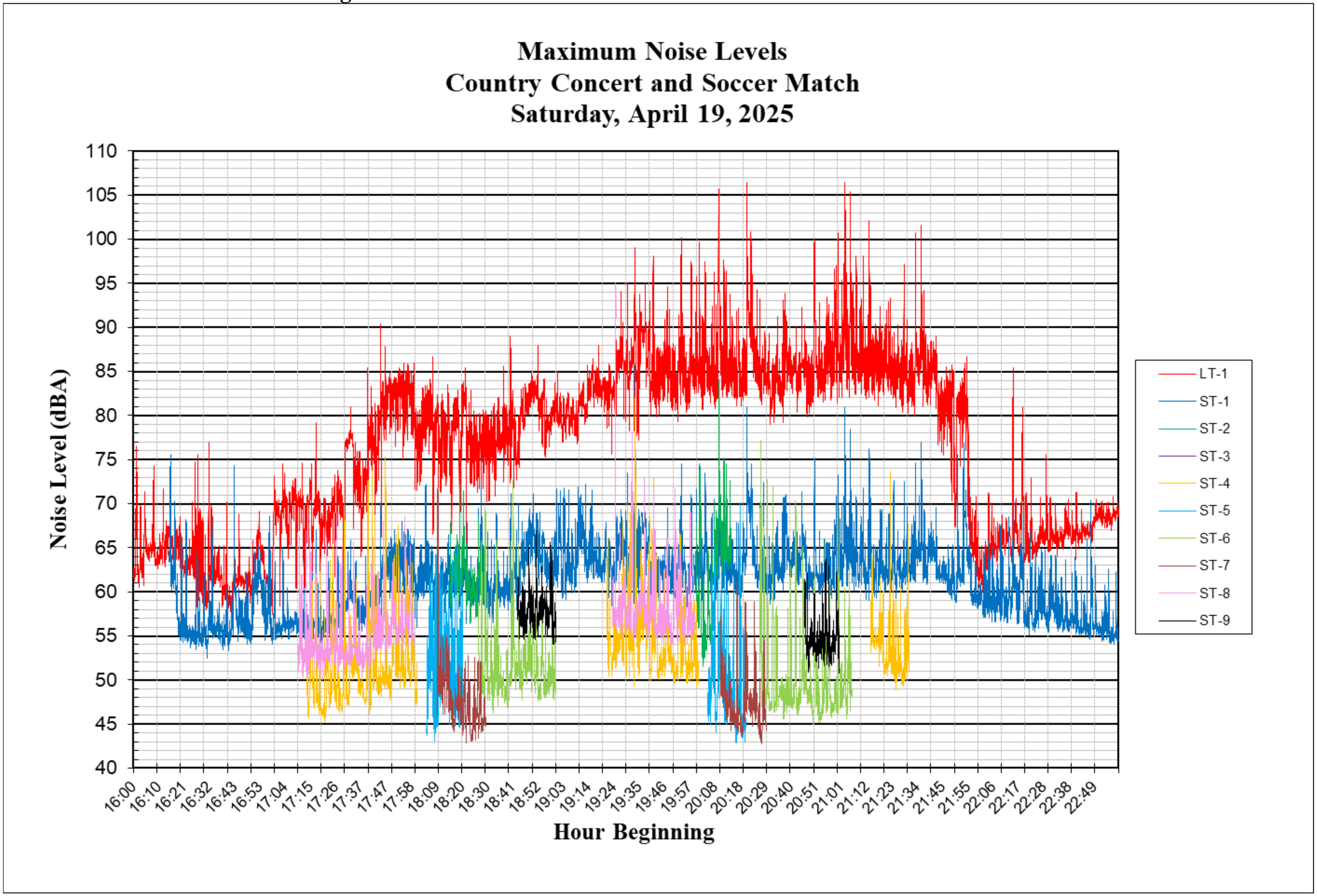
Short-Term Noise Measurements

Nine short-term noise measurement locations (ST-1 through ST-9) were selected to supplement the long-term data by quantifying and characterizing noise levels during a Major League Soccer match on Saturday, April 19, 2025. The soccer match was between Sporting Kansas City and the San Jose Earthquakes. Approximately 14,150 spectators attended the soccer match at the stadium. Prior to the match, the San Jose Earthquakes celebrated their first-ever Country Night headlined by a pregame concert from Clayton Johnson. Noise sources measured at this MLS event included vehicles within the parking lots before during and after the event, tail-gating activities, amplified music within and around the stadium, announcements made through the public address system, fireworks, and from the spectators themselves while cheering, chanting, groaning, playing trumpets and drums, and stomping on the bleachers.

Figure 2 shows the trend in maximum noise levels measured throughout the event within the stadium (LT-1) and during simultaneous periods at the nine satellite locations. Site ST-1 was at the southwest boundary of the Audi parking lot, Site ST-2 was adjacent to the Element San Jose Airport hotel, and Site ST-3 represented multi-family residential buildings to the northwest near the intersection of Champions Way and Wondo Way. Sites ST-4, ST-5, ST-6, and ST-7 represented residential land uses in the Campbell Avenue area to the southwest. Site ST-8 represented the Newhall neighborhood to the southeast of the stadium, and ST-9 represented residences to the northeast, opposite San Jose Mineta International Airport and State Route 87 within the Rosemary Gardens neighborhood.

A review of Figure 2 shows that noise levels at the Element San Jose Airport hotel typically ranged from 60 to 75 dBA during the soccer match. Noise levels reached 84 dBA when a goal was scored by the Earthquakes. Soccer match noise levels were not detectable above ambient noise levels at ST-3. Soccer match noise levels at ST-4 generally ranged from 52 to 62 dBA and reached 76 to 80 dBA during pre-game fireworks. At ST-5, ST-6, and ST-7, soccer match noise levels were generally less than 50 dBA and difficult to discern above other ambient transportation noise sources in the project vicinity that produced noise levels typically ranging from 50 to 60 dBA. At ST-8, sounds produced by the pre-game concert were noted to range from 53 to 61 dBA, and sounds produced during the soccer match were noted to range from 55 to 62 dBA. Pre-game fireworks produced noise levels reaching 72 to 77 dBA during pre-game fireworks. Soccer match noise levels were not detectable above ambient noise levels at ST-9. Noise levels produced by traffic along SR 87 and by aircraft associated with San Jose Mineta International Airport were typically 52 to 65 dBA.

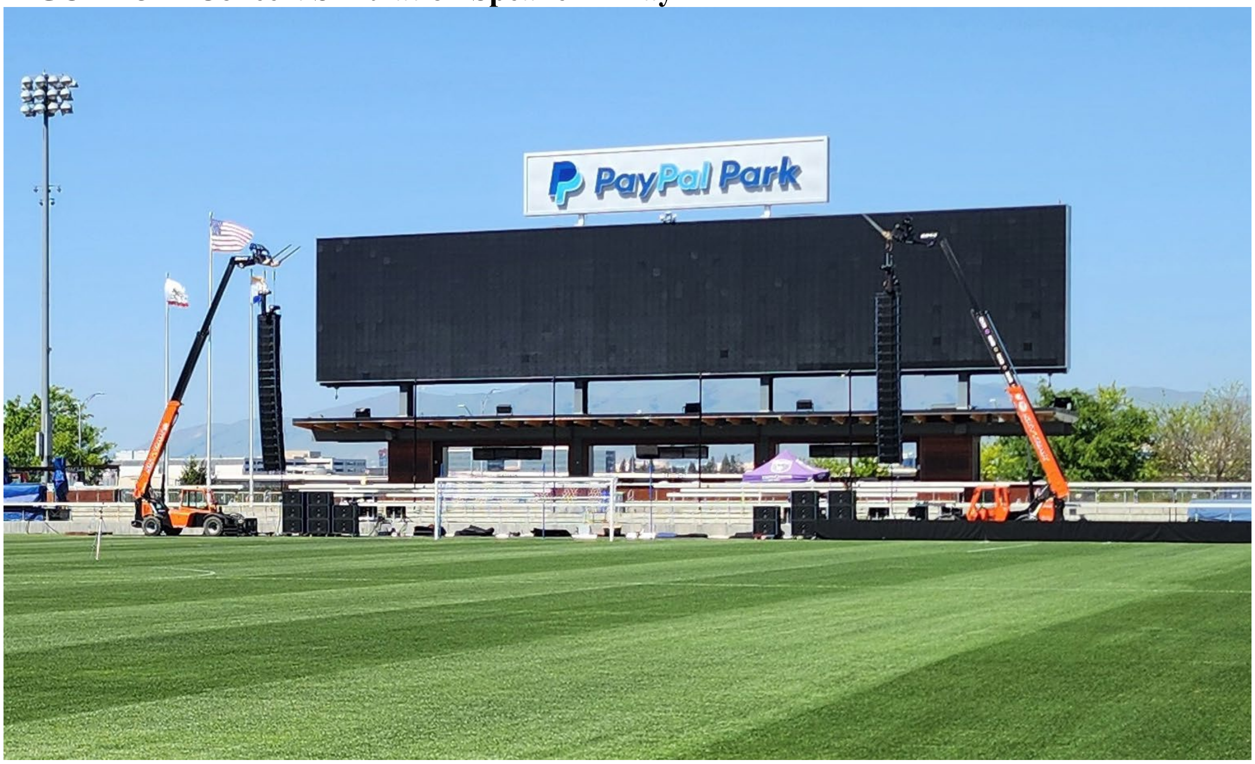
FIGURE 2 Noise Levels During Soccer Match



CONCERT SIMULATION

The source levels for a representative full stadium outdoor amplified concert were established with the use of a concert grade sound system supplied and operated by a concert audio production company on Monday, April 21, 2025. The audio amplification system used was composed of two sets of eight (8) ground level midrange/subwoofer powered speakers and an 18 speaker line array elevated to a height of between approximately 10 to 32 feet above field level facing the southern (closed) end of the stadium on either side of the goal area at the northern (open end) of the stadium. The placement of the ground level speakers was used to establish the front of stage position. Figure 3 is a photograph of the event simulation speaker array. A stationary sound level monitor was positioned at 135 feet from this front of stage (see P1 in Figure 4), which according to the concert audio operator is the typical distance from the front of stage to the audio control/mixing position for an outdoor stadium concert.

FIGURE 3 Concert Simulation Speaker Array



A series of four songs, representing a range in musical genres (Banda, R&B/Pop, Hard Rock/Heavy Metal, and Hip-Hop/Rap) and a range of audio qualities (brass, blues, and rock instrumentation, high and low pitched vocals and deep bass sounds) of amplified music that could be expected at concerts in the stadium, were played for the concert simulation. The Banda style music featured clarinets, trumpets, trombones, alto horns, tubas, drums, and vocals. Pop vocalist Mariah Carey's "Emotions" featured high notes, heavy metal band Motörhead's "Ace of Spades" featured heavy guitar riffs, and rapper Travis Scott's "FE!N" featured deep bass sounds. These songs were played in a loop with the audio system set to produce sound levels of between 100 and 106 dBA (with an average level of 104 dBA), at the audio control/mixing position, 135 feet from the established front of stage.

While each loop of four songs was played, a series of six measurements located at the control/mixing position (P1), at the edge of the field at the setback of the mixing position (P2 & P6), and at the southern perimeter and center edges of the field (P3, P4 & P6) were also made as shown in Figure 4. The results of these measurements indicated that maximum sound levels at the field perimeter locations ranged from 102 to 107 dBA, with average sound levels ranging from 87 to 98 dBA.

FIGURE 4 Speaker and Measurement Positions within PayPal Park Stadium

Noise measurements were also made during the four-song concert simulation loop at the nine short-term noise measurement locations originally selected to quantify noise levels during the soccer match (ST-1 through ST-9). Two series of measurements at the short term locations were made. The first was conducted during the afternoon hours, and the second was made during the evening hours to document any changes in noise propagation that may occur with afternoon and evening concerts.

The first (afternoon) series of measurements occurred between approximately 2:50 p.m. and 4:00 p.m. on Monday, April 21, 2025. I&R staff remained with the sound system to notify the sound engineers when the other I&R staff members were in position to complete the measurements. Once the sample was completed, the I&R staff member on site would advise sound engineers to stop the music until the I&R staff arrived at the next measurement location. A second (evening) series of measurements occurred between approximately 7:00 p.m. and 8:00 p.m.

Figures 5 and 6 show the trend in maximum noise levels measured during the simulated concert events within the stadium and during simultaneous time periods at the nine satellite locations. The looped music tracks documented at the mid-field position clearly indicate the times when the music was turned on to make simultaneous noise measurements throughout the area. The short-term sites were the same as previously described for the soccer match.

A review of Figures 4 and 5 shows that noise levels at the Element San Jose Airport hotel (ST-2) typically ranged from 65 to 70 dBA during the concert simulation. Similar to the soccer match noise measurements, the simulated concert noise levels were not detectable above ambient noise levels at ST-3. Simulated concert noise levels at ST-4 generally ranged from 60 to 67 dBA, with aircraft and trains producing noise levels ranging from 62 to 70 dBA. At ST-5, ST-6, and ST-7, simulated concert noise levels generally ranged from 46 to 54 dBA and were difficult to discern above other ambient transportation noise sources in the project vicinity. At ST-8, simulated concert noise levels generally ranged from 55 to 65 dBA. Simulated concert noise levels were not detectable above ambient noise levels at ST-9, where noise produced by traffic along SR 87 and by aircraft associated with San Jose Mineta International Airport were typically 47 to 70 dBA.

FIGURE 5 Noise Levels During Afternoon Concert Simulation

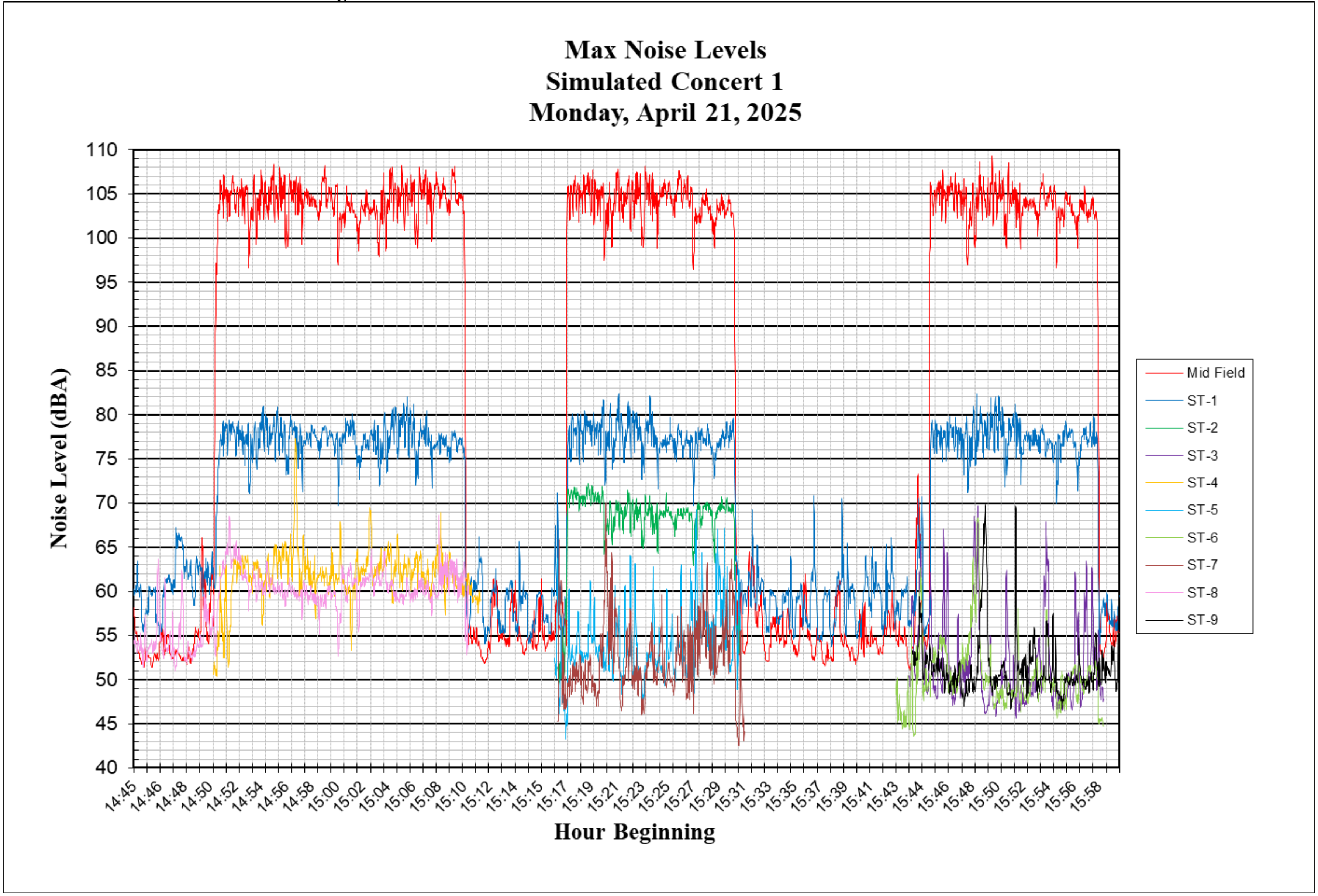
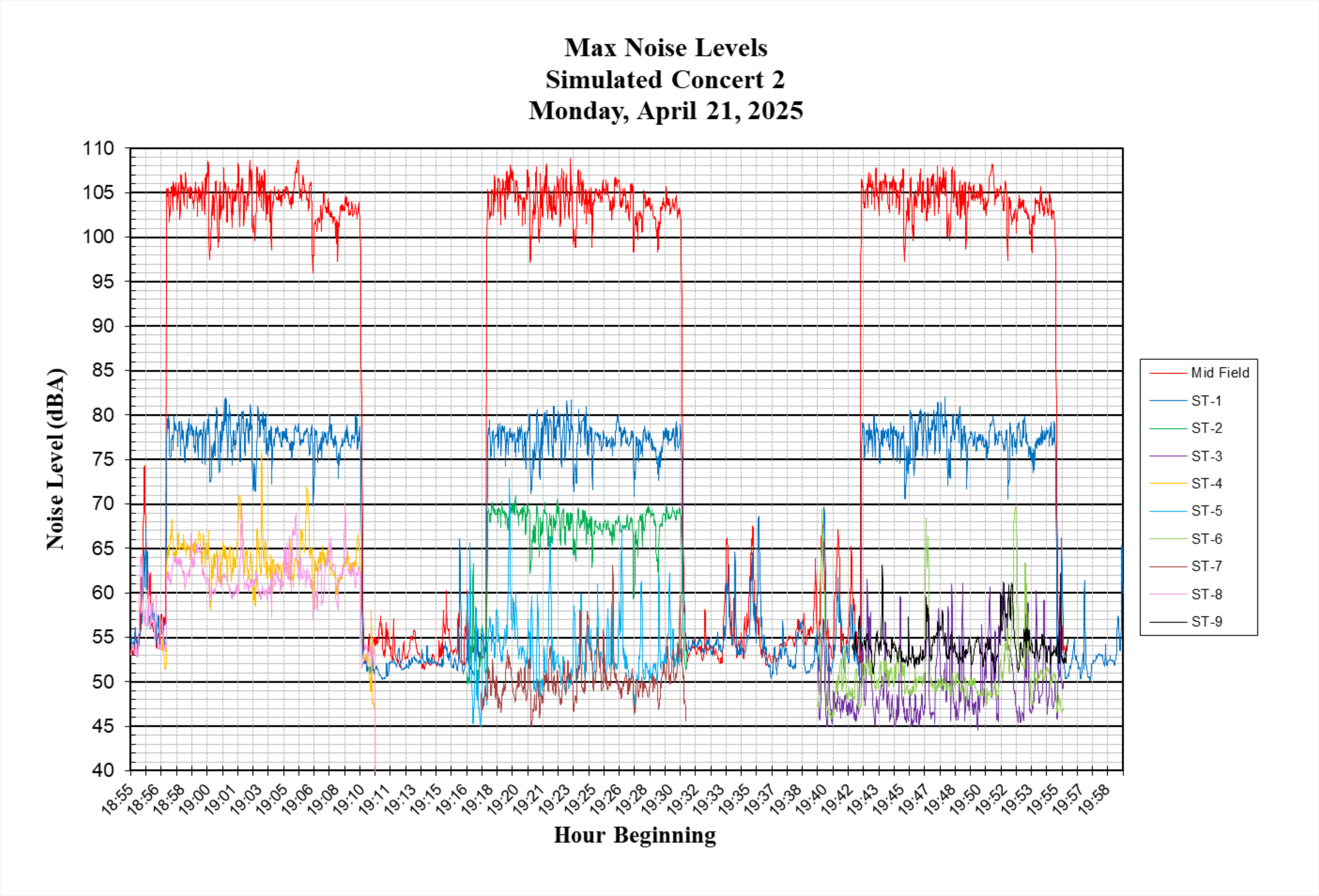


FIGURE 6 Noise Levels During Evening Concert Simulation



NOISE MODELING RESULTS

SoundPLAN Version 9.1, a three-dimensional ray-tracing computer program, was used to calculate noise levels from concert events occurring at PayPal Park Stadium. The calculations considered the frequency spectra of the noise source, the directivity of the noise source, the acoustical shielding provided by the stadium and off-site buildings in the site vicinity, and the topography of the area. The predicted noise levels were compared to measured noise levels obtained during the concert simulation for validation purposes, and adjustments were made as necessary to the model.

Figure 7 displays the concert noise contours in terms of hourly average noise levels, assuming that the stage is set up at the north (open) end of the stadium and that the speakers are oriented toward the southwest. This scenario represents the worst-case conditions for the nearest receptors to the southwest in the Campbell Avenue area. Figure 8 displays the concert noise contours assuming that the stage is set up at the south (closed) end of the stadium and that the speakers are oriented toward the northeast. This scenario represents the worst-case conditions for the nearest receptors to the northeast in the Rosemary Gardens area.

Table 3 summarizes the results of the ambient noise measurements made during the 7:00 p.m. to 11:00 p.m. time periods and the predicted concert noise levels assuming the two alternative speaker configurations. With the speakers oriented to the southwest, concert noise levels would exceed typical hourly average noise levels (averaged over Thursday, Friday, and Sunday) by up to 8 dBA at residences represented by LT-3, LT-4, LT-5, and LT-6. With the speakers oriented to the northeast, concert noise levels would not typically exceed hourly average noise levels at residences represented by LT-3, LT-4, LT-5, and LT-6.

TABLE 3 Hourly Average Noise Levels at Long-Term Sites (7:00 p.m. to 11:00 p.m..)

Site	Location	L_{eq}, dBA				
		Ambient	Ambient	Ambient	Concert	Concert
		Thursday 4/17/25	Friday 4/18/25	Sunday 4/20/25	SW Facing	NE Facing
LT-2	Hotel/Offices	59	59	57	64	64
LT-3	Waco Street	60	61	60	58	58
LT-4	San Juan Avenue	59	60	59	58	60
LT-5	De Altura Common	59	59	57	64	55
LT-6	O'Brien Court	47	50	56	59	49

Table 4 summarizes ambient DNL noise levels and the DNL attributable to concerts, assuming that the concert noise is continuous from 7:00 p.m. to 11:00 p.m. The predicted noise levels are presented for both speaker configurations. Concert noise levels, as measured on a DNL basis, would not exceed typical DNL noise levels at residences represented by LT-3, LT-4, or LT-5, but could exceed ambient DNL noise levels at LT-6 by up to 3 dBA with the speakers facing southwest. The addition of a concert would increase ambient DNL noise levels by 1 to 3 dBA at LT-3, LT-4, and LT-5 and by up to 4 dBA at LT-6.

TABLE 4 Day Night Average Noise Levels at Long-Term Sites (7:00 p.m. to 11:00 p.m.)

Site	Location	DNL, dBA			
		Ambient	Ambient	Concert[1]	Concert[1]
		Friday 4/18/25	Sunday 4/20/25	SW Facing	NE Facing
LT-2	Hotel/Offices	62	61	61	61
LT-3	Waco Street	66	64	55	55
LT-4	San Juan Avenue	63	62	55	57
LT-5	De Altura Common	62	60	61	52
LT-6	O'Brien Court	54	53	56	46

1. DNL from the concert between 7:00 p.m. to 11:00 p.m. This estimate does not include other ambient noise.

FIGURE 7 SoundPLAN Noise Contours – Speakers Facing Southwest

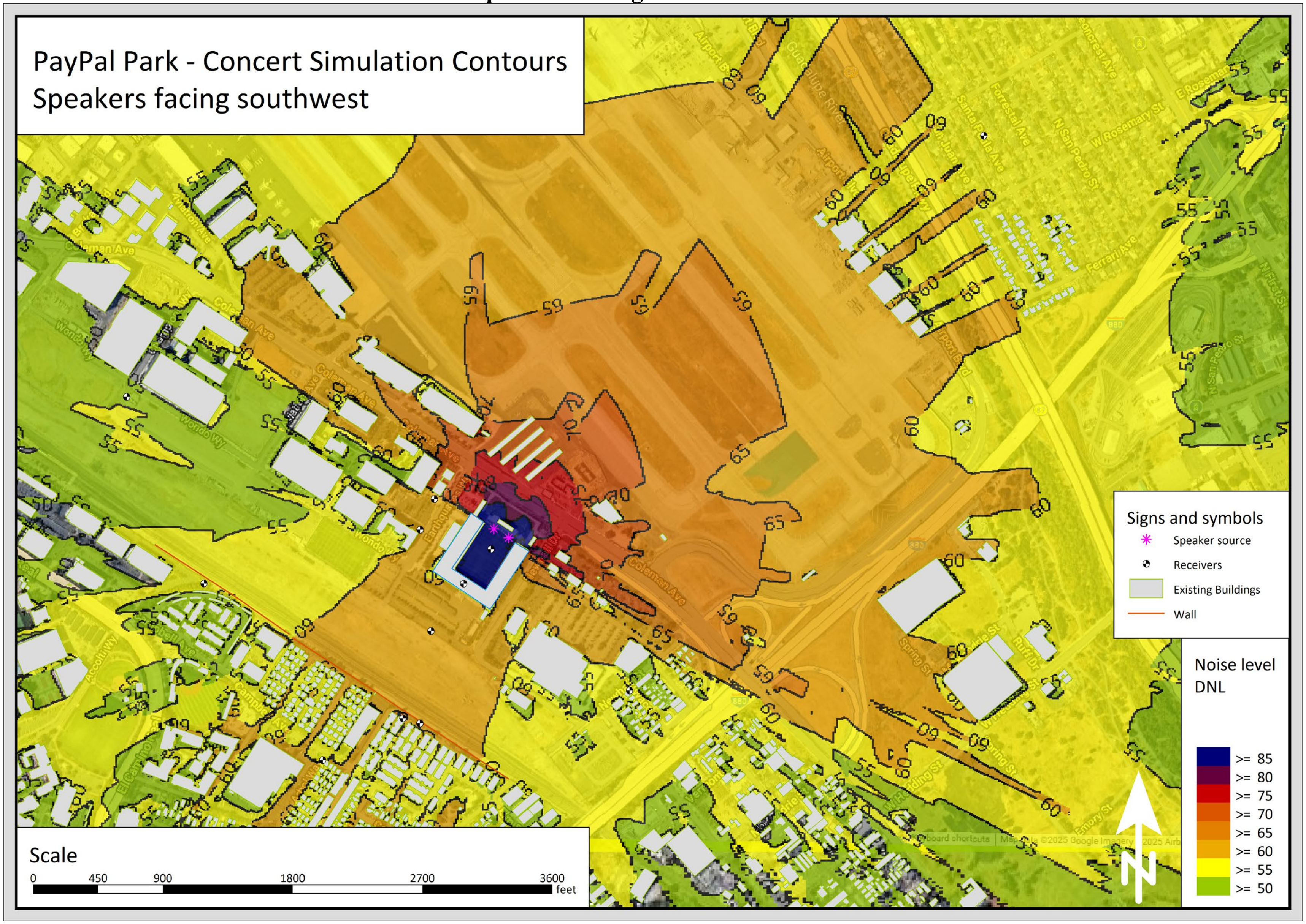
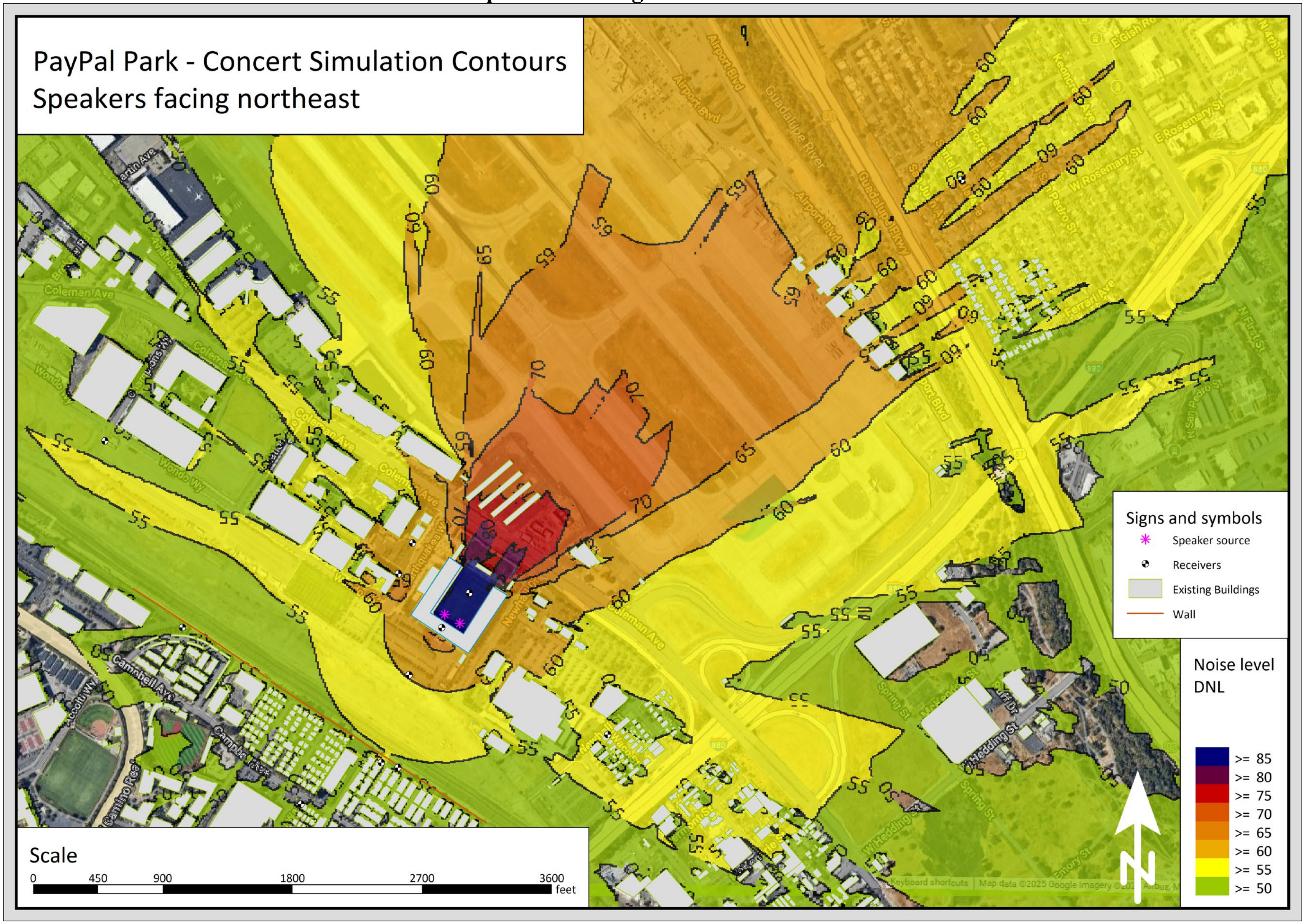


FIGURE 8 SoundPLAN Noise Contours – Speakers Facing Northeast



NOISE CONTROL RECOMMENDATIONS

With the speakers oriented to the southwest, concert noise levels would exceed typical hourly average noise levels by up to 8 dBA at residences, and the addition of concerts would increase ambient DNL noise levels by 1 to 4 dBA. For comparative purposes, a typical soccer match increased the day-night average noise levels by 0 to 2 dBA above ambient conditions at the nearest residences.

Concert noise levels would also be received differently by noise-sensitive receptors. The fairly constant sounds of music and speech, particularly when occurring over several hours, can be considered more annoying than other events currently held at the stadium. Noise from concerts could interfere with sleep, conversations, and other daily activities, resulting in frustration for some people.

As noted previously, the noise assessment prepared for the Airport West Stadium Development identified a significant and unavoidable noise impact from concerts held at the stadium because they would substantially increase hourly average and daily average noise levels at nearby receivers. In order to reduce hourly average and daily average noise levels at nearby receivers to at or below ambient conditions, the following measures should be implemented:

- Orient the stage and speakers toward the southwest and limit speaker output to 96 dBA L_{eq} at 135 feet from the front of the stage. The noise limit established at this location assumes an average noise level throughout the four-hour concert event between 7:00 p.m. and 11:00 p.m. Based on the data presented in Tables 3 and 4, and the noise contours presented in Figure 7, hourly average and daily average concert noise levels would be reduced to ambient conditions, assuming a minimum 8 dBA reduction in speaker output from the 104 dBA L_{eq} source level tested during the concert simulation. With the speaker output limited to 96 dBA L_e at 135 feet, hourly average noise levels at residences would range from 50 to 56 dBA L_{eq}, which would be at or below ambient conditions. In addition, DNL noise levels resulting from concerts would be less than 55 dBA at residences.

- Alternately, orient the stage and speakers toward the southwest and limit speaker output to 98 dBA L_{eq} at 135 feet from the front of the stage during four-hour concert events occurring between 6:00 p.m. and 10:00 p.m. Hourly average and daily average concert noise levels would be reduced to ambient conditions during the 6:00 p.m. to 10:00 p.m. timeframe, assuming a minimum 6 dBA reduction in speaker output from the 104 dBA L_{eq} source level tested during the concert simulation. With the speaker output limited to 98 dBA L_{eq} at 135 feet, hourly average noise levels at residences would range from 52 to 58 dBA L_{eq}, which would be at or below ambient conditions. In addition, DNL noise levels resulting from concerts would be less than 55 dBA at residences.

- Alternately, orient the stage and speakers toward the northeast and maintain speaker output at 104 dBA L_{eq} at 135 feet from the front of the stage. Based on the data presented in Tables 3 and 4, and the noise contours presented in Figure 8, hourly average and daily average concert noise levels would be reduced to ambient conditions. No reduction in speaker output would be required. Hourly average noise levels at residences would range from 49 to 60 dBA L_{eq}, which would be at or below ambient conditions. In addition, DNL noise levels resulting from concerts would be 57 dBA or less at residences.

- Under either speaker orientation scenario outlined above, conduct a series of noise measurements during the first two concerts of this speaker orientation scenario to confirm that hourly average noise levels at residential receptors are within the range of ambient noise conditions. Further reductions in speaker output at 135 feet from the front of the stage shall be made until the goal noise levels are achieved.

Appendix A – Noise Fundamentals

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 the 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 A1.

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 A2. 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 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 p.m. to 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. to 7:00 a.m.) 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.

TABLE A1 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 A2 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.

Effects of Noise

Sleep and Speech Interference

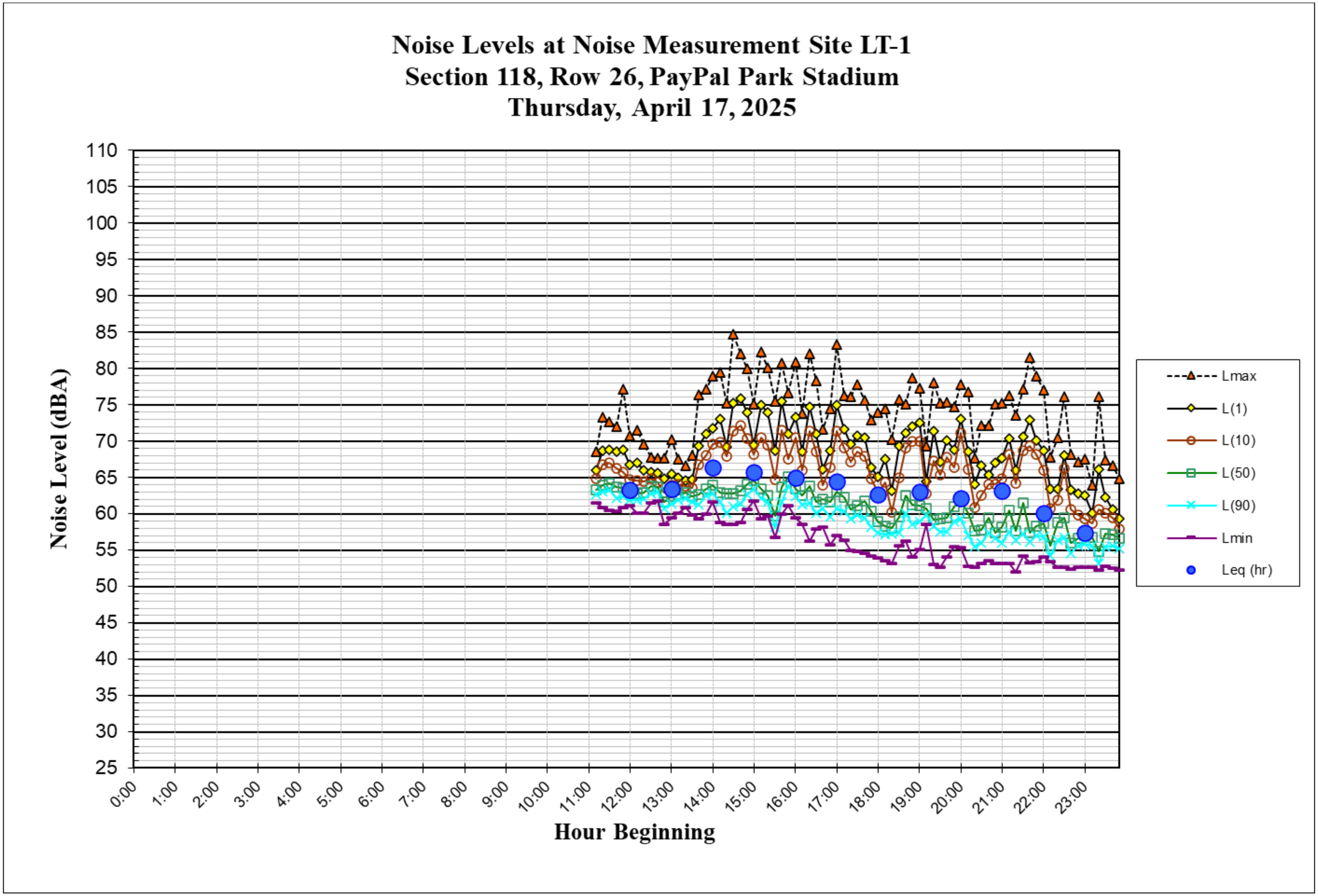
The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} 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 to 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.[1] Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA L_{dn} with open windows and 65 to 70 dBA L_{dn} if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 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 L_{dn} 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 L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn} of 60 to 70 dBA. Between a L_{dn} of 70 to 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 L_{dn} is 60 dBA, approximately 30 to 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.[2]

[1] Based on the U.S. Department of Transportation Federal Highway Administration document "Highway Traffic Noise: Analysis and Abatement Guidance" (2010) and data from Illingworth & Rodkin, Inc. noise monitoring projects.
[2] Kryter, Karl D. The Effects of Noise on Man. Menlo Park, Academic Press, Inc., 1985.

Appendix B – Long-Term Noise Data


Noise Levels at Noise Measurement Site LT-1
Section 118, Row 26, PayPal Park Stadium
Thursday, April 17, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
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35
30
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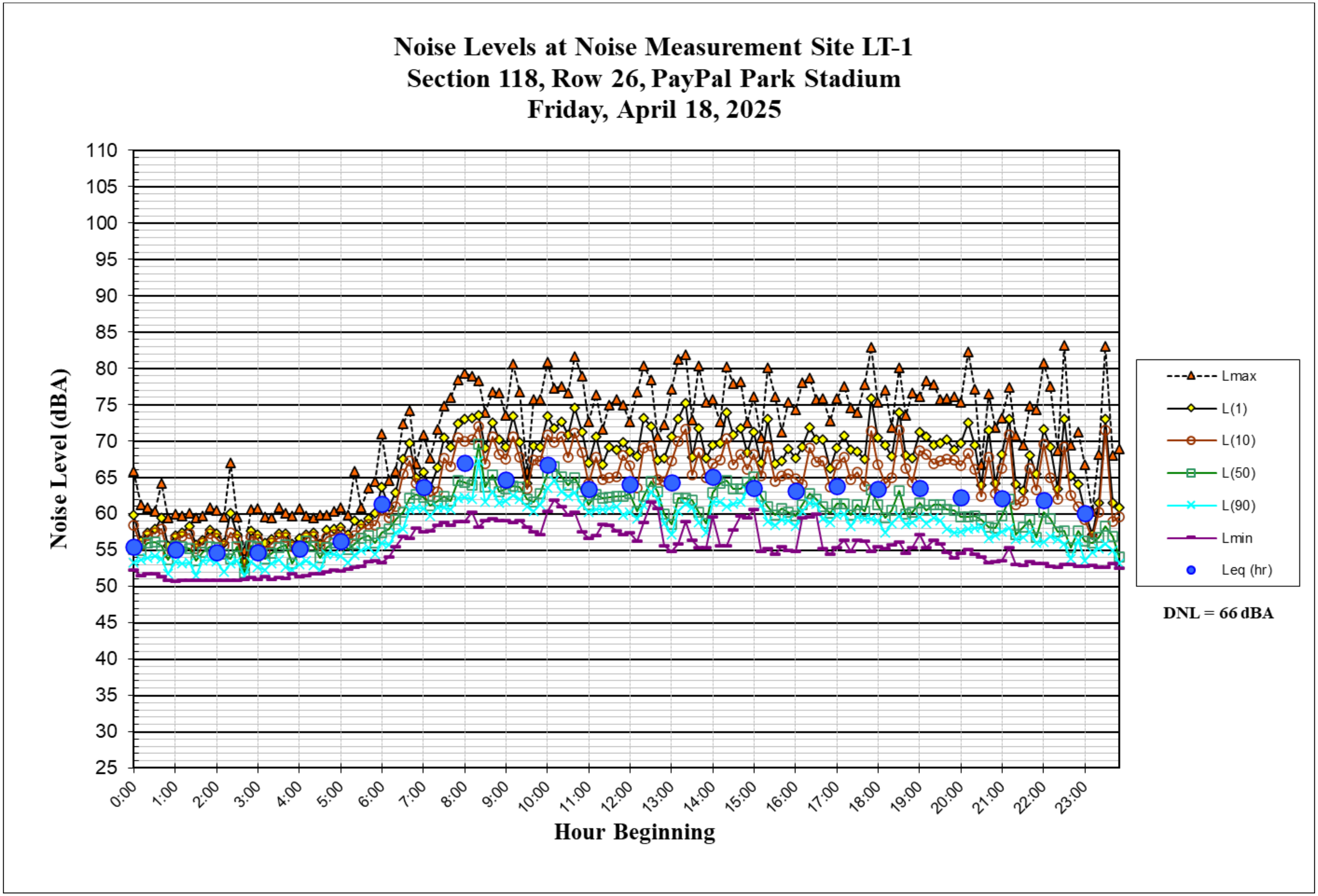
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-1
Section 118, Row 26, PayPal Park Stadium
Friday, April 18, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
1:00
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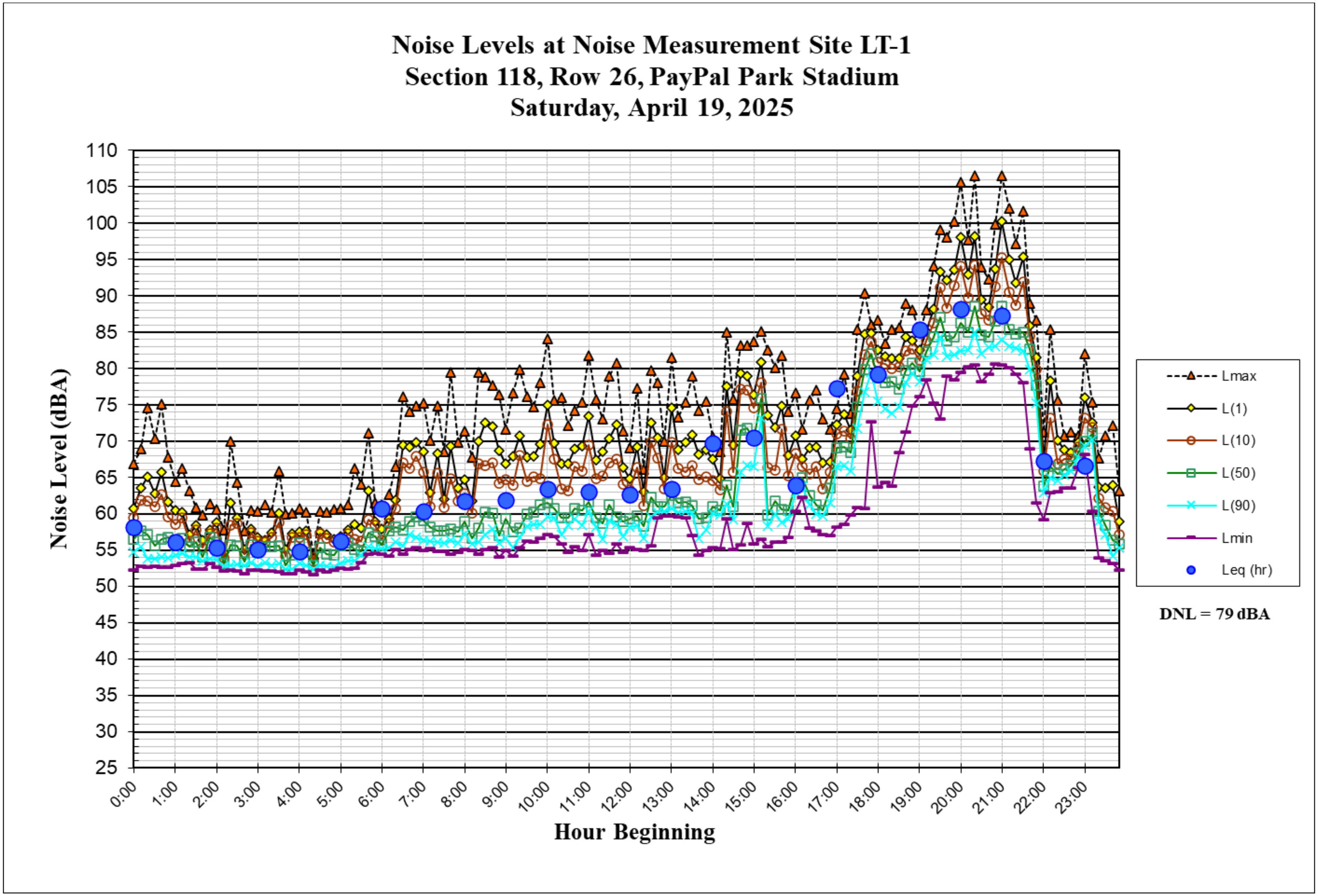
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 66 dBA


Noise Levels at Noise Measurement Site LT-1
Section 118, Row 26, PayPal Park Stadium
Saturday, April 19, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
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25
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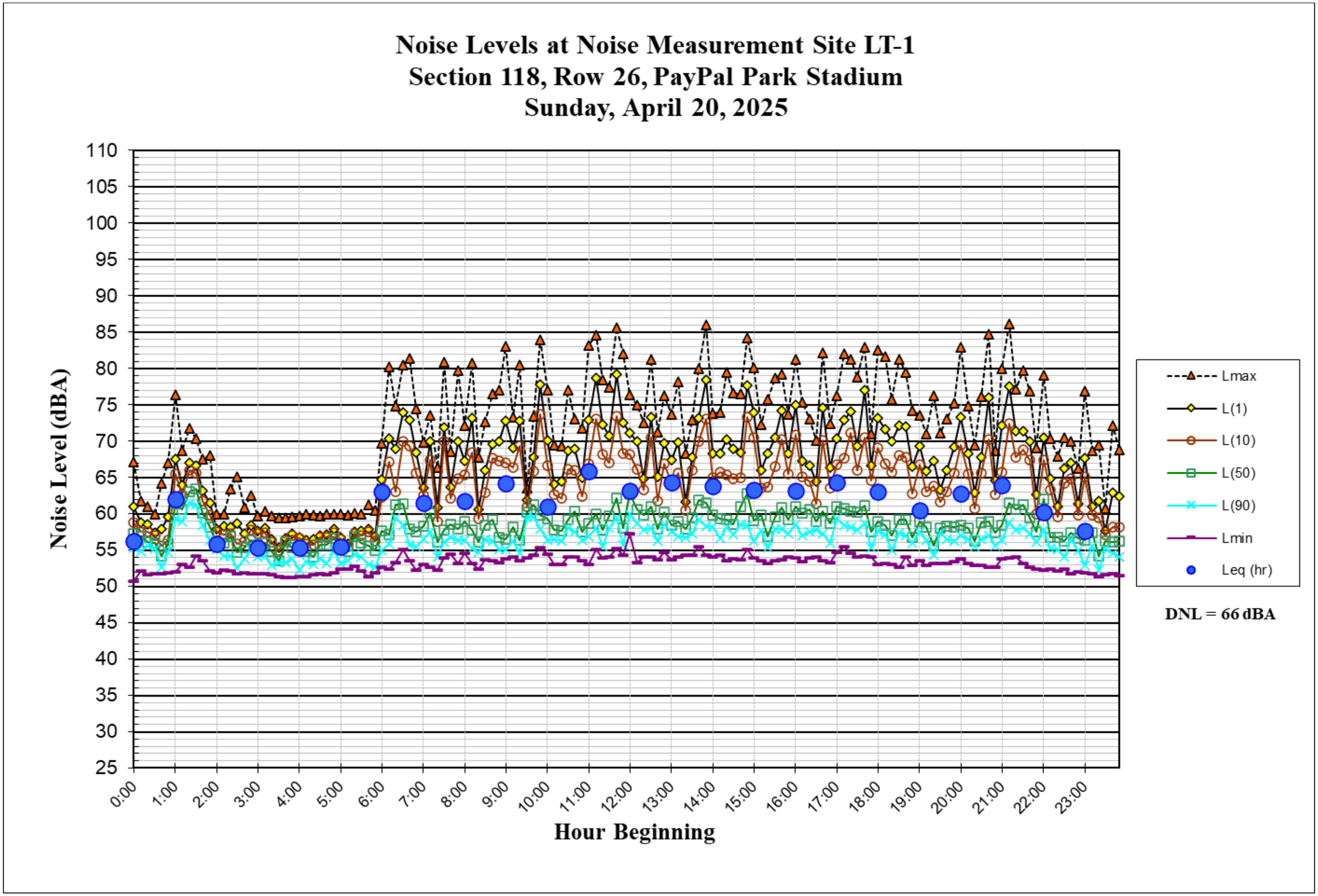
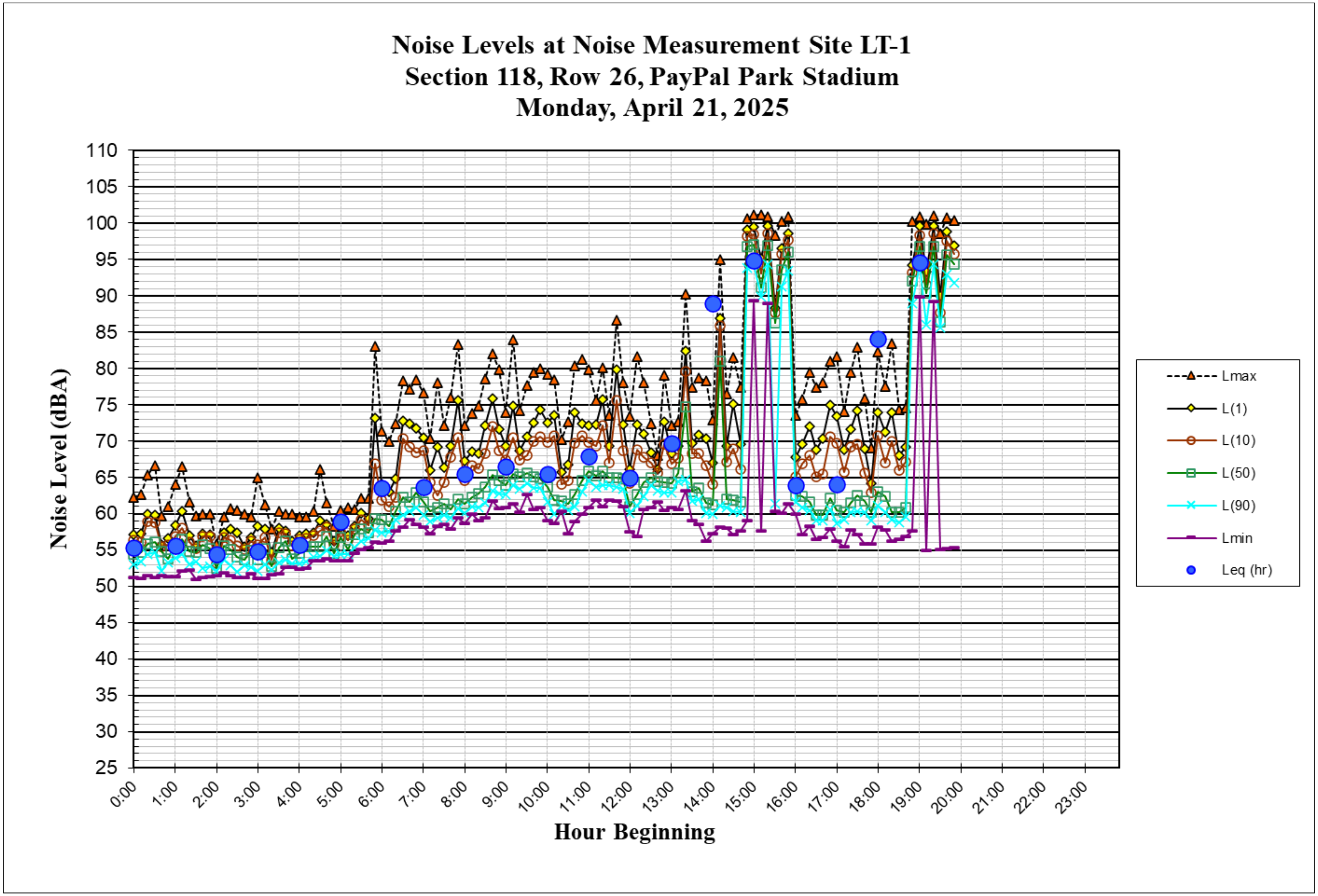
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 79 dBA


Noise Levels at Noise Measurement Site LT-1
Section 118, Row 26, PayPal Park Stadium
Sunday, April 20, 2025
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 66 dBA


Noise Levels at Noise Measurement Site LT-1
Section 118, Row 26, PayPal Park Stadium
Monday, April 21, 2025
Noise Level (dBA)
110
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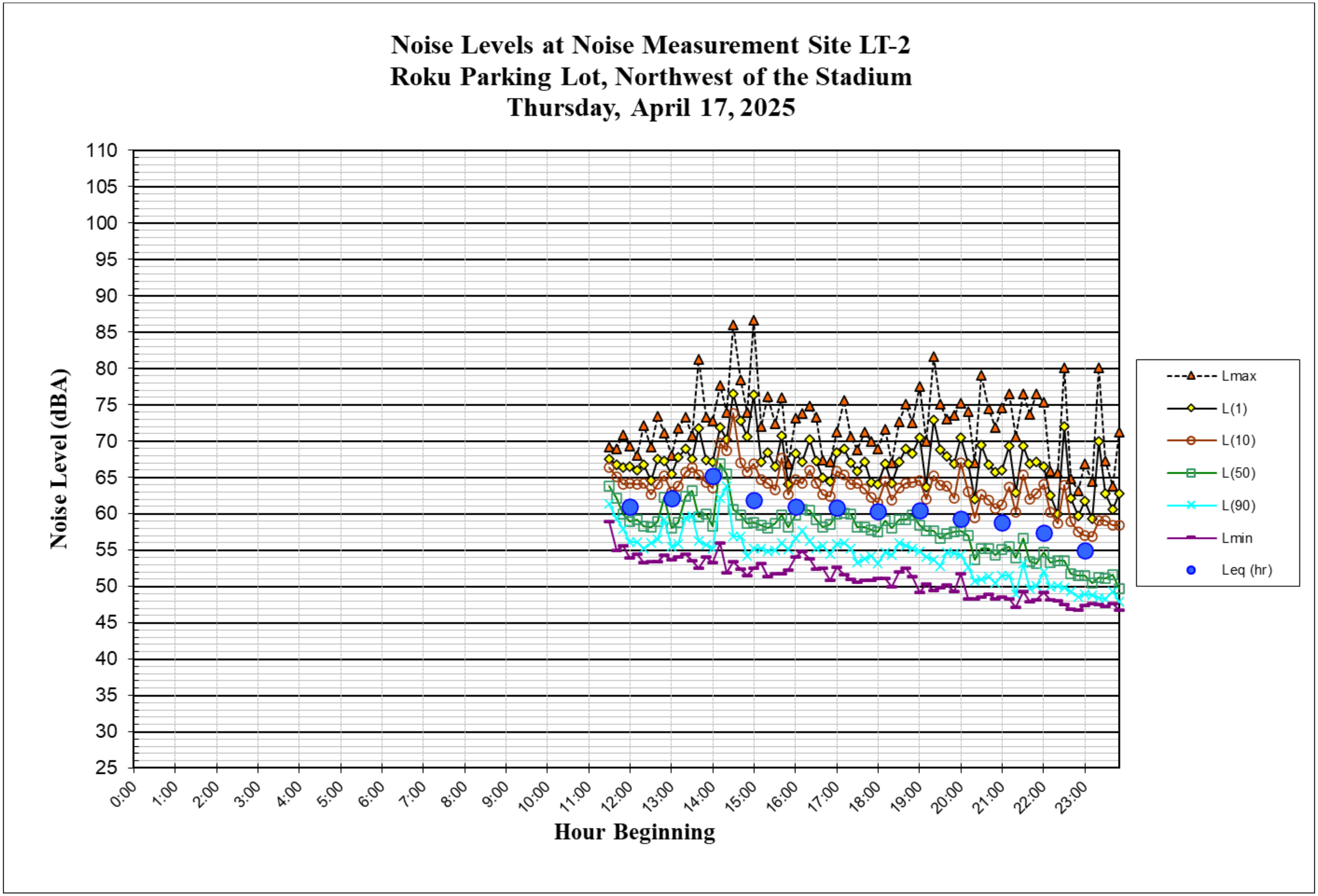
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-2
Roku Parking Lot, Northwest of the Stadium
Thursday, April 17, 2025
Noise Level (dBA)
110
105
100
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25
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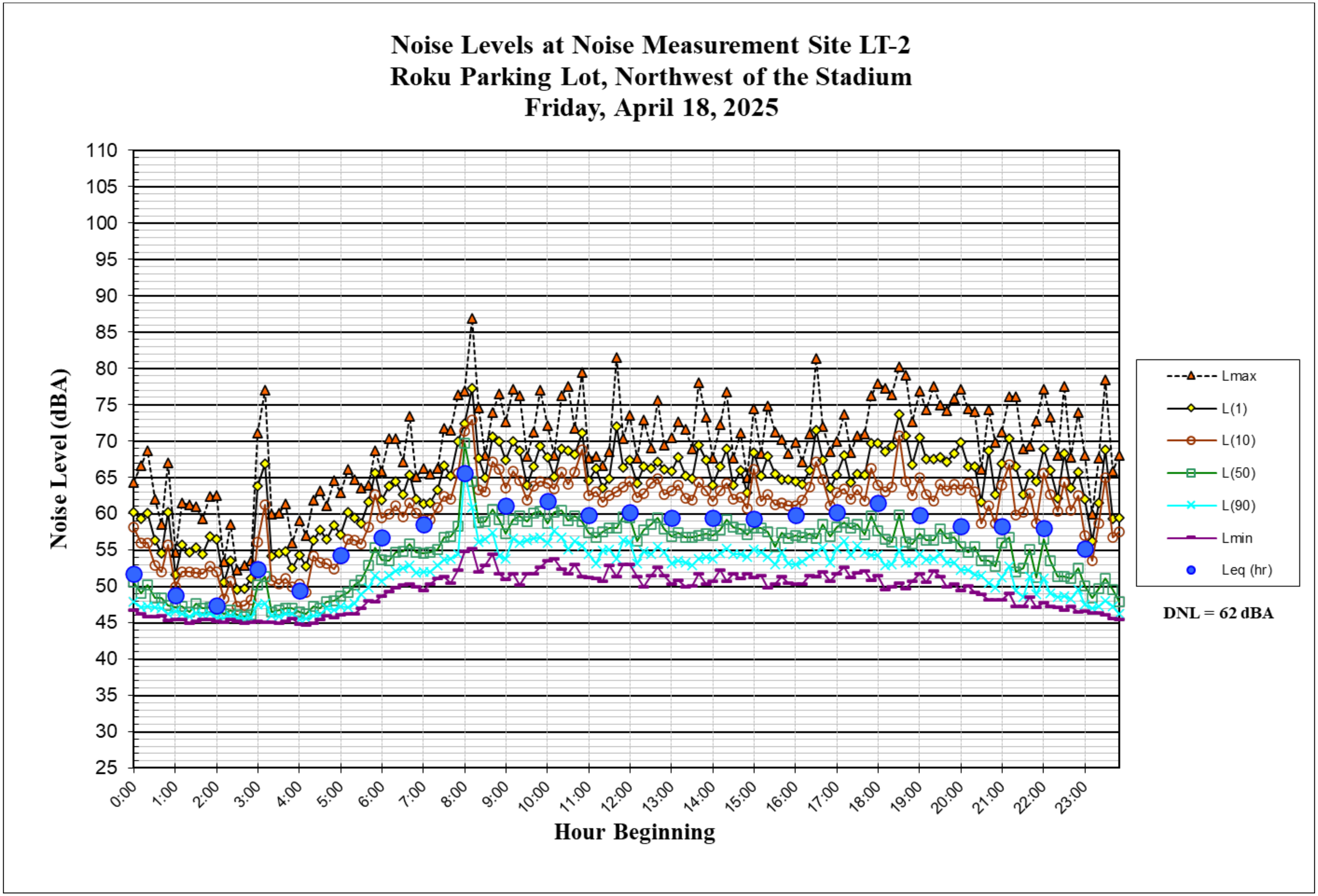
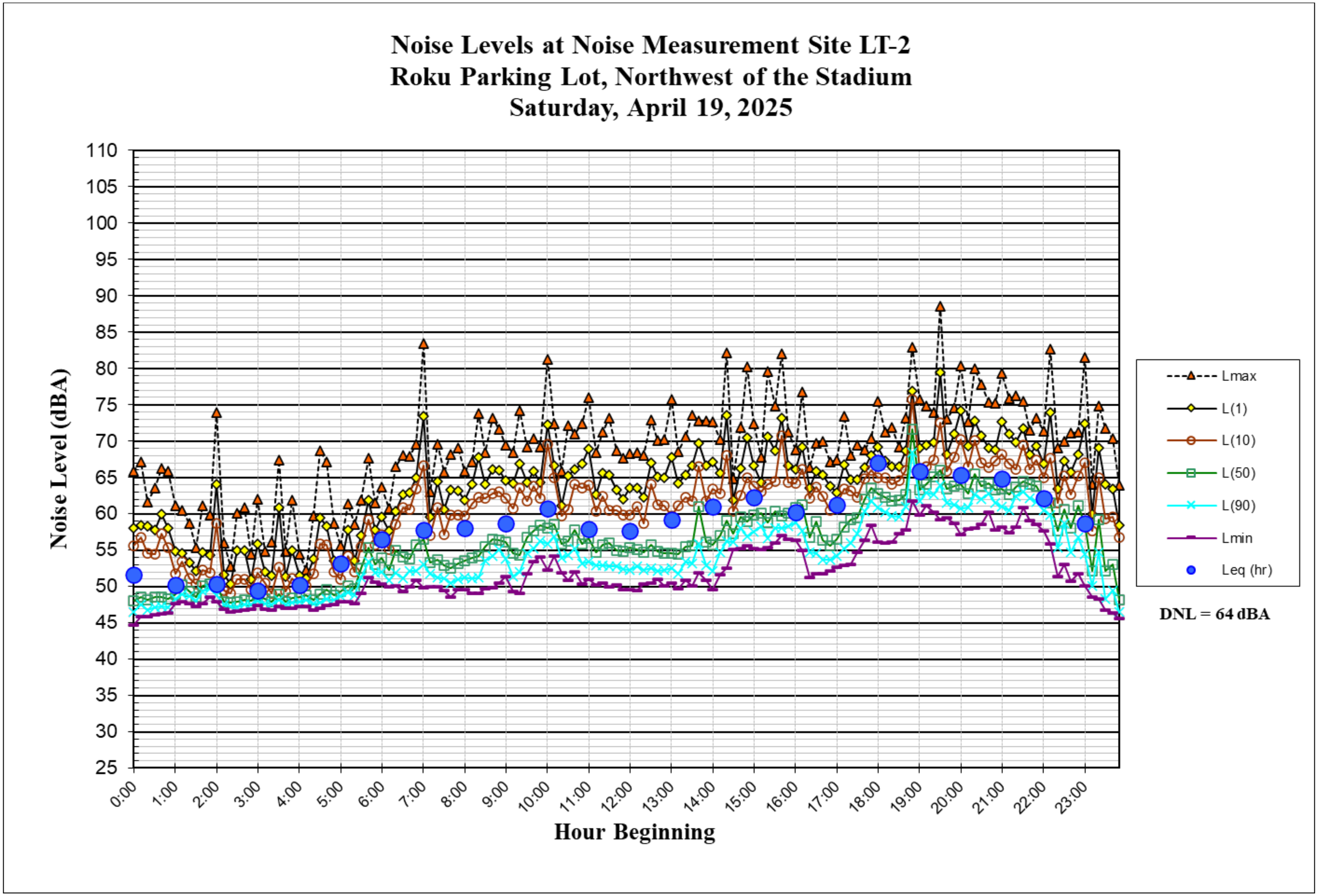
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-2
Roku Parking Lot, Northwest of the Stadium
Friday, April 18, 2025
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 62 dBA


Noise Levels at Noise Measurement Site LT-2
Roku Parking Lot, Northwest of the Stadium
Saturday, April 19, 2025
Noise Level (dBA)
110
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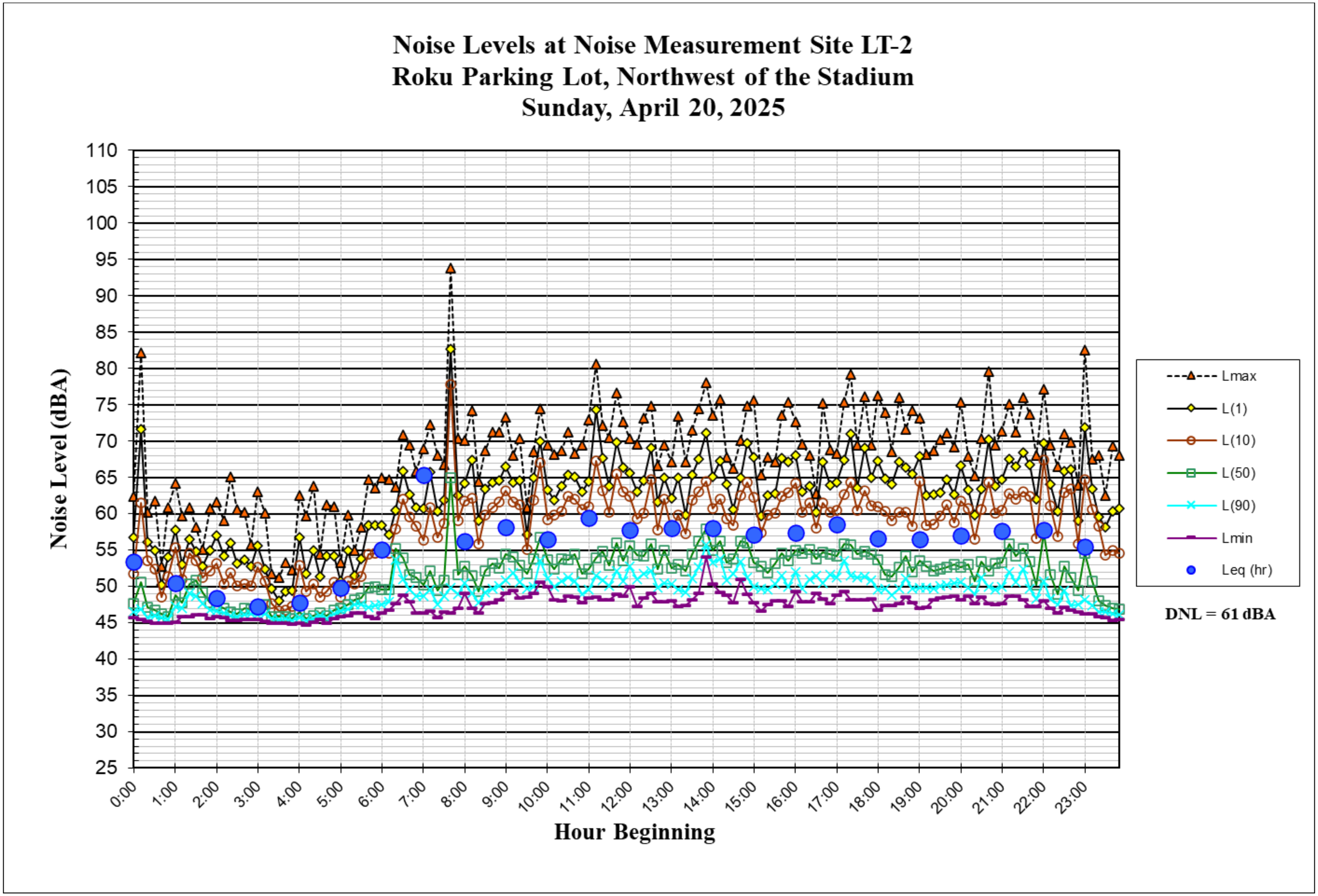
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 64 dBA


Noise Levels at Noise Measurement Site LT-2
Roku Parking Lot, Northwest of the Stadium
Sunday, April 20, 2025
Noise Level (dBA)
110
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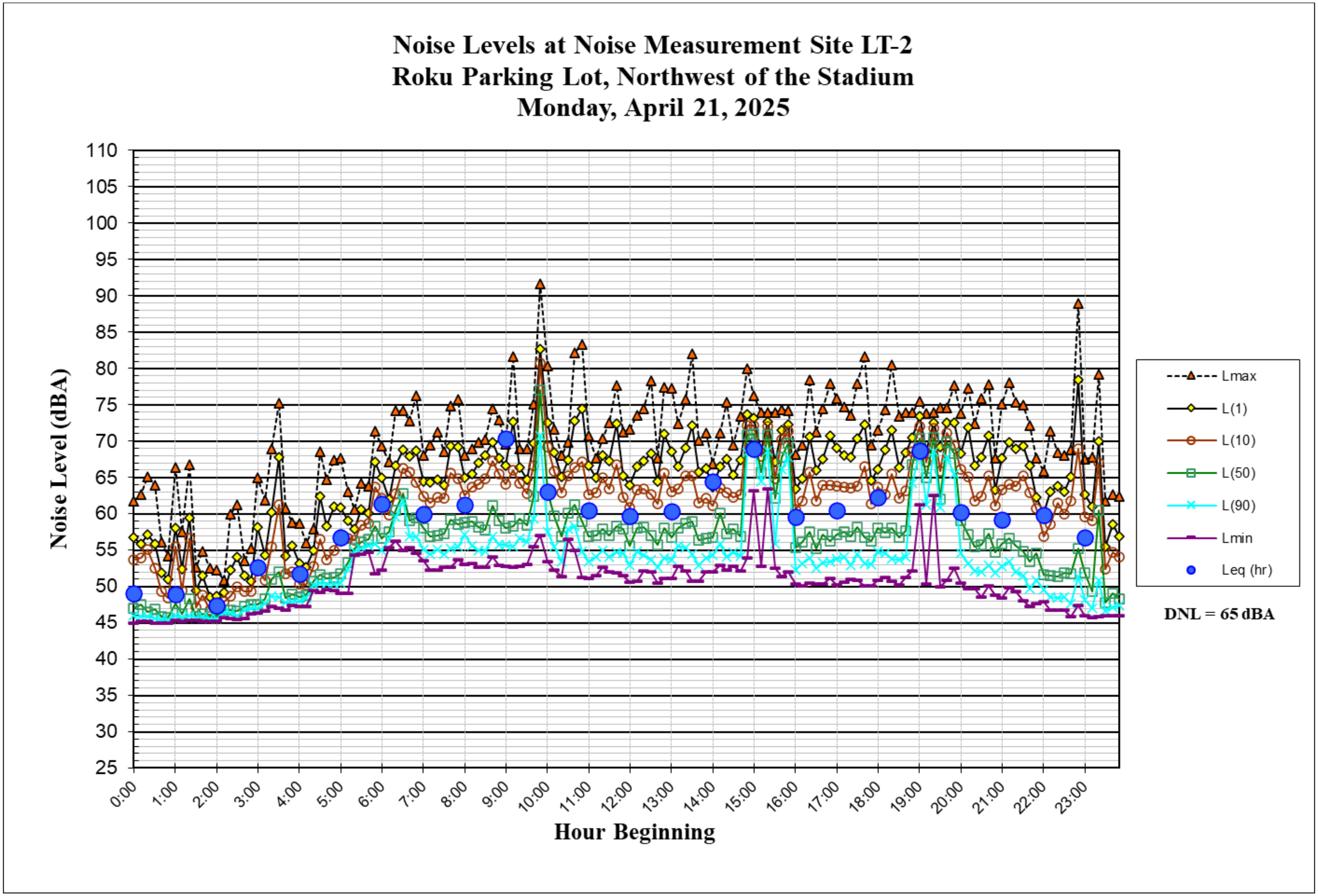
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 61 dBA


Noise Levels at Noise Measurement Site LT-2
Roku Parking Lot, Northwest of the Stadium
Monday, April 21, 2025
Noise Level (dBA)
110
105
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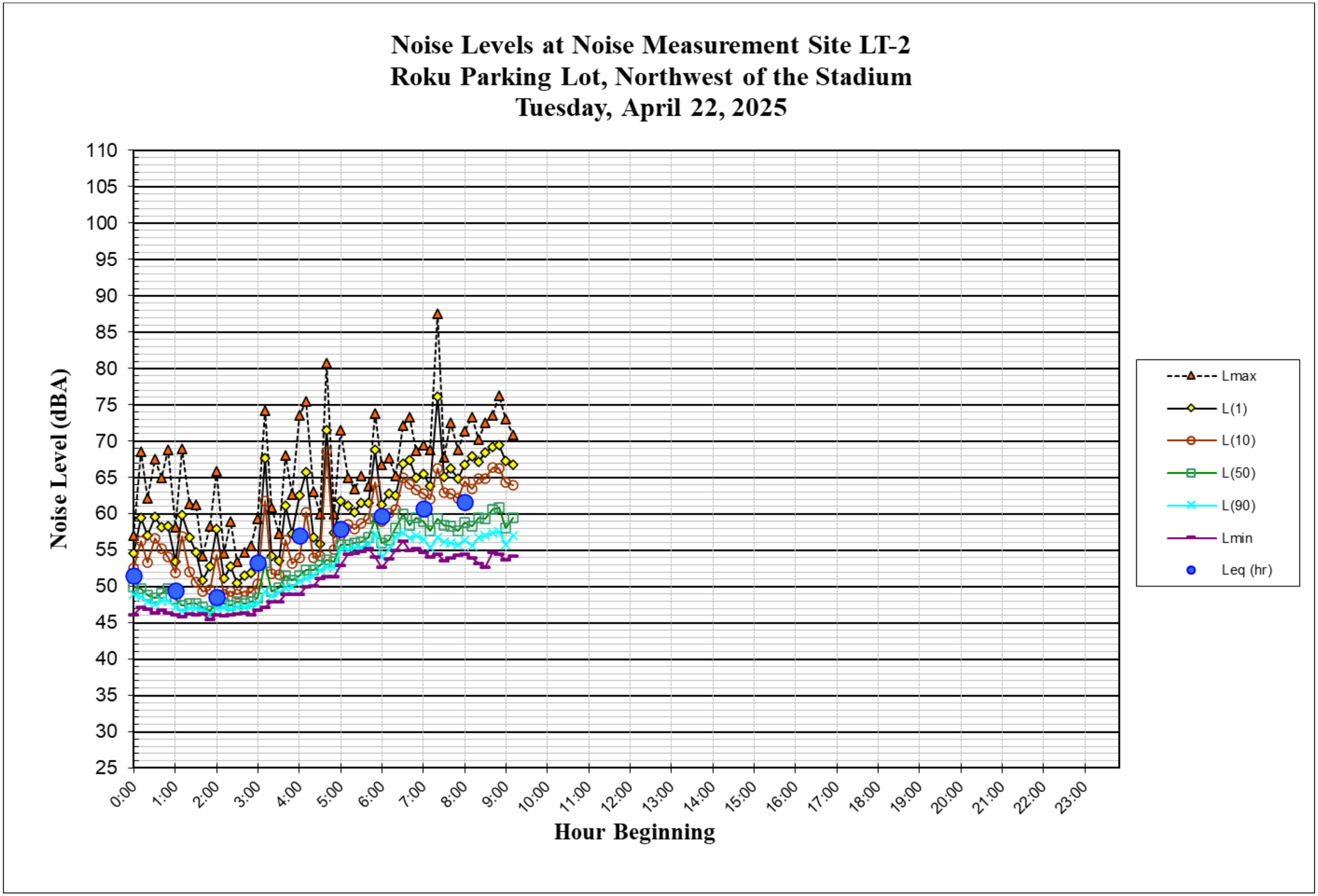
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 65 dBA


Noise Levels at Noise Measurement Site LT-2
Roku Parking Lot, Northwest of the Stadium
Tuesday, April 22, 2025
Noise Level (dBA)
110
105
100
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90
85
80
75
70
65
60
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25
0:00
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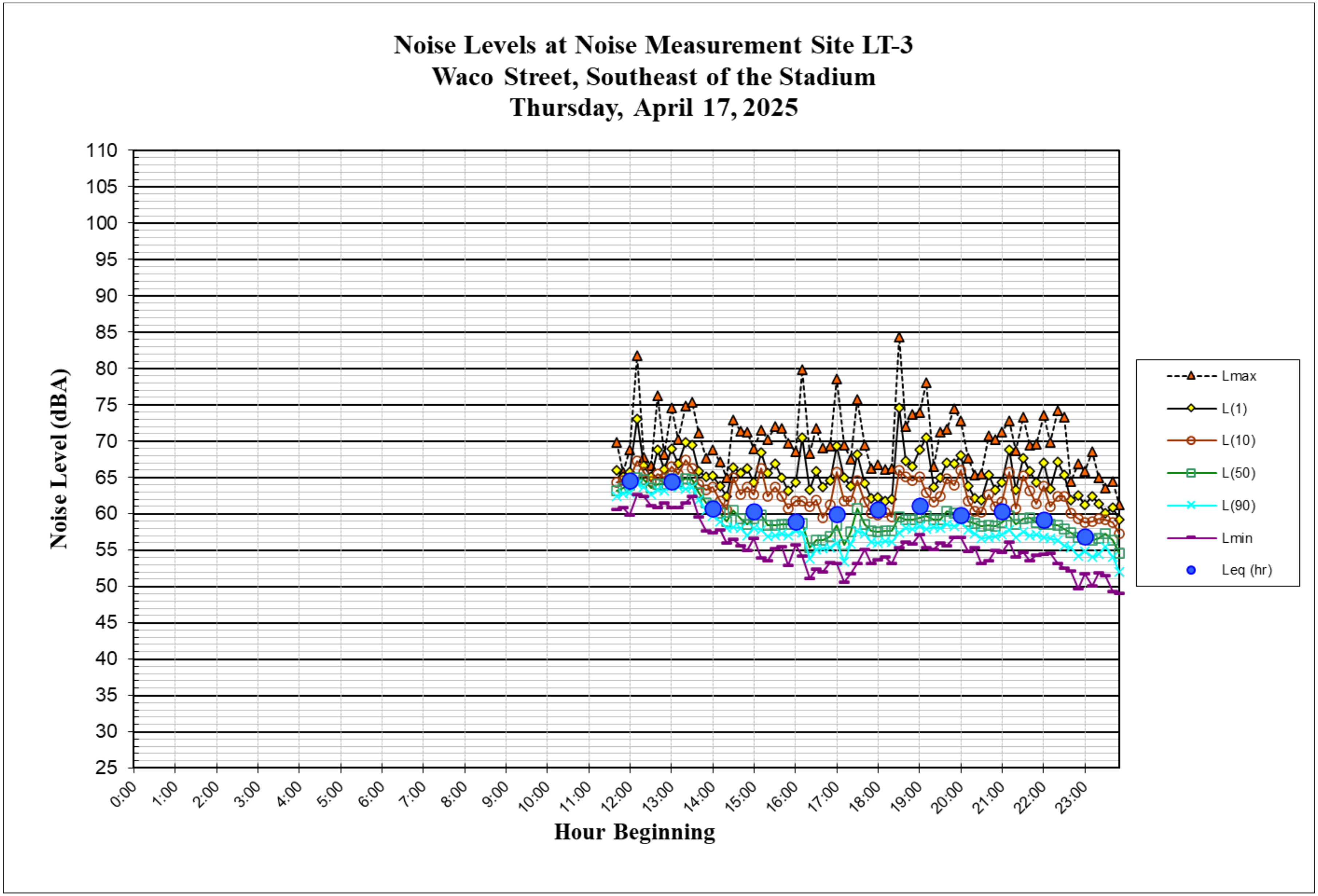
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-3
Waco Street, Southeast of the Stadium
Thursday, April 17, 2025
Noise Level (dBA)
110
105
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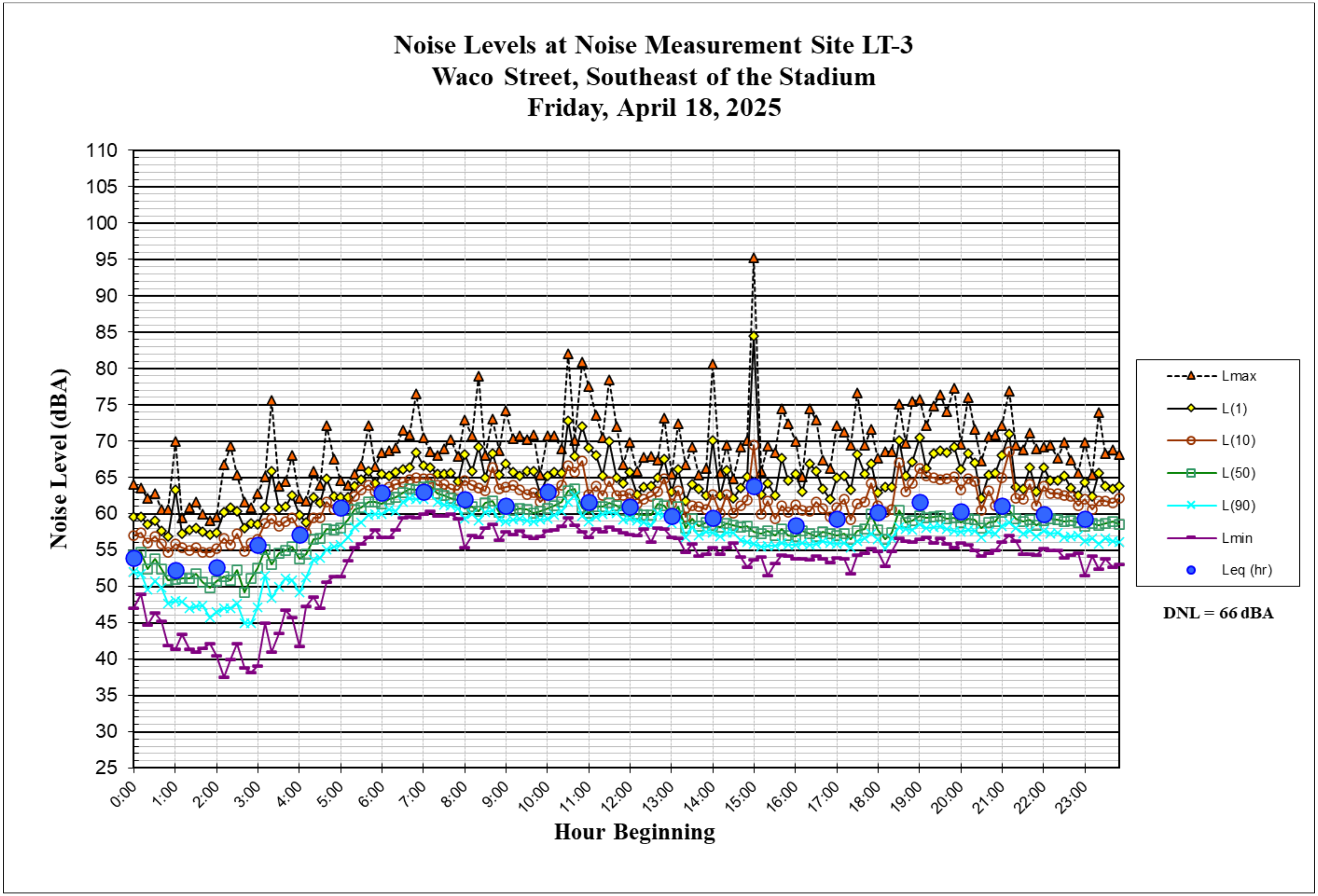
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-3
Waco Street, Southeast of the Stadium
Friday, April 18, 2025
Noise Level (dBA)
110
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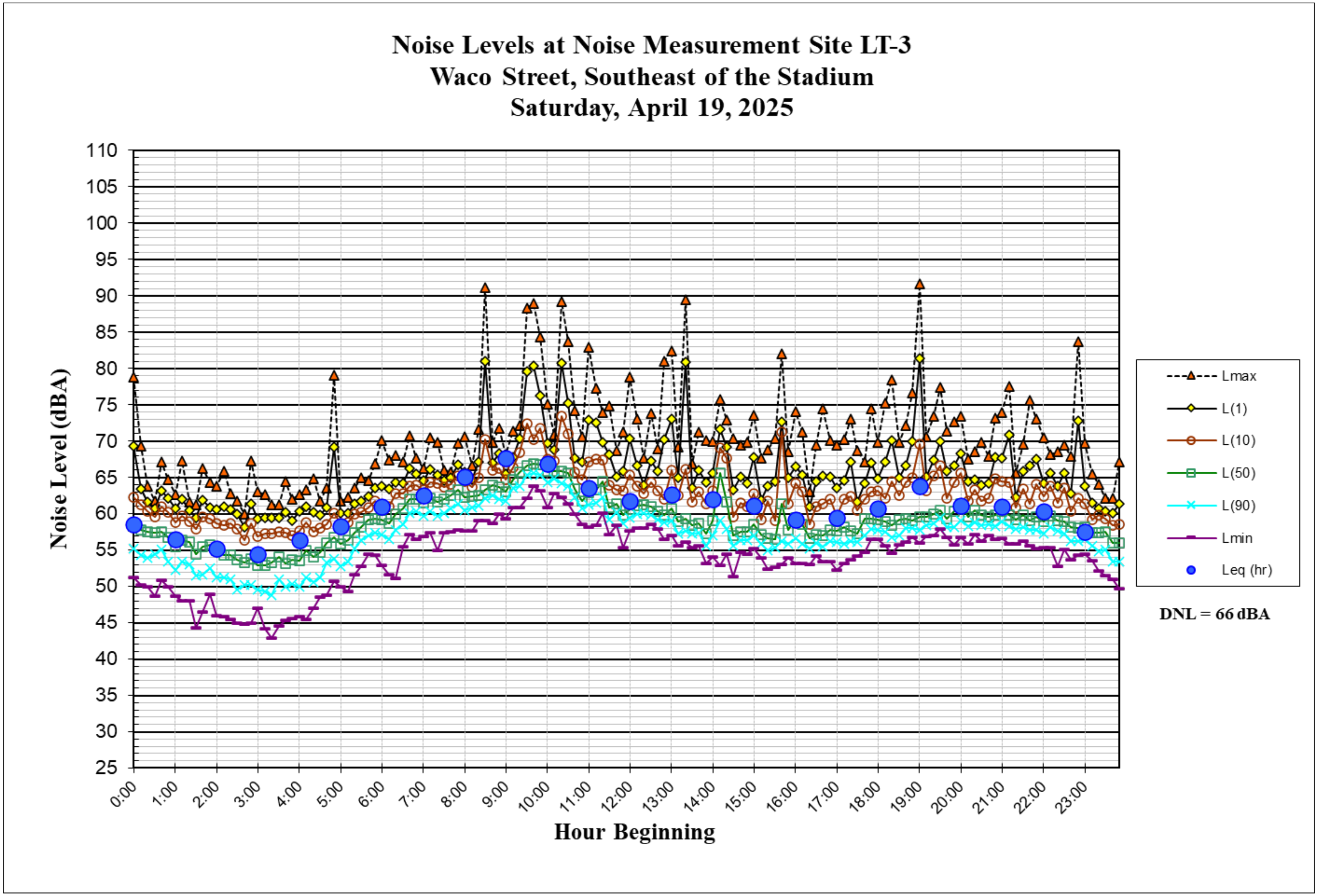
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 66 dBA

B-13


Noise Levels at Noise Measurement Site LT-3
Waco Street, Southeast of the Stadium
Saturday, April 19, 2025
Noise Level (dBA)
110
105
100
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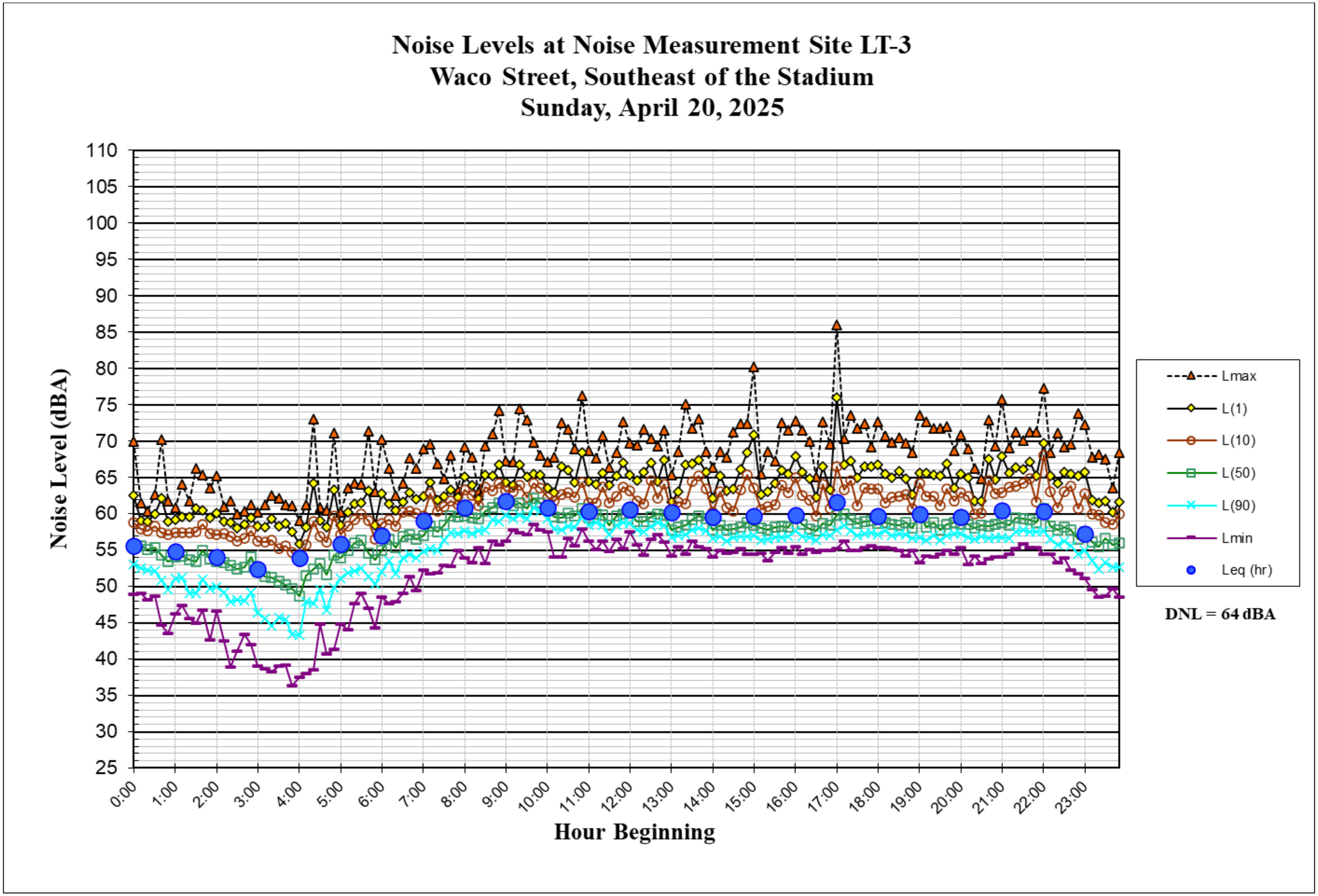
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 66 dBA


Noise Levels at Noise Measurement Site LT-3
Waco Street, Southeast of the Stadium
Sunday, April 20, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
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25
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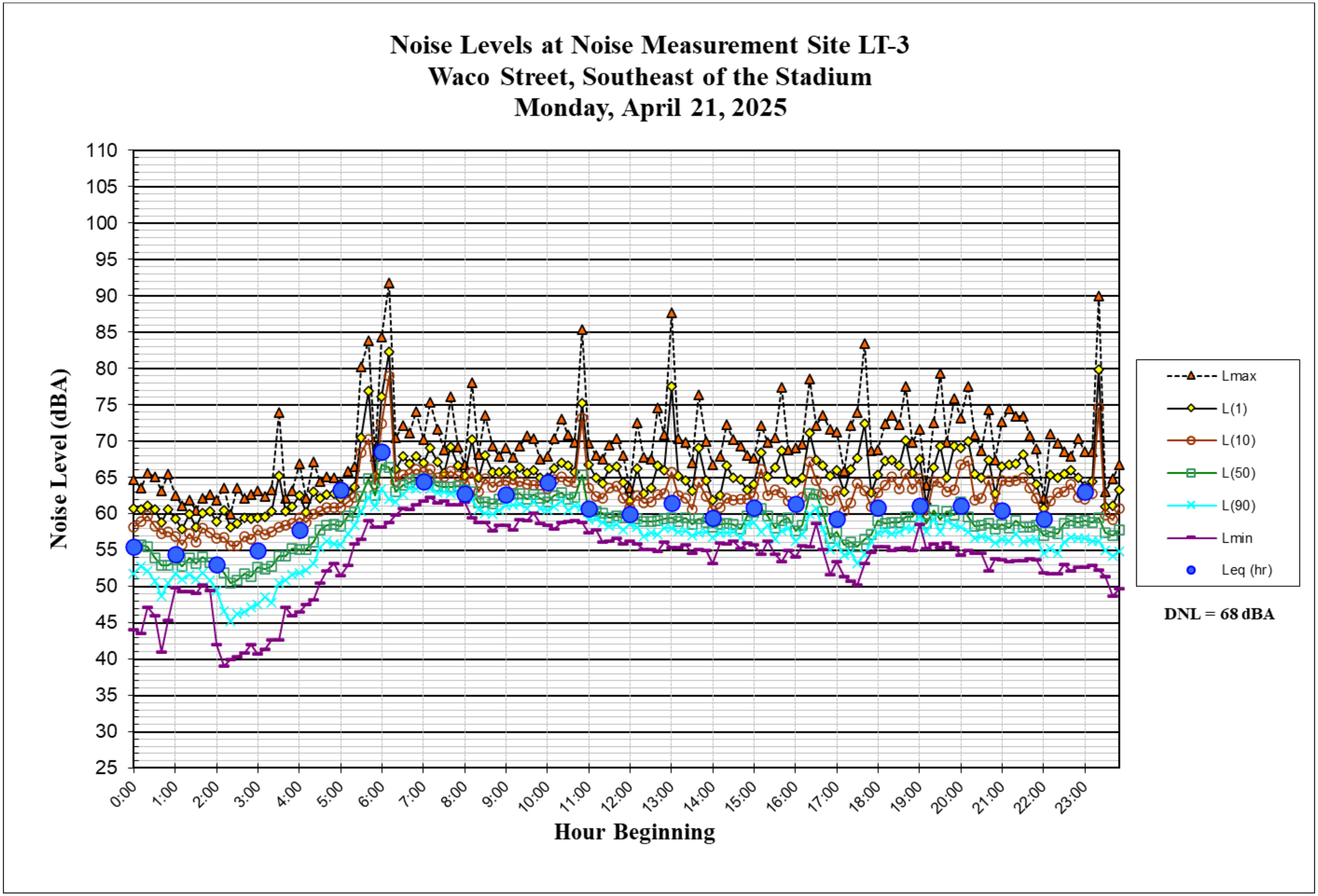
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 64 dBA


Noise Levels at Noise Measurement Site LT-3
Waco Street, Southeast of the Stadium
Monday, April 21, 2025
Noise Level (dBA)
110
105
100
95
90
85
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75
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65
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55
50
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25
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16:00
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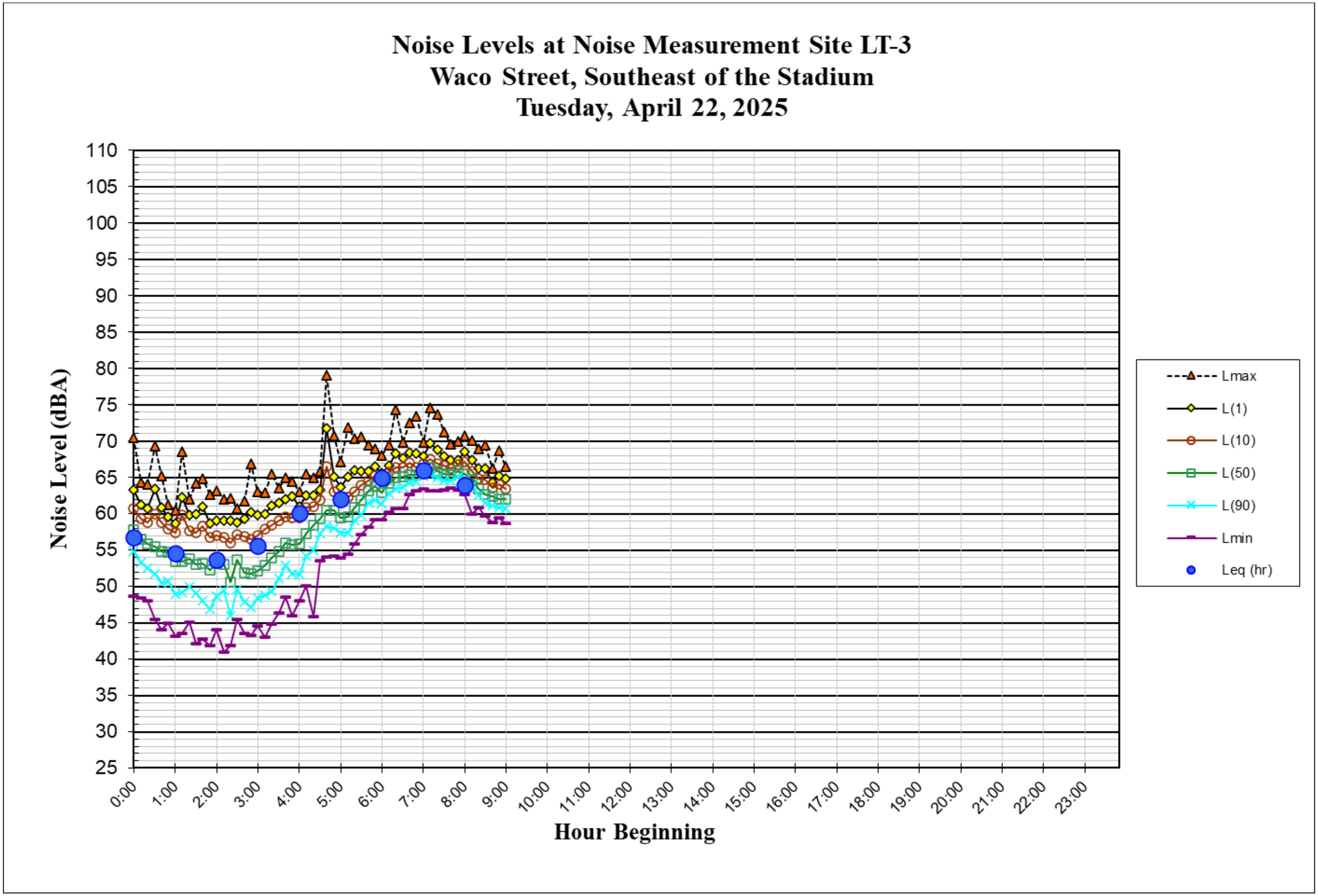
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 68 dBA



Noise Levels at Noise Measurement Site LT-3
Waco Street, Southeast of the Stadium
Tuesday, April 22, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
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50
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25
0:00
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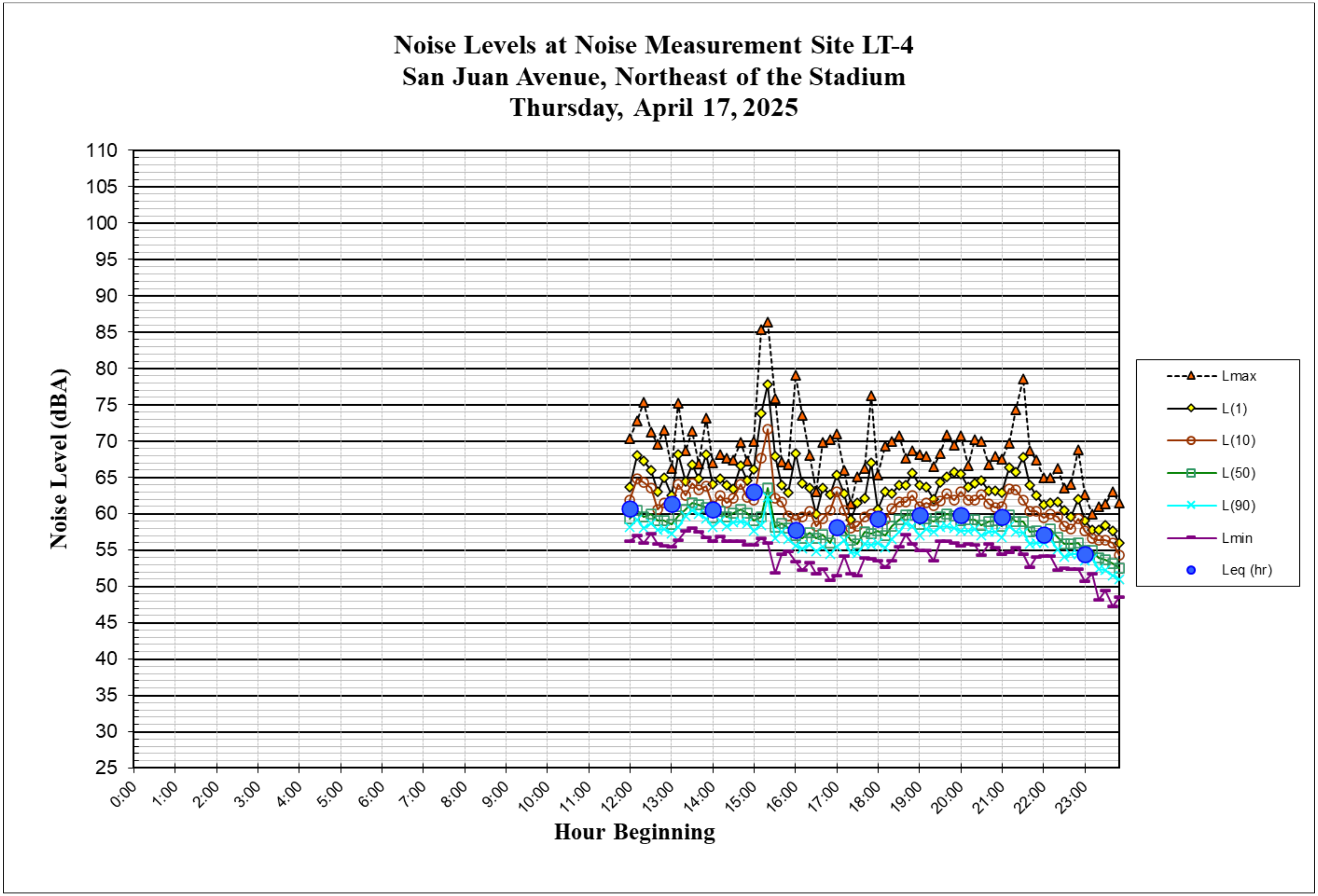
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-4
San Juan Avenue, Northeast of the Stadium
Thursday, April 17, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
1:00
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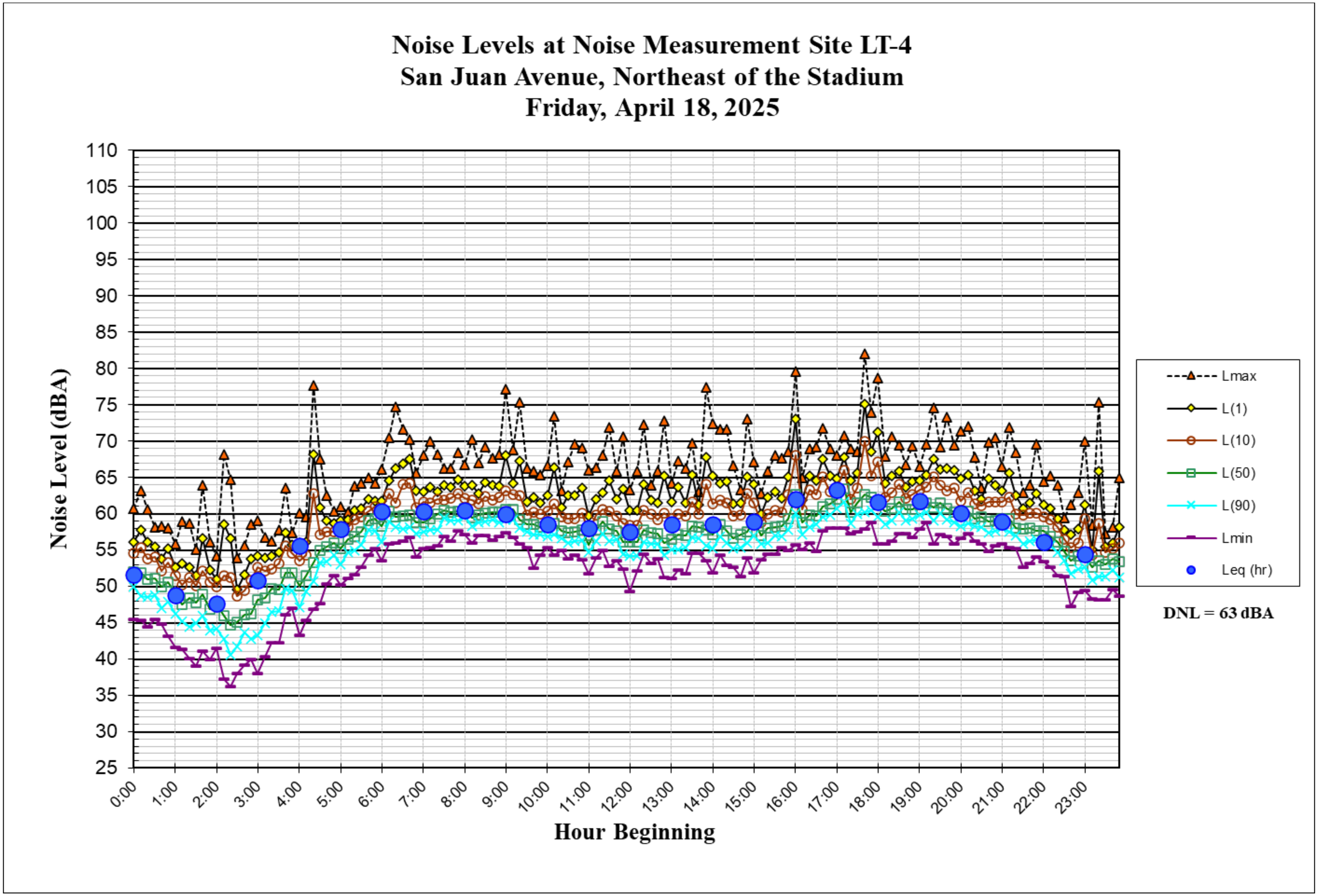
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-4
San Juan Avenue, Northeast of the Stadium
Friday, April 18, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
1:00
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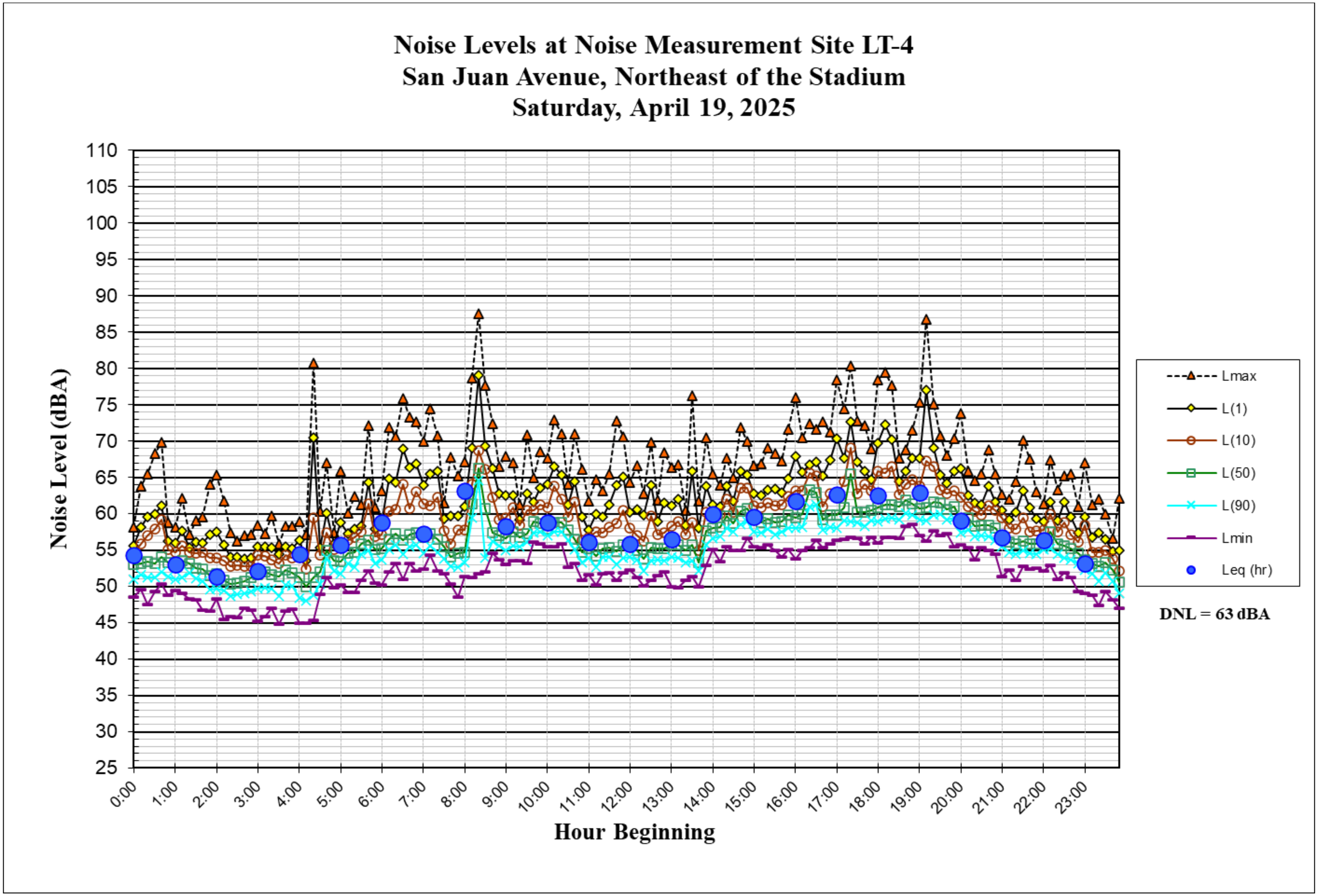
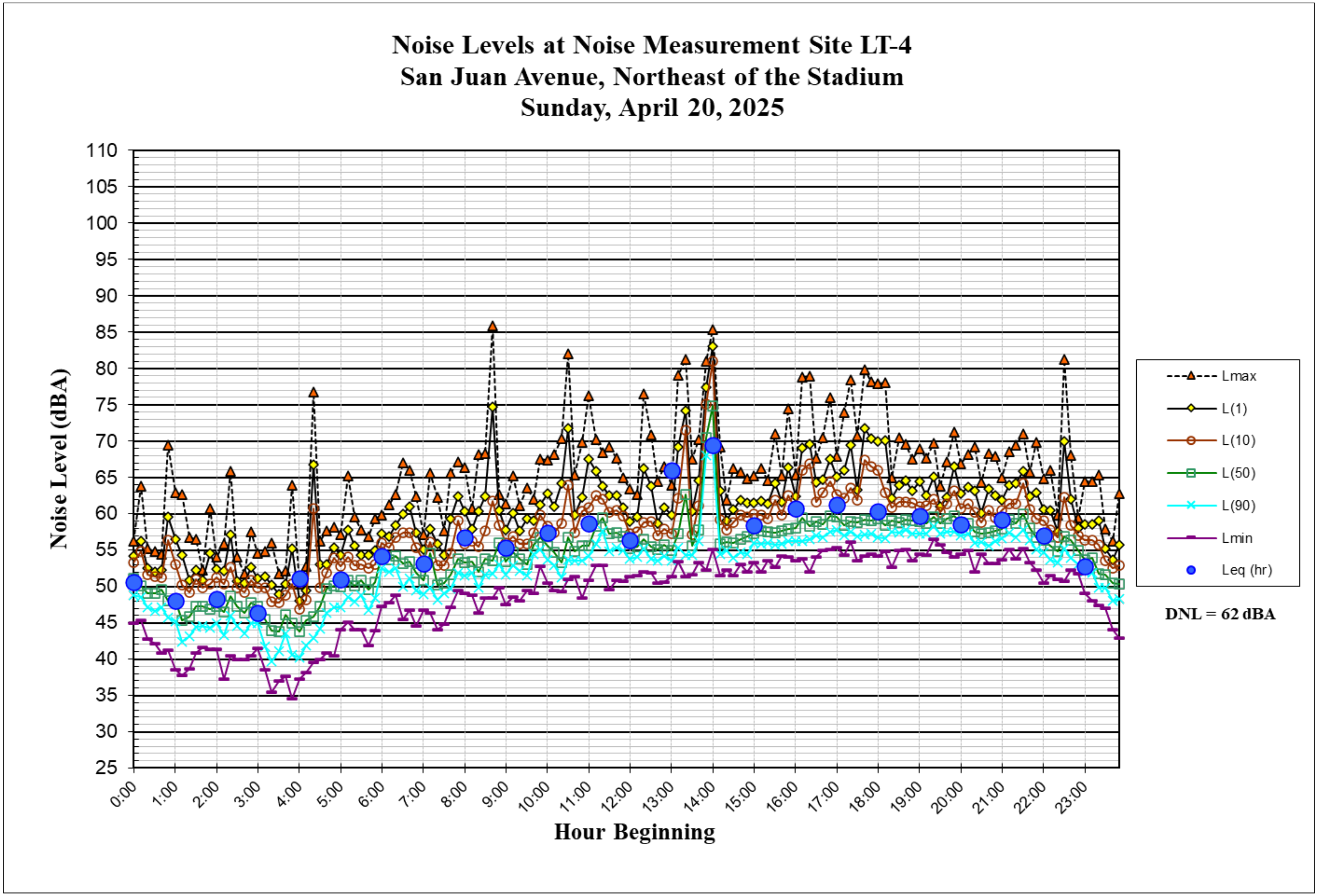
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 63 dBA

B-19


Noise Levels at Noise Measurement Site LT-4
San Juan Avenue, Northeast of the Stadium
Saturday, April 19, 2025
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 63 dBA


Noise Levels at Noise Measurement Site LT-4
San Juan Avenue, Northeast of the Stadium
Sunday, April 20, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
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35
30
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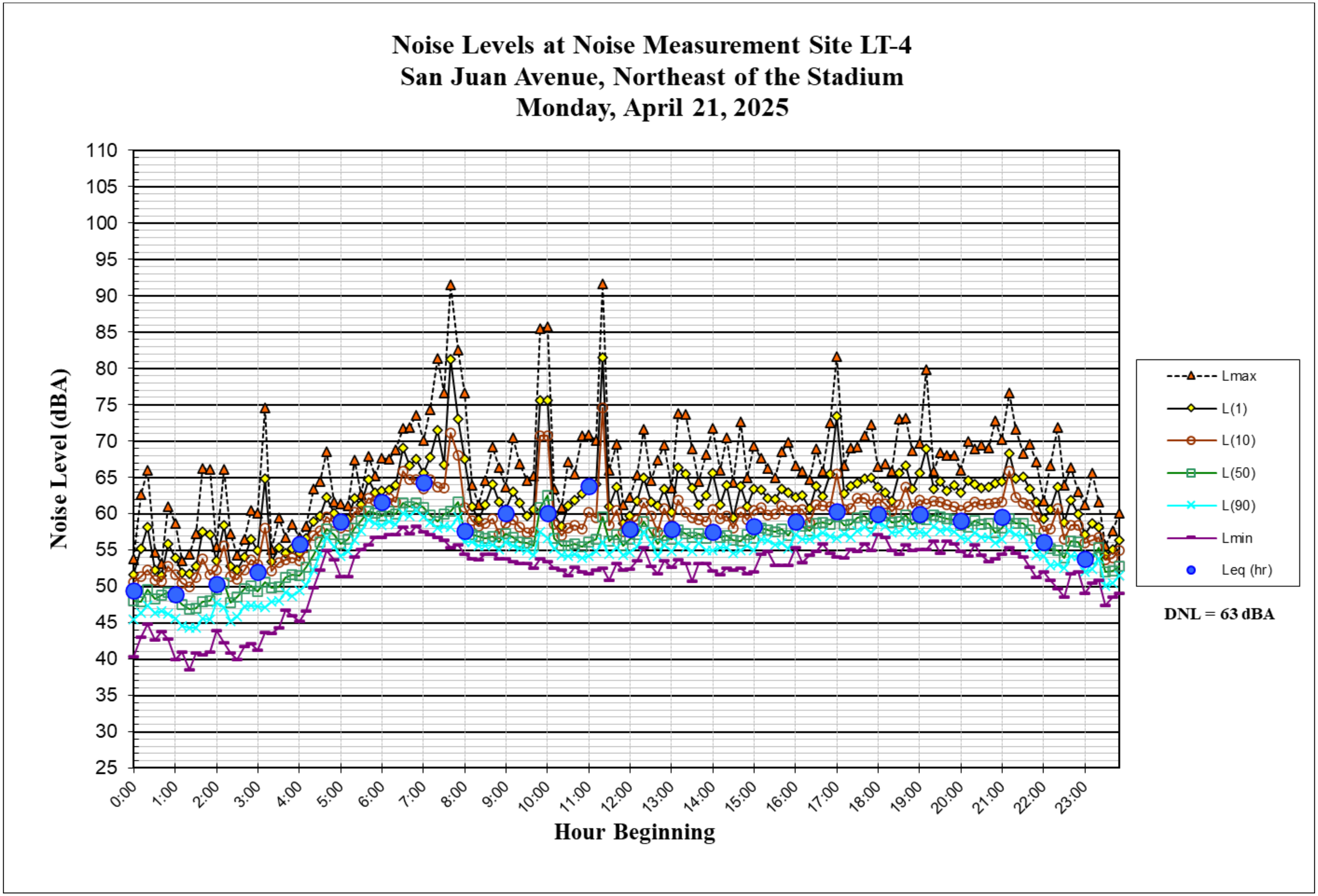
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 62 dBA



Noise Levels at Noise Measurement Site LT-4
San Juan Avenue, Northeast of the Stadium
Monday, April 21, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
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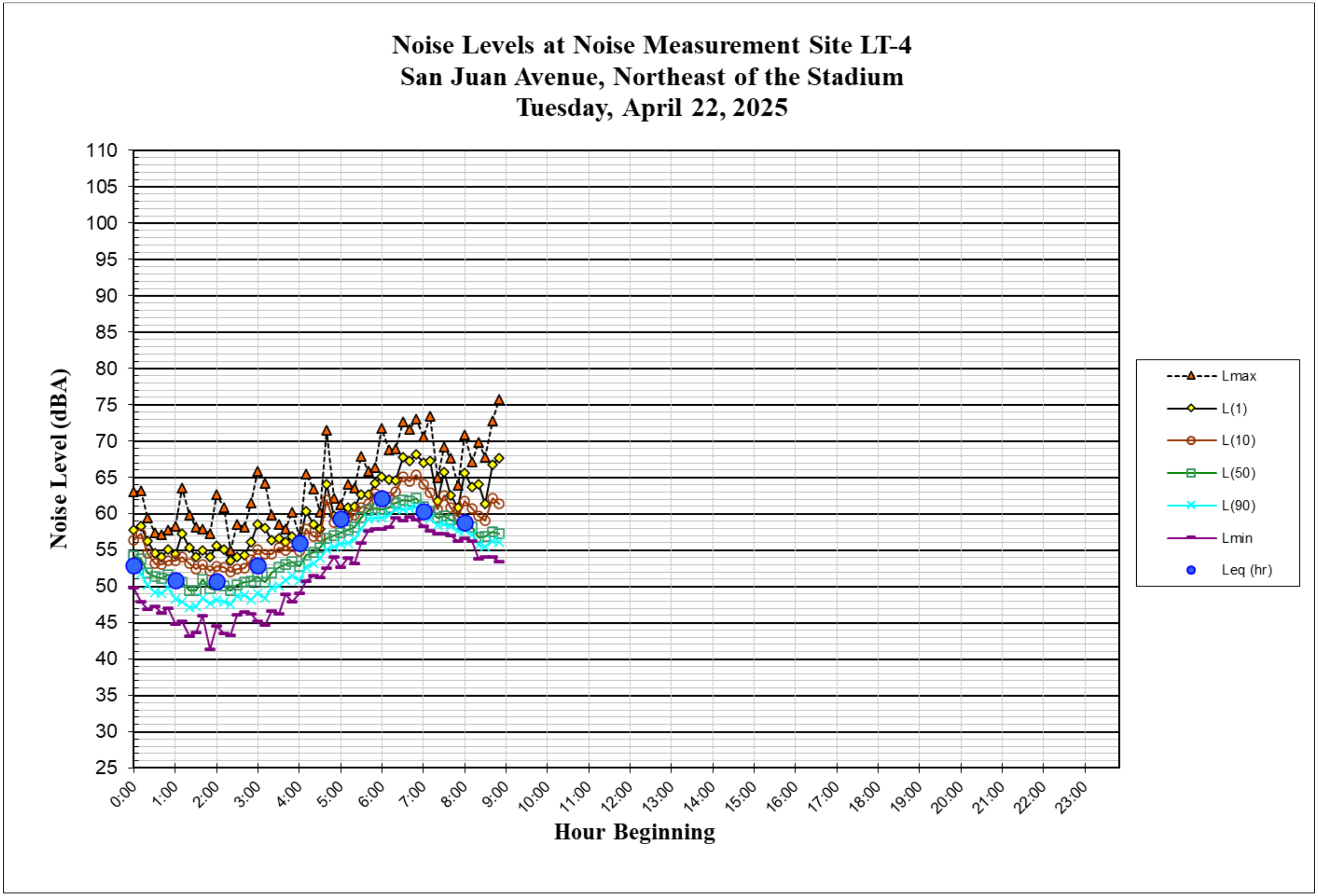
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 63 dBA


Noise Levels at Noise Measurement Site LT-4
San Juan Avenue, Northeast of the Stadium
Tuesday, April 22, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
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45
40
35
30
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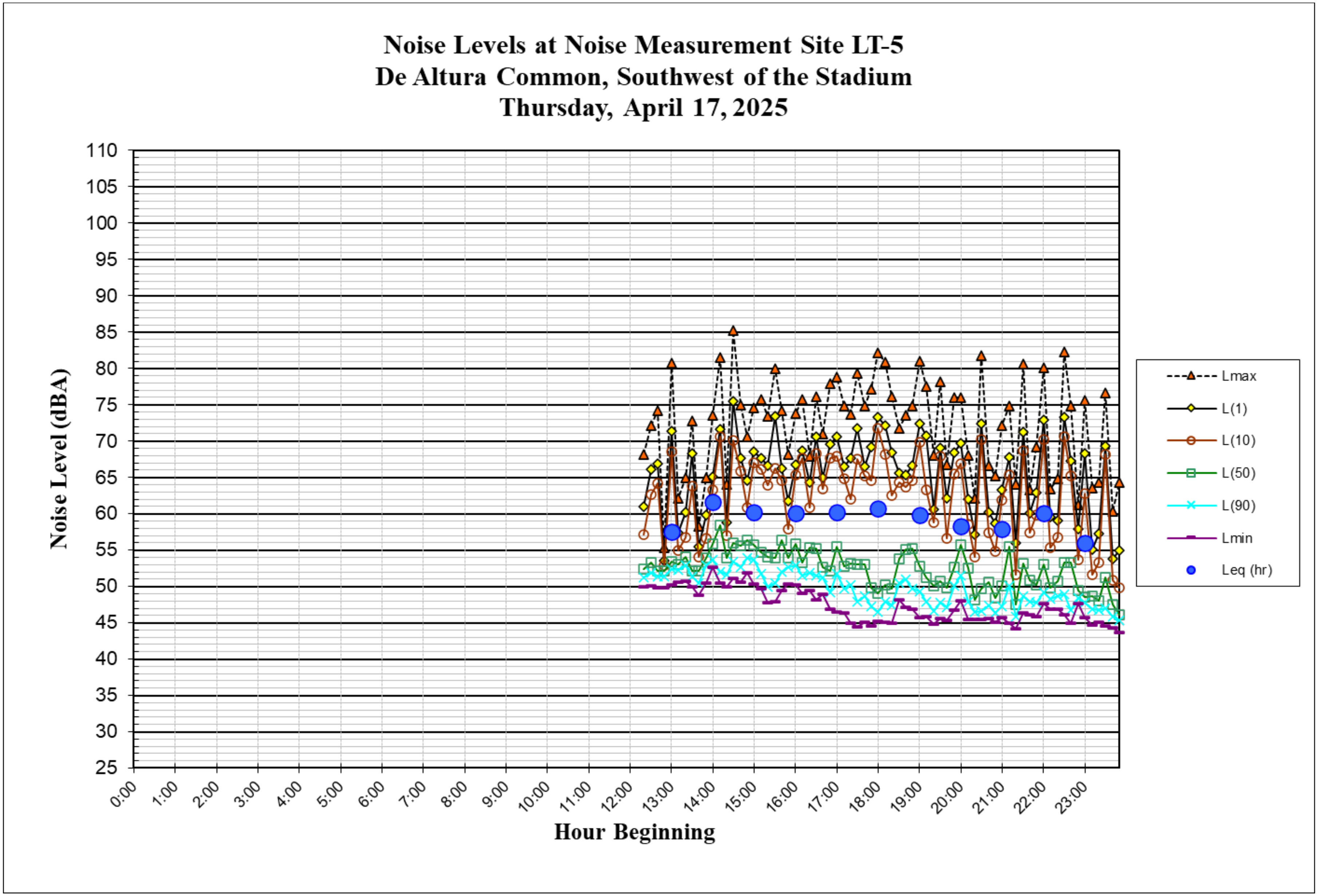
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-5
De Altura Common, Southwest of the Stadium
Thursday, April 17, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
1:00
2:00
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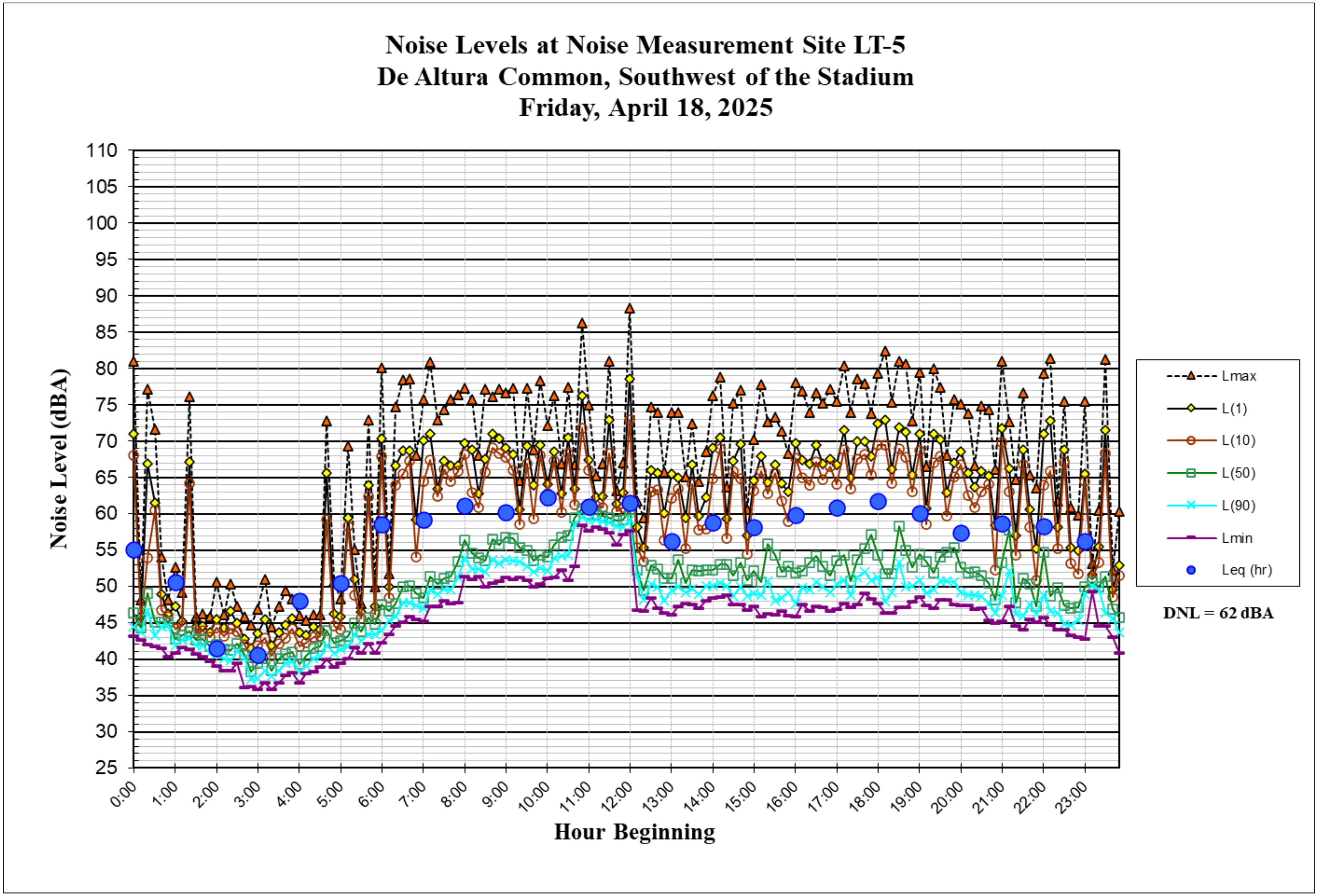
19:00
20:00
21:00
22:00
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-5
De Altura Common, Southwest of the Stadium
Friday, April 18, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
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35
30
25
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19:00
20:00
21:00
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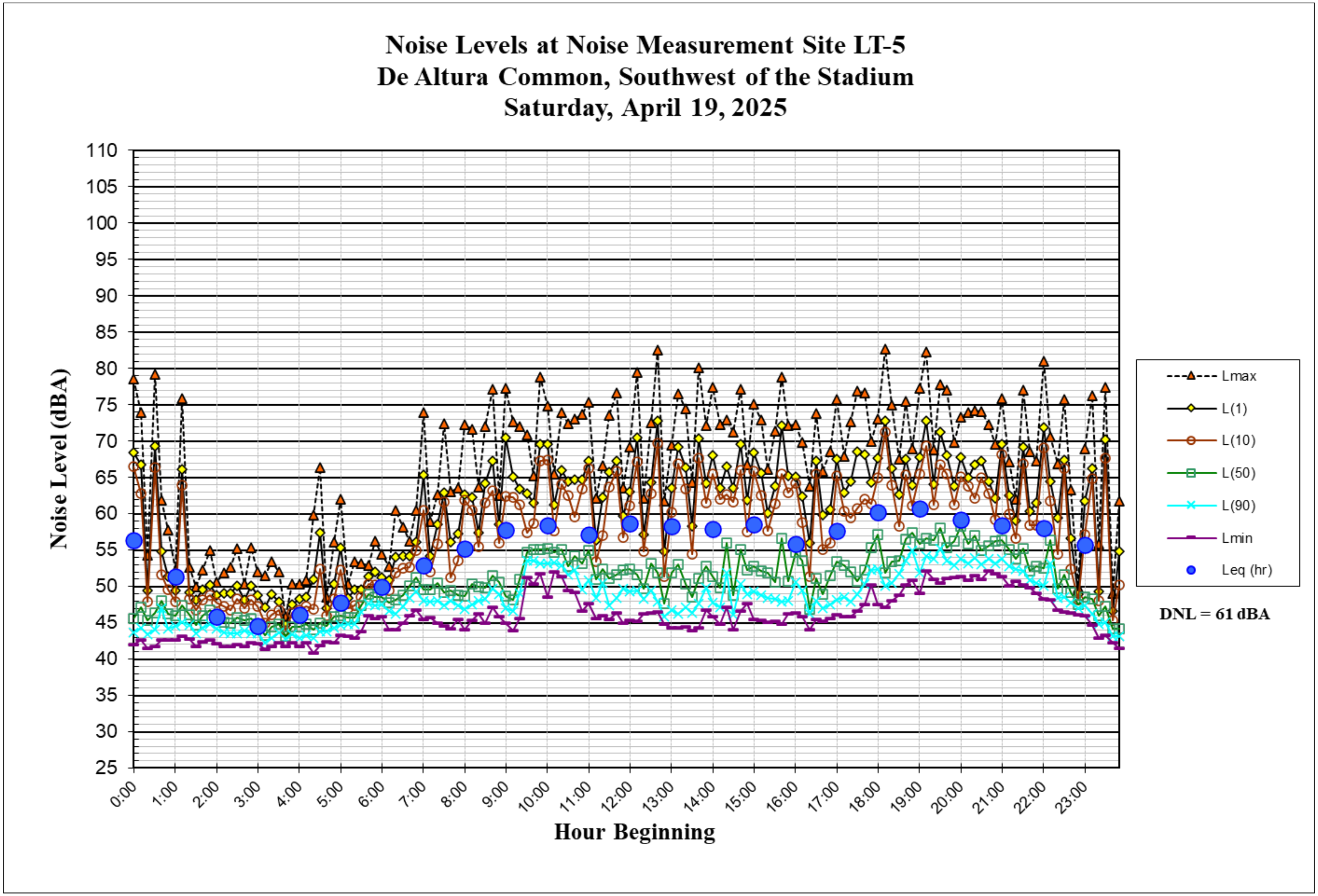
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 62 dBA


Noise Levels at Noise Measurement Site LT-5
De Altura Common, Southwest of the Stadium
Saturday, April 19, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
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40
35
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25
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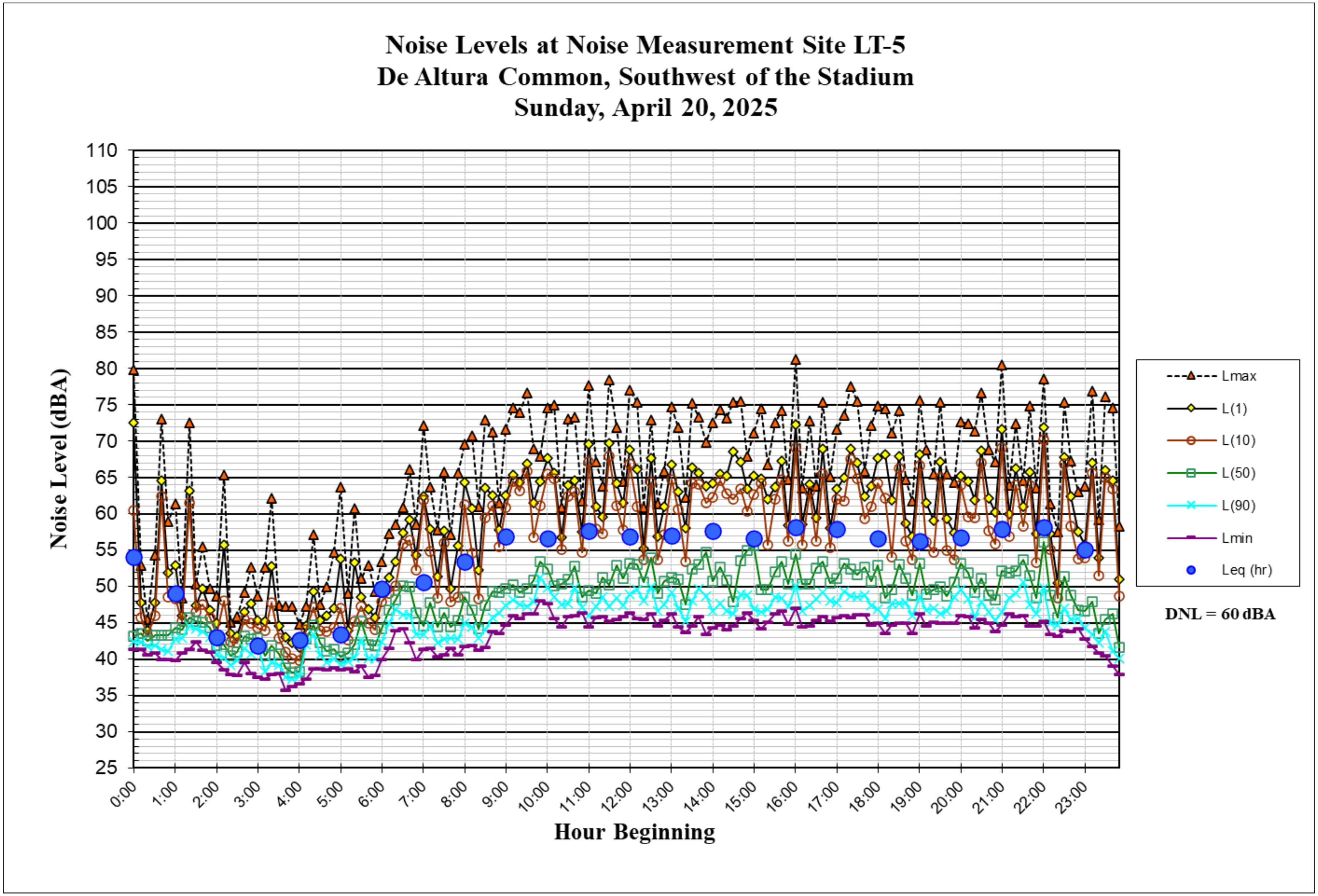
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 61 dBA


Noise Levels at Noise Measurement Site LT-5
De Altura Common, Southwest of the Stadium
Sunday, April 20, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
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55
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45
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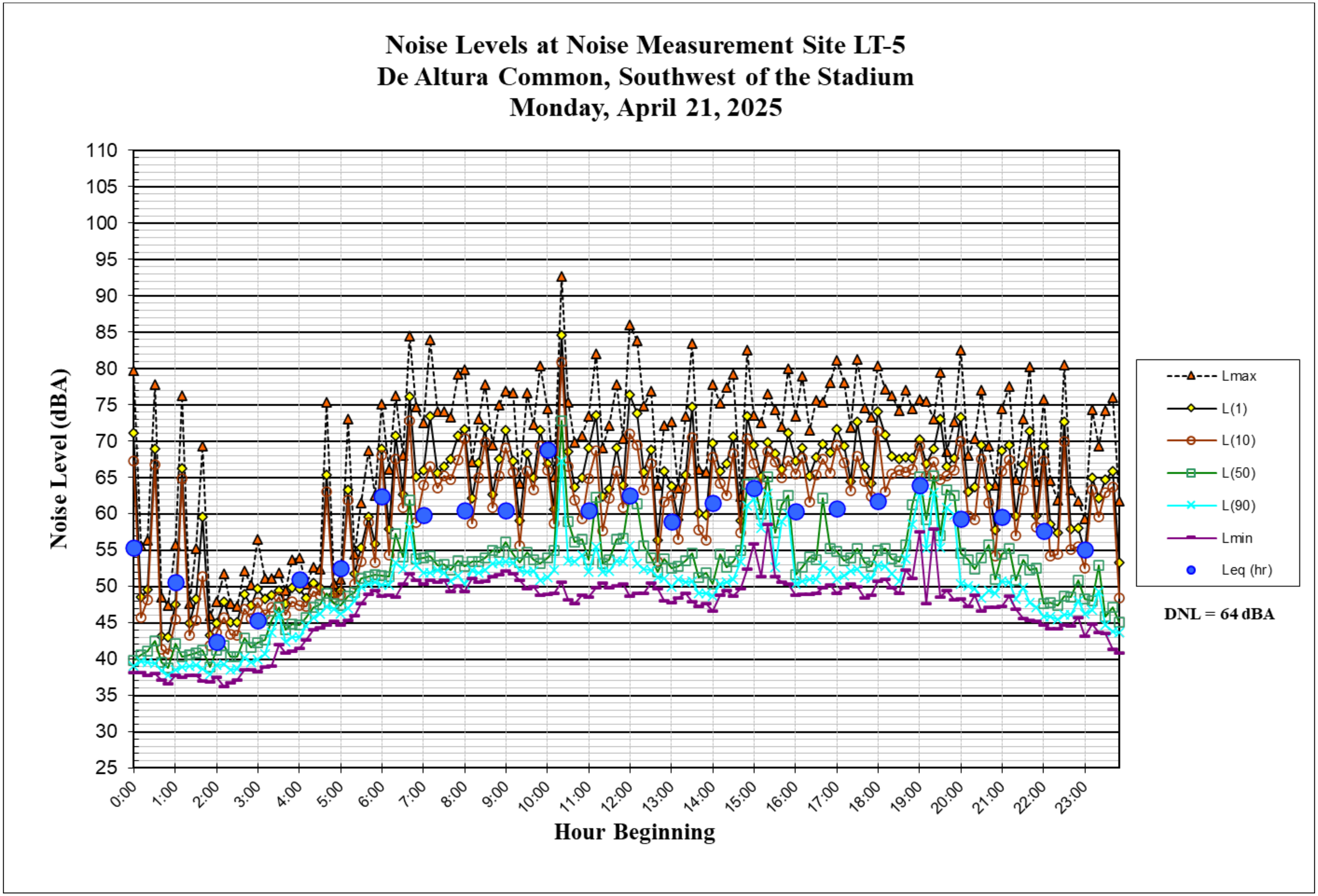
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 60 dBA


Noise Levels at Noise Measurement Site LT-5
De Altura Common, Southwest of the Stadium
Monday, April 21, 2025
Noise Level (dBA)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
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21:00
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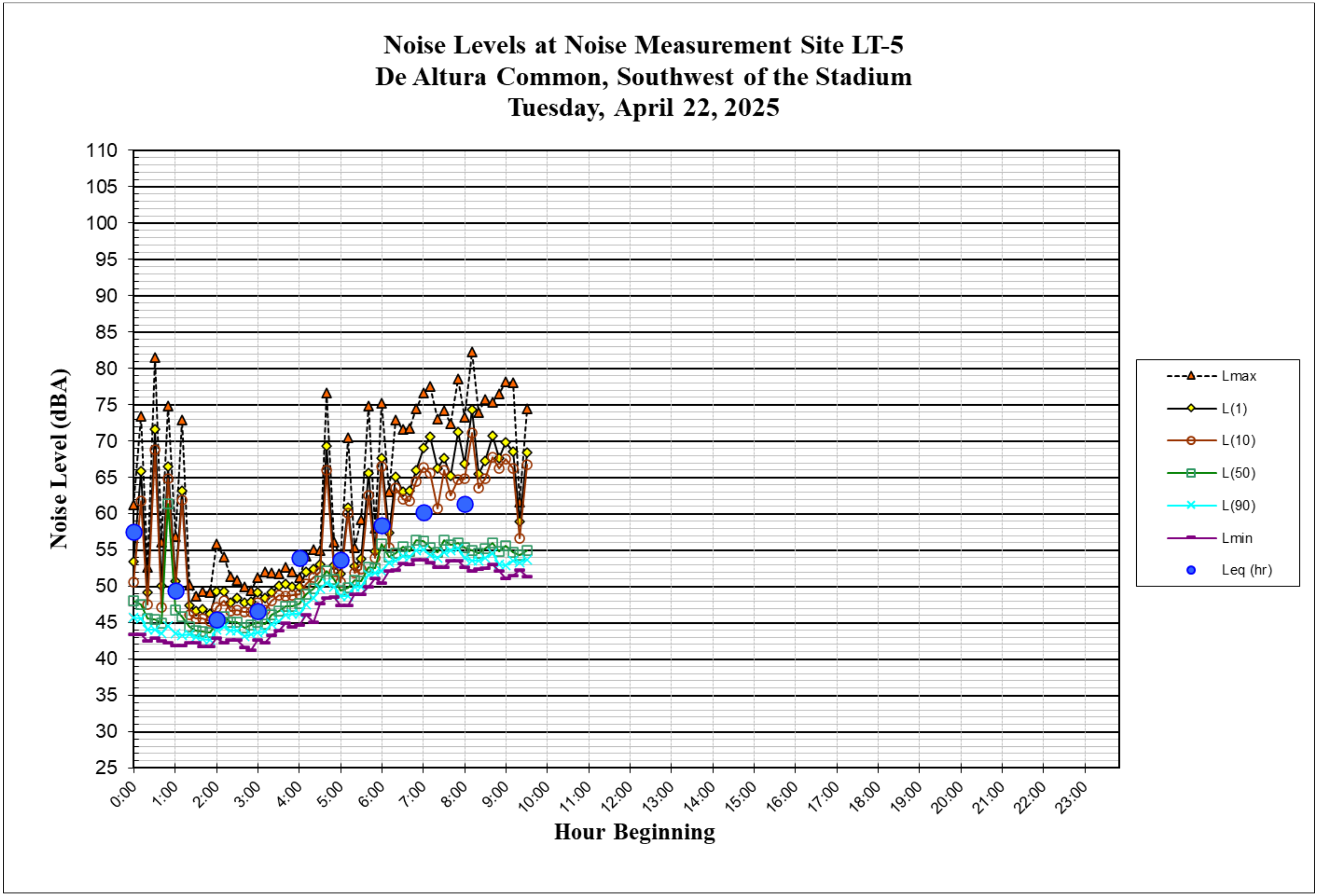
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 64 dBA


Noise Levels at Noise Measurement Site LT-5
De Altura Common, Southwest of the Stadium
Tuesday, April 22, 2025
Noise Level (dBA)
110
105
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95
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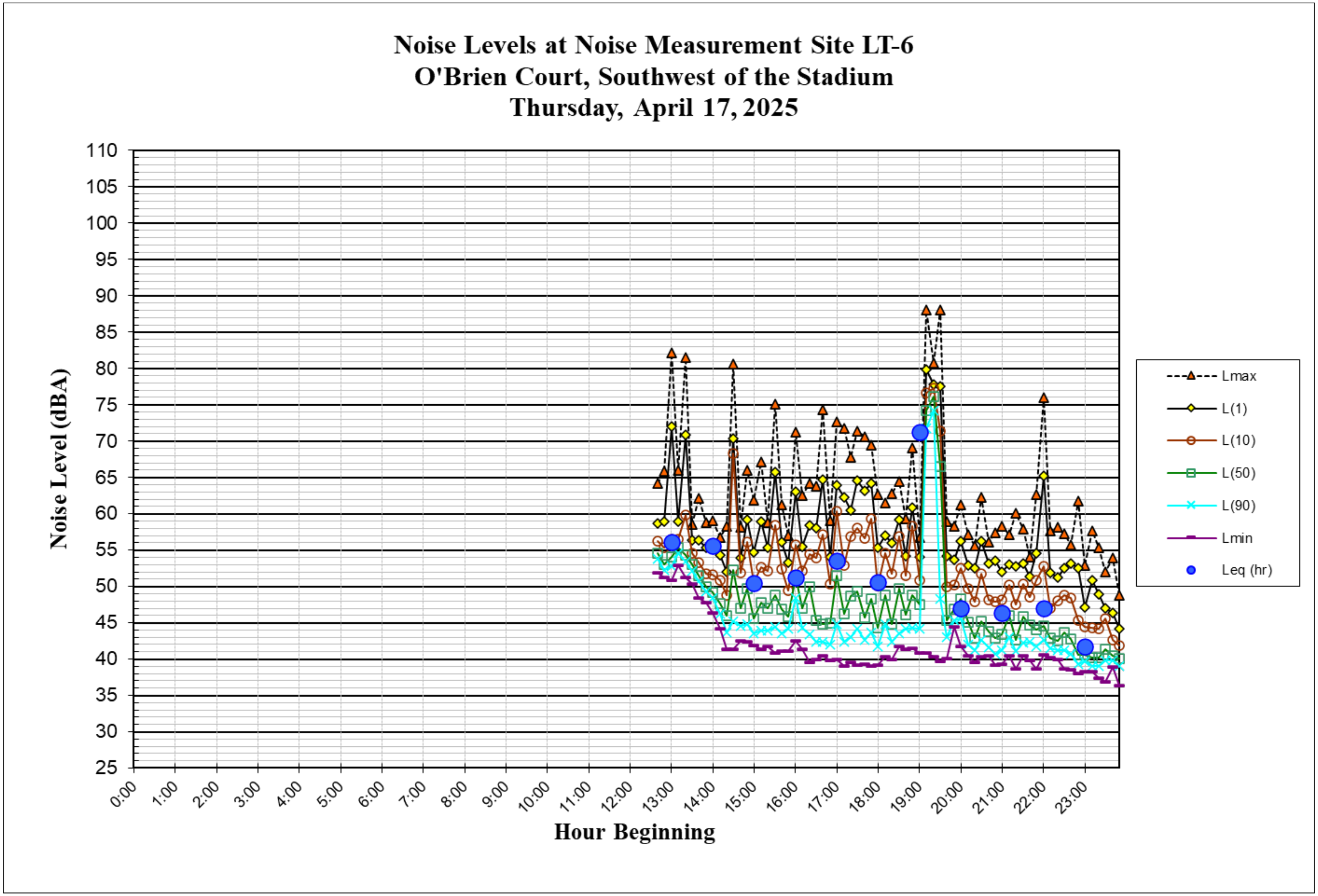
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-6
O'Brien Court, Southwest of the Stadium
Thursday, April 17, 2025
110
105
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90
85
80
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70
65
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50
45
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30
25
Noise Level (dBA)
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19:00
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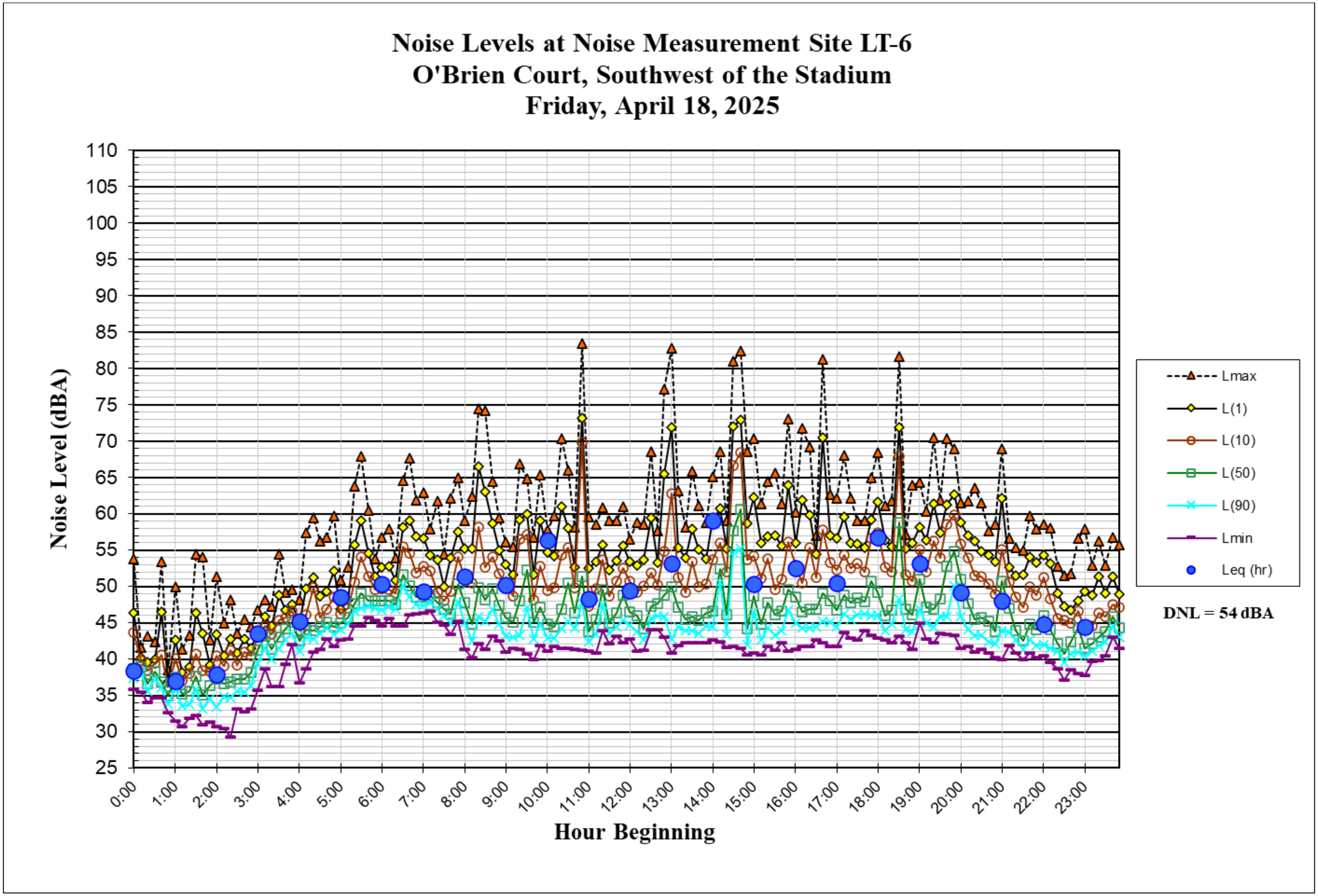
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)


Noise Levels at Noise Measurement Site LT-6
O'Brien Court, Southwest of the Stadium
Friday, April 18, 2025
Noise Level (dBA)
110
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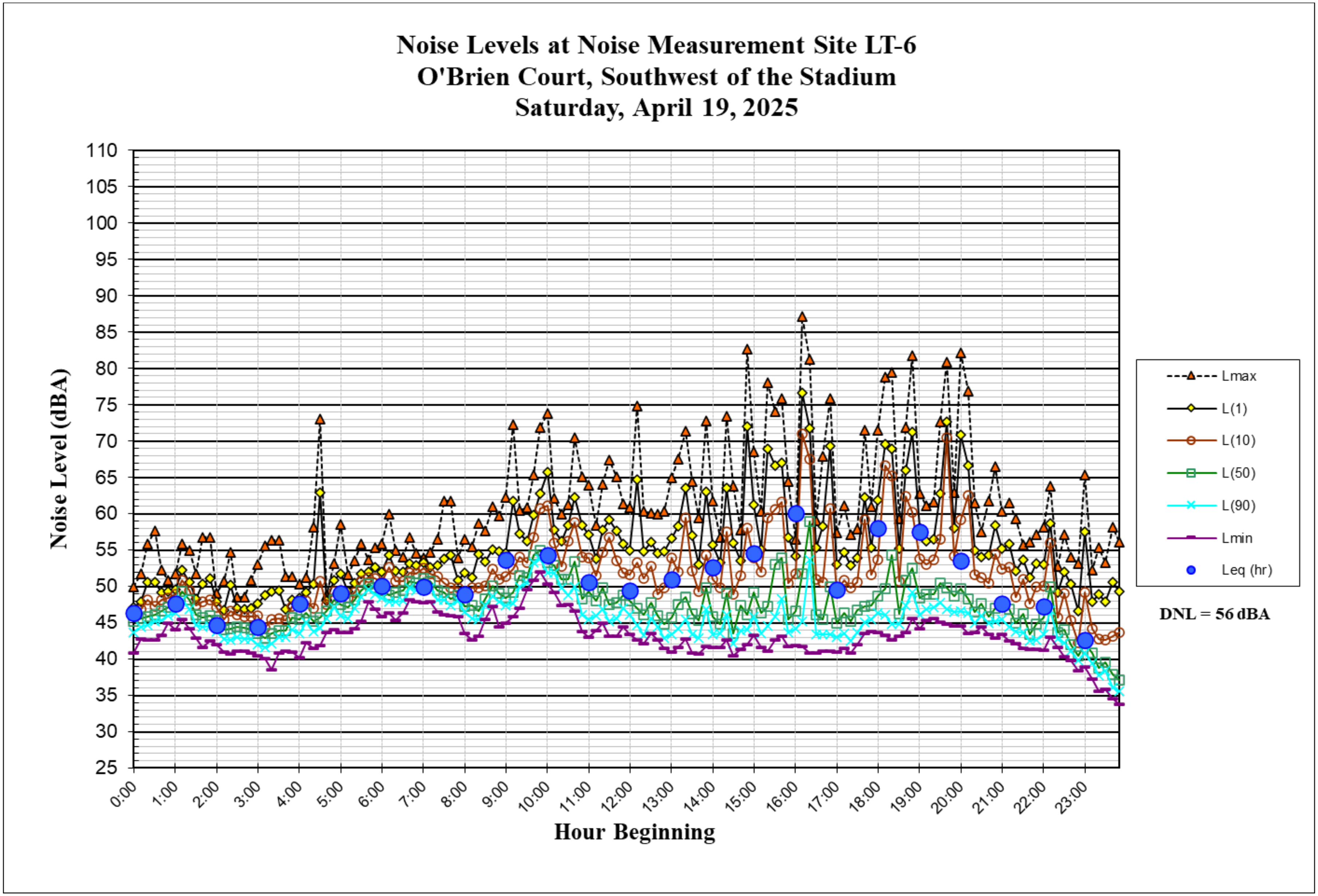
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 54 dBA


Noise Levels at Noise Measurement Site LT-6
O'Brien Court, Southwest of the Stadium
Saturday, April 19, 2025
Noise Level (dBA)
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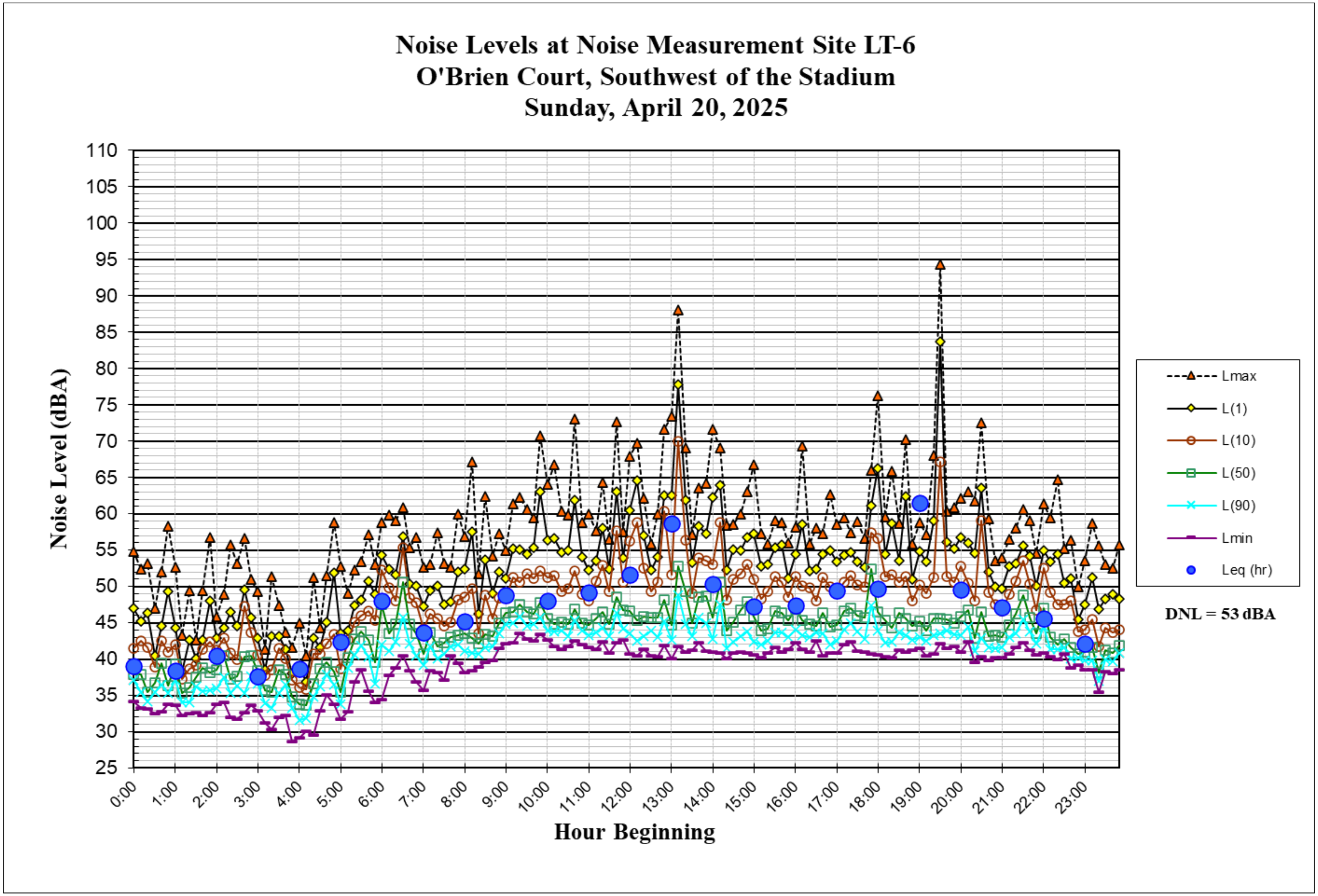
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 56 dBA


Noise Levels at Noise Measurement Site LT-6
O'Brien Court, Southwest of the Stadium
Sunday, April 20, 2025
Noise Level (dBA)
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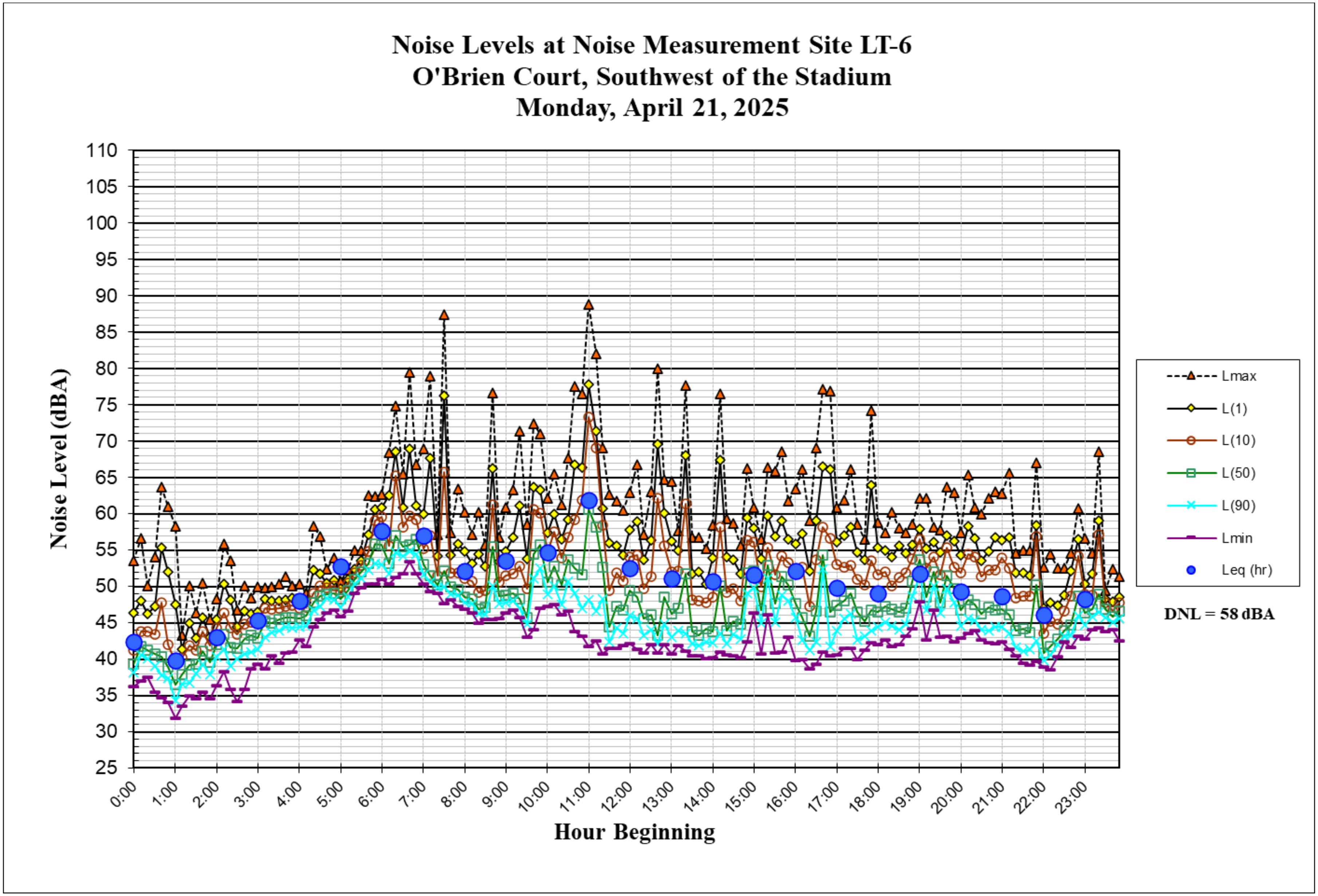
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 53 dBA


Noise Levels at Noise Measurement Site LT-6
O'Brien Court, Southwest of the Stadium
Monday, April 21, 2025
Noise Level (dBA)
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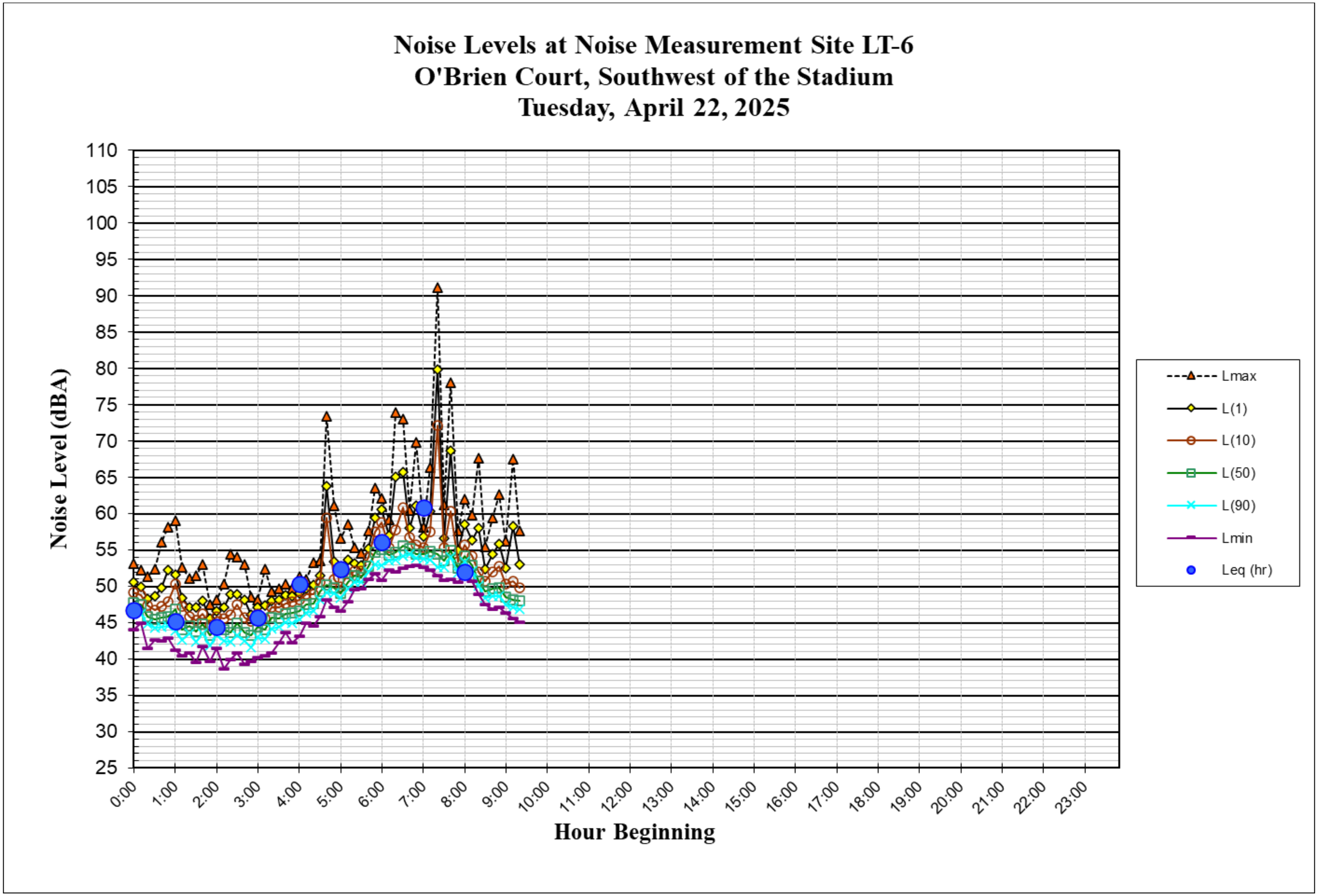
23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
DNL = 58 dBA


Noise Levels at Noise Measurement Site LT-6
O'Brien Court, Southwest of the Stadium
Tuesday, April 22, 2025
Noise Level (dBA)
110
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23:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)