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M E M O

Date: April 3, 2019

To: **Julie Wright**
David J. Powers & Associates, Inc.

From: **Michael S. Thill**
Illingworth & Rodkin, Inc.

RE: Newark Area 4 Noise and Vibration Assessment Update (I&R Job 18-102)

Illingworth & Rodkin, Inc. has prepared this memo updating the original 2009 Newark Areas 3 and 4 Noise and Vibration Assessment that was incorporated into the 2015 Newark Areas 3 and 4 Specific Plan Project Recirculated EIR (2015 REIR). The REIR analyzed environmental impacts associated with 1,260 housing units of various densities, an elementary school, a golf course, and open space areas, as well as retention of existing light industrial and institutional uses (Ohlone College, City fire station, park, and community activity center). Area 4 of the Specific Plan consists of approximately 560 acres and is surrounded by the Alameda County Flood Control & Water District channel to the north, the Union Pacific Railroad (UPRR) to the east, the City of Newark/City of Fremont city limits (generally Stevenson Boulevard) to the south, and Mowry Slough to the west.

Area 4 of the Specific Plan land use plan, as analyzed in the REIR, included up to 316 acres of potential development and divided the development envelope into three subareas (Sub-Area B, C and D). Development within the land use plan was analyzed to include a golf course, single-family detached houses, and neighborhood parks. An 80-foot setback from the centerline of the near through railroad track is required for any residential development within Sub-Areas B and C. The Specific Plan REIR also included the extension of Stevenson Boulevard into Area 4, with a bridge overcrossing of the UPRR tracks and modification to two Pacific Gas & Electric Company (PG&E) towers and electric transmission lines to provide sufficient clearance of the Stevenson Boulevard overcrossing, and a combined emergency vehicle access (EVA) and pedestrian/bicycle trail across Area 4 west of the UPRR tracks. The current proposal involves the development of 469 single-family residences in the "Sub-Area B and C" of the Area 4 planning area. No golf course is proposed at this time.

This update includes a discussion of the policies set forth in the current (2013) Noise Element of the City's General Plan, the current Noise Ordinance (2018) set forth in the City's Zoning Ordinance, and the results of updated baseline noise and vibration measurements, which were conducted near the project site to determine whether REIR impacts or mitigation measures needed to be revised. Consistency of the proposed project with updated policies and regulations, the significance of noise and vibration impacts of the proposed project, and measures to mitigate the impacts of the proposed

project are discussed below. As discussed, the proposed project does not result in any new or substantially more significant impacts compared to those identified in the REIR.

Regulatory Criteria

City of Newark Noise Element. The Noise Element of the City of Newark General Plan Update (adopted December 12, 2013) identifies noise and land use compatibility standards for various land uses, including those listed below. These standards are intended to provide compatible land uses throughout the community when considering the effects of environmental noise.

> Policy EH-7.4 Residential Noise Standard – Exterior. Plan for and implement strategies to maintain exterior noise levels that are consistent with the noise compatibility guidelines in Table EH-2 (not included). For residential areas, this limit is 60 dBA L_{dn} for outdoor living areas. Where this level is exceeded due to freeways, arterials, and/or railroads, the construction of berms, walls, buffer zones, and other noise-reduction measures to reduce noise to the greatest extent feasible will be required.
>
> Policy EH-7.5 Residential Noise Standard – Interior. Use site planning and architectural design to protect occupants of new buildings from excessive noise, per California State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code (UBC). For example, site planning should place bedrooms and other noise-sensitive rooms away from exterior noise sources and architectural design should use double-paned windows and other insulating measures to reduce interior noise.
>
> Policy EH-7.7 Acoustical Study Requirement. Require acoustical studies for new developments in areas where the noise levels exceed the 'normally acceptable' levels for the proposed land use; based on Table EH-2 (not included). For residential uses, the analysis should include mitigation measures to limit the noise exposure in interior living spaces to 45 dB L_{dn}, consistent with California Title 24.

The City's Noise Element includes the following policy related to construction noise:

> Policy EH-6.7 Construction Noise – Addressing Sources of Construction Noise. Reduce noise associated with construction activities by requiring properly maintained mufflers on construction vehicles, requiring the placement of stationary construction equipment as far as possible from developed areas, and requiring temporary acoustical barriers/shielding to minimize construction noise impacts at adjacent receptors. Special attention should be paid to noise-sensitive receptors (including residential, hospital, school, and religious land uses).

The City's Noise Element also includes the following applicable action items related to groundborne vibration:

> Action EH-7.D Vibration-Intensive Construction. Implement a standard operating procedure that requires the evaluation of vibration impacts for individual projects which use vibration-intensive construction activities, such as pile drivers, jack hammers, and

vibratory rollers, near sensitive receptors. If construction-related vibration is determined to be perceptible (i.e., in excess of Federal Transit Administrations vibration annoyance criterion) at vibration-sensitive uses, then additional requirements, such as the use of less-vibration-intensive equipment or construction techniques, shall be implemented during construction.

Action EH-7.E New Development Near Railroads. Implement a standard operating procedure that requires the evaluation of potential vibration impacts for new development that occurs within 200 feet of a railroad track, in accordance with the FTA's vibration screening distances. In such instances, the project property owner/developers shall retain an acoustical engineer to conduct an acoustic analysis and identify, where appropriate, site design features and/or required building construction improvements to ensure that vibration impacts would remain below acceptable levels for residential uses.

City of Newark Noise Ordinance. The City's new Noise Ordinance (adopted January 2018) is set forth in Section 17.24.100, Noise, of the Zoning Code. Items 2 and 3 are applicable to this assessment:

2. Noise Restriction by Decibel.

a. *Residential Property Noise Limits.*

i. No person shall produce or allow to be produced by human voice, machine, device, or any combination of same, on residential property, a noise level at any point outside of the property plane that exceeds 70 dBA between the hours of 7:00 a.m. and 9:00 p.m. or 60 dBA between the hours of 9:00 p.m. and 7:00 a.m.

3. Construction and Landscaping Activities. Unless otherwise provided pursuant to a duly issued permit or a condition of approval of a land use entitlement, the construction, alteration, or repair of structures and any landscaping activities, occurring between the hours of 10:00 a.m. and 6:00 p.m. on Sundays and holidays, and 7:00 a.m. and 7:00 p.m. on other days, shall be subject to the following:

a. No individual device or piece of equipment shall produce a noise level exceeding 83 dBA at a distance of 25 feet from the source. If the device or equipment is housed within a structure on the property, the measurement shall be made outside the structure at a distance as close as possible to 25 feet from the equipment.

b. The noise level at any point outside of the property plane shall not exceed 86 dBA. During all other times, the decibel levels set forth in Subsection 17.24.100.A.2, Noise Restriction by Decibel, Control.

Updated Noise and Vibration Measurements. A noise monitoring survey was performed at the site beginning on Thursday, July 19, 2018 and concluding on Wednesday July 25, 2018. The monitoring survey included two long-term noise measurements, as shown in Figure 1. The ambient

noise environment at the site results primarily from train activity on the UPRR as well as operational noise from businesses located at the Stevenson Point Tech Park. Occasional aircraft flyovers associated with Norman Y. Mineta San José International Airport and Hayward Executive Airport also contribute to the ambient noise environment. The project site is not located within two miles of an airport or within an airport land use plan area and is not expected to be exposed to excessive noise from aircraft.

Long-term noise measurement LT-1 was conducted near the boundary of the proposed project site adjacent to the UPRR, approximately 40 feet southwest of the railroad track. LT-1 was positioned on a utility pole along the track, about 10 feet above the ground. Hourly average noise levels at LT-1 typically ranged from 58 to 77 dBA L_{eq} during the daytime hours and from 48 to 66 dBA L_{eq} during the nighttime hours. The daily trend in noise levels at LT-1 is shown in Figures 2 through 8. Levels recorded at LT-1 are primarily representative of train horns and other train noise. The maximum noise levels during train passbys were typically between 90 to 105 dBA L_{max}. The day-night average noise level was 71 to 72 dBA L_{dn} on weekdays, 70 dBA L_{dn} on Saturday, and 68 dBA L_{dn} on Sunday. The overall day-night average noise level between July 19, 2018 and July 25, 2018, was 71 dBA L_{dn}.

LT-2 was conducted approximately 800 feet away from the UPRR. Like LT-1, noise levels recorded at LT-2 also represent intermittent train activity along the railroad. Hourly average noise levels at LT-2 typically ranged from 48 to 59 dBA L_{eq} during the daytime hours and from 42 to 58 dBA L_{eq} during the nighttime hours. The overall day-night average noise level measured between Thursday, July 19, 2018 and Wednesday, July 25, 2018 was 58 dBA L_{dn}. The daily trend in noise levels at LT-2 is shown in Figures 9 through 15.

Short-term measurement ST-1 was conducted on Thursday, July 19, 2018 at 12:40 pm while short-term measurement ST-2 was conducted on Wednesday, July 25, 2018 at 3:10 pm. Both measurements were made in ten-minute intervals. No train events occurred during either of the two short-term measurements. Short term measurement ST-1 was conducted near the southern section of the proposed residential units while short term measurement ST-2 was made in the parking lot of a nearby industrial land use. Levels at ST-1 are representative of distant traffic and operational noise related to the industrial land uses in the project vicinity. The 10-minute average noise level measured at ST-1 was 45 dBA L_{eq}. Levels at ST-2 were representative of mostly truck traffic within the parking lot and aircraft noise. The 10-minute average noise level measured at ST-2 was 48 dBA L_{eq}. Table 1 summarizes the results of the short-term measurements.

The measured data indicate that existing train noise levels are somewhat lower than 2006 levels.

TABLE 1 Summary of Short-Term Noise Measurement Data (dBA)

Noise Measurement Location	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: 1,200 feet southwest of railroad (no trains). (7/19/2018, 12:40 p.m. - 12:50 p.m.)	57	54	48	42	40	45
ST-2: Eureka Drive Business parking lot, 90 feet from railroad (no trains). (7/25/2018, 12:00 p.m. - 12:10 p.m.)	58	57	51	45	43	48

Vibration measurements were made on Thursday, December 6, 2018 at two positions along Stevenson Boulevard northeast of the UPRR. In the vicinity of Stevenson Boulevard, one set of railroad tracks exists. Moving northward of Stevenson Boulevard, the single set of railroad tracks split to three sets of tracks (two through tracks and one spur track). Position V-1 was approximately 60 feet from the center of the single set of railroad tracks. Position V-2 was an additional 60 feet northeast of Position V-1 and 120 feet from the center of the single set of railroad tracks. The two different setbacks were used to evaluate the attenuation in ground vibration levels with distance from the tracks.

As with the vibration levels measured in the REIR, vibration levels were only measured in the vertical axis because ground vibration resulting from railroad trains is typically most dominant on this axis. The instrumentation used to take the measurements included seismic grade, low noise accelerometers firmly fixed to the ground, and a digital recorder. This system is capable of accurately measuring very low vibration levels. Vibration levels were measured at ground level and were representative of vibration levels that would shake a building's foundation.

Vibration measurements were taken during the passage of nine trains (eight passenger trains and one freight train). These trains were observed to travel at speeds of approximately 40 to 70 mph through the project area. Vibration levels measured at each measurement position during train passby events are summarized in Figures 16 and 17. The closest residential lot to the UPRR tracks is 60 feet from the center of the nearest track. At 60 feet from the center of the track, maximum overall levels for a single event ranged from 68 to 81 VdB, with the average train producing a maximum overall level of 74 VdB. At 120 feet, maximum overall levels for a single event ranged from 50 to 68 VdB. The measured data was generally consistent with train vibration levels in the REIR (vibration levels of approximately 75 VdB at a distance of 80 feet and 71 VdB at 115 feet to 130 feet during train passbys). Based on these data, maximum overall levels for a single event at 80 feet from the center of the track would be expected to range from from 63 to 76 VdB, with the average train producing a maximum overall level of 69 VdB. The current data support the previously recommended setback distance of 80 feet from the centerline of the nearest through railroad track for residential structures.

Assessment of Noise and Vibration at the Project Site

Outdoor Activities

Pursuant to the City of Newark General Plan Noise Element, residential land uses are considered "normally acceptable" in exterior noise environments of 60 dBA L_{dn} or less, while interior noise levels attributable to exterior noise sources are required to be maintained at or below 45 dBA L_{dn}. The proposed project would locate three residential properties approximately 60 to 65 feet from the centerline of the nearest through railroad track. Lots 1, 31, and 54 are proposed within 80 feet of the centerline of the nearest through railroad track. Accounting for the difference in distance between where the train noise was measured (40 feet from the near track) and the distance to the nearest lots (60 feet), the noise level at the residential property lines is calculated to be approximately 69 dBA L_{dn}, which exceeds the City's criteria of 60 dBA L_{dn} for exterior noise environments. As noted in the REIR Noise Assessment, as part of the project, a bridge would be constructed over the UPRR at Stevenson Boulevard. This would allow trains to pass noise sensitive receptors in Area 4 without having to sound their warning whistles, thereby removing a substantial noise source. The removal of train warning whistles was calculated to decrease the L_{dn} noise level by 4 dBA. This calculation was made by subtracting the acoustical energy produced by the train warning whistles from the calculated hourly average noise level during hours affected by railroad train passby events. Under this assumption, the future noise levels at the closest property line to the UPRR would be approximately 65 dBA L_{dn}. Therefore, the projected noise level would continue to exceed the 60 dBA L_{dn} acceptability criteria for residential outdoor activity areas.

The REIR analysis concluded that projected noise levels would exceed the City's acceptability criteria of 60 dBA L_{dn} at the project's nearest residential uses to the UPRR. The REIR concluded that noise barriers eight feet in height along the residential property lines of homes adjacent to the UPRR would ensure project compatibility with the City's General Plan noise compatibility guidelines. An eight-foot effective height barrier would reduce rail noise to a maximum of 60 dBA L_{dn} at residential rear yards.

As with the project analyzed in the REIR, the proposed project would locate the nearest residential units 60 feet from the centerline of the nearest through railroad track . Noise barriers would either be constructed at the UPRR right of way or at the residential property lines, which would be consistent with the REIR. An updated analysis of the effectiveness of the REIR noise barriers was conducted for the proposed project. The analysis concluded that if the sound barriers are constructed at the UPRR right of way, the barriers would need to be approximately 14 feet high. If the barriers are constructed at the residential property lines and connecting streets, the barriers would need to be eight feet in height as measured above the residential pad elevation.[1]

The REIR requires that: (1) the barriers be constructed solidly over the entire surface and at the base, (2) openings or gaps between barrier materials or the ground decrease the reduction provided by a noise barrier; (3) suitable material should have a minimum surface weight of 3 lbs/ft, and (4) the final design of noise barriers must be completed during project-level review when detailed site plans and grading plans are available. The REIR analysis for rail noise assumed that there would be an

[11] The elevation of the UPRR right of way is approximately 5 ½ feet below the proposed residential building pad elevation.

overcrossing for Stevenson Boulevard at the UPRR tracks prior to occupancy of the residences in Area 4 eliminating the requirement for trains to sound their warning horns as they pass through Area 4 near the residences. As required by the REIR, the final design for the barriers would account for noise from train horns if the overcrossing is not constructed.

Residential Interiors

The proposed project proposes three residential lots approximately 60 to 65 feet from the centerline of the nearest through railroad track . As with the REIR, given the anticipated exterior noise level at first-row residential units proposed along the railroad, anticipated ambient noise levels in Area 4 would require that residential units be designed to control interior noise levels below the City's interior noise standard of 45 dBA L_{dn}. Consistent with the REIR, the project would conduct project-specific acoustical analyses to sufficiently reduce interior noise levels below 45 dBA L_{dn} and ensure compatibility with the City's General Plan noise compatibility guidelines.

Vibration

The City of Newark General Plan Action EH-7.E utilizes Federal Transit Administration (FTA) vibration acceptability criteria as the guideline of acceptability for exposure to ground vibration due to passage of passenger and freight trains. As noted in the REIR, the applicable acceptability criterion for groundborne vibration resulting from occasional events (30 to 70 vibration events of the same source per day) is 75 VdB at proposed residential uses.

Where maximum overall levels for a single event exceed 75 VdB at proposed residential uses, a detailed vibration analysis is required for compliance with FTA guidelines. A vibration analysis was conducted for the proposed project. As shown on Figure 16, most of the train passby events (all passenger trains and freight cars) produced vibration levels below the FTA's criteria for a detailed analysis for residential land uses with one exception in which a freight train exceeded the criteria.

Based on the results of the vibration measurements, a detailed vibration analysis was conducted. The calculated contour distance for similar freight and passenger train events to the 75 VdB vibration limit was determined to be 80 feet from the centerline of the nearest through railroad track. This 80-foot minimum setback from the centerline of the nearest through railroad track for residential structures within Sub-Areas B and C near the UPRR is included in the adopted Specific Plan. As noted previously, Lots 1, 31, and 54 are proposed 60 to 65 feet from the centerline of the nearest through railroad track and within the 80-foot minimum setback. As determined in the REIR, vibration levels of the railway would be compatible with the proposed residential land uses provided that residential buildings are located no closer than 80 feet of the centerline of the nearest through railroad track.

<u>Assessment of Off-site Project-Generated Traffic Noise</u>

Traffic noise increases of less than 3 dBA L_{dn} are not typically perceptible and are not considered substantial.

Traffic noise level increases associated with the proposed project were calculated following the same methodology used in the 2006 REIR by comparing existing plus project traffic volumes to existing traffic volumes. Consistent with the REIR , the evaluation of traffic noise impacts from the proposed project concluded that the addition of project traffic would increase noise levels at noise-sensitive receptors by 2 dBA L_{dn} or less. The proposed project would not result in substantially more traffic noise than the project analyzed in the REIR, primarily because the proposed project would decrease the development footprint on the project site compared to the project analyzed in the REIR. Therefore, as with the REIR, impacts would be less than significant without mitigation.

Assessment of Cumulative Traffic Noise

Cumulative traffic noise impacts are considered significant if cumulative traffic results in a noise level increase of greater than 3 dBA L_{dn}. A "cumulatively considerable" contribution is defined as an increase of 1 dBA L_{dn} attributable solely to a project.

In the REIR, cumulative traffic noise levels were anticipated to increase by 3 L_{dn} because of cumulative plus project conditions along Cherry Street between Stevenson Boulevard and Mowry Avenue and by up to 4 dBA along Stevenson Boulevard, west and east of Cherry Street. The REIR concluded that 2 dB of the 4 dB increase was attributable to the project, which would result in a significant and unavoidable cumulative impact after implementation of mitigation. A cumulative traffic noise analysis was conducted for the proposed project, in which less than 1 dB (0.1 to 0.3 dB) of the traffic noise increase was attributed to the project along Cherry Street between Stevenson Boulevard and Mowry Avenue and along Stevenson Boulevard between Cherry Street and Cedar Street, primarily because the development footprint and square footage of the proposed project would be reduced relative to the project analyzed in the REIR. Therefore, cumulative noise impacts would be lower than the cumulative noise impacts analyzed in the REIR. The proposed project would not result in any new or substantially more significant cumulative noise impacts or require new or revised mitigation measures.

Assessment of Construction Noise

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. Construction noise impacts primarily occur when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise sensitive land uses, or when construction durations last over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses in the project vicinity for a period greater than one year, impacts are considered significant.

Typical hourly average construction generated noise levels are about 81 dBA to 88 dBA L_{eq} measured at 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). The Area 4 site is located over 2,800 feet from the nearest existing residential receptors along Cherry Street and separated from these receptors by several rows of

industrial buildings. As with the project analyzed in the REIR, at 2,800 feet, and when accounting for intervening acoustical shielding (estimate at a minimum of 5 dBA), construction noise levels at the nearest Cherry Street residences would be 48 dBA L_{eq} or less, and generally inaudible above existing Cheery Street traffic. Similarly, the Area 4 site is located at least 1,000 feet from residences that are currently under construction on the Area 3 site south of Cherry Street. When accounting for intervening acoustical shielding (estimate at a minimum of 5 dBA), construction noise levels at the nearest Area 3 residences would be 57 dBA L_{eq} or less. Because the proposed project's footprint and development square footage would be reduced compared to the project analyzed in the REIR, construction noise would be slightly lower than the construction noise in the REIR. As detailed in the REIR, the incorporation of standard construction noise controls would ensure the noise impact resulting from project construction would be less-than-significant.

From the comparison of the updated and the previous assessment of construction noise impacts in the REIR, the proposed project would have no new or substantially more significant construction noise impacts than the project analyzed in the 2015 REIR and no new mitigation measures are required.

Assessment of Construction Vibration

The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. A conservative vibration limit of 0.3 in/sec PPV has been used for buildings that are found to be structurally sound but where structural damage is a major concern. For historical buildings or buildings that are documented to be structurally weakened, a conservative limit of 0.08 in/sec PPV is often used to provide the highest level of protection. No historical buildings or buildings that are documented to be structurally weakened adjoin the project site. For the purposes of this study, groundborne vibration levels exceeding the conservative 0.3 in/sec PPV limit at the nearest buildings would have the potential to result in a significant vibration impact.

Table 2 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.) would generate vibration in the immediate vicinity of the project site.

Construction activities would occur as close as approximately 125 feet from the nearest buildings, which are industrial buildings. As shown in Table 2, construction could produce vibration levels up to 0.036 in/sec PPV at the nearest buildings. Vibration levels of up to 0.036 in/sec PPV are well below the conservative threshold of 0.3 in/sec PPV identified above. While nearby buildings may be exposed to minor vibration, vibration levels would be intermittent and would not cause structural damage to any surrounding buildings. Further, there are no buildings in the immediate vicinity of the project site that contain land uses particularly susceptible to vibration impacts.

A discussion of construction vibration was not provided in the REIR. However, the proposed project would have no new vibration impact and no new mitigation measures are required.

TABLE 2 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	PPV at 125 ft. (in/sec)	PPV at 200 ft. (in/sec)
Clam shovel drop		0.202	0.034	0.021
Hydromill (slurry wall)	in soil	0.008	0.001	0.001
	in rock	0.017	0.003	0.002
Vibratory Roller		0.210	0.036	0.021
Hoe Ram		0.089	0.015	0.009
Large bulldozer		0.089	0.015	0.009
Caisson drilling		0.089	0.015	0.009
Loaded trucks		0.076	0.013	0.008
Jackhammer		0.035	0.006	0.004
Small bulldozer		0.003	0.001	0.000

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

FIGURE 1 Noise and Vibration Measurement Locations

Source: Google Earth, 2018.

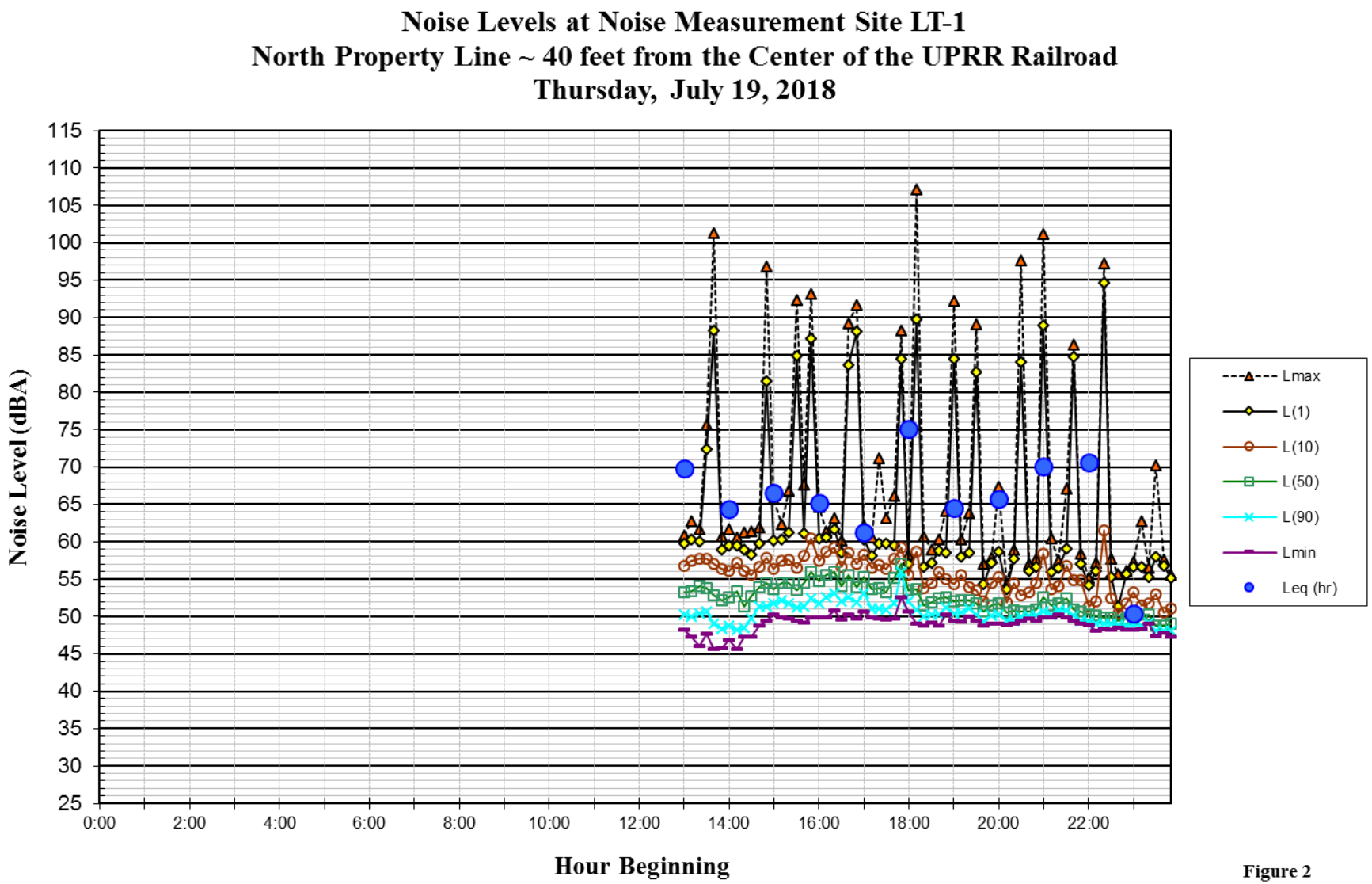
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Thursday, July 19, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 2

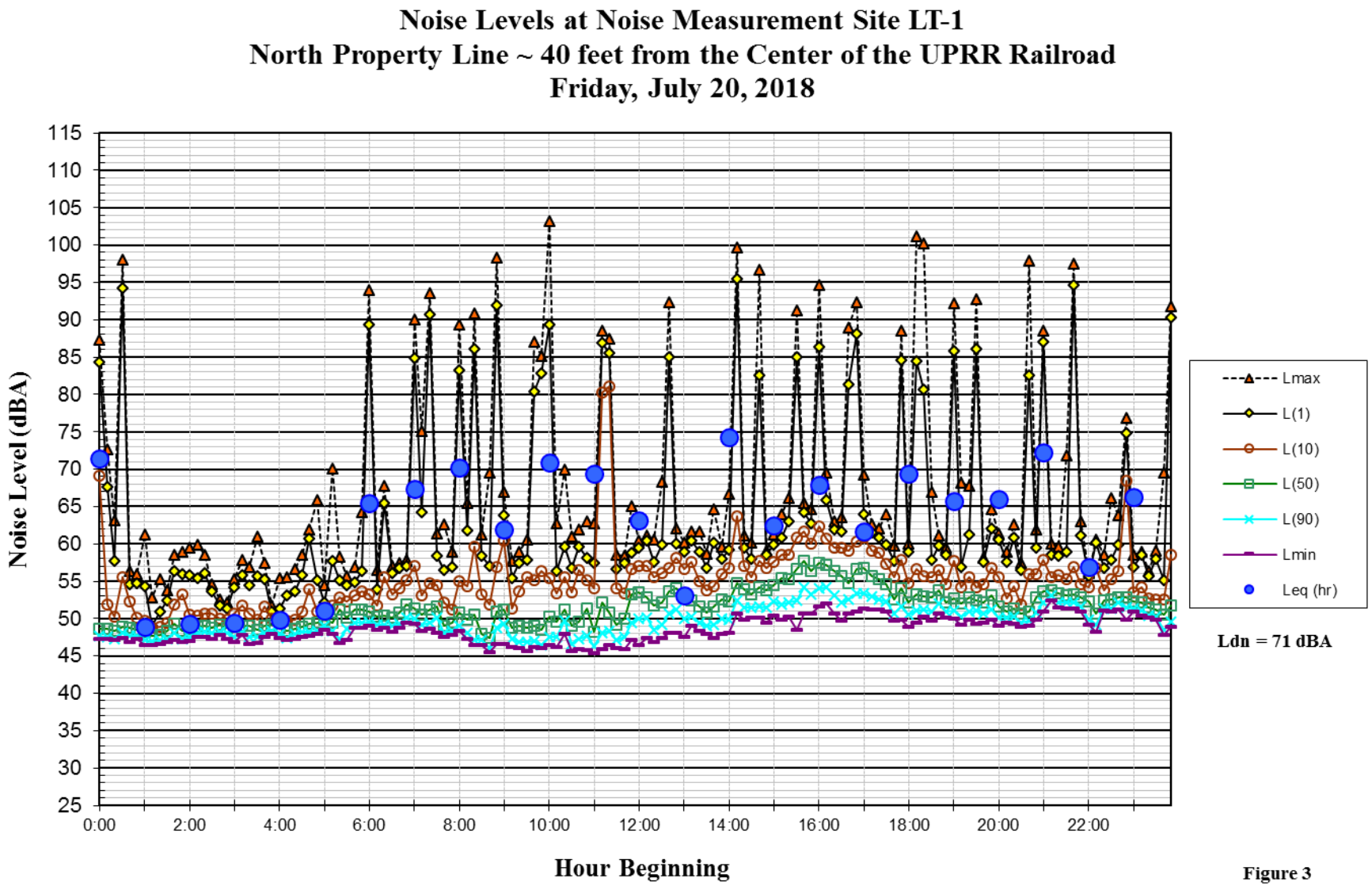
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Friday, July 20, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 71 dBA

Figure 3

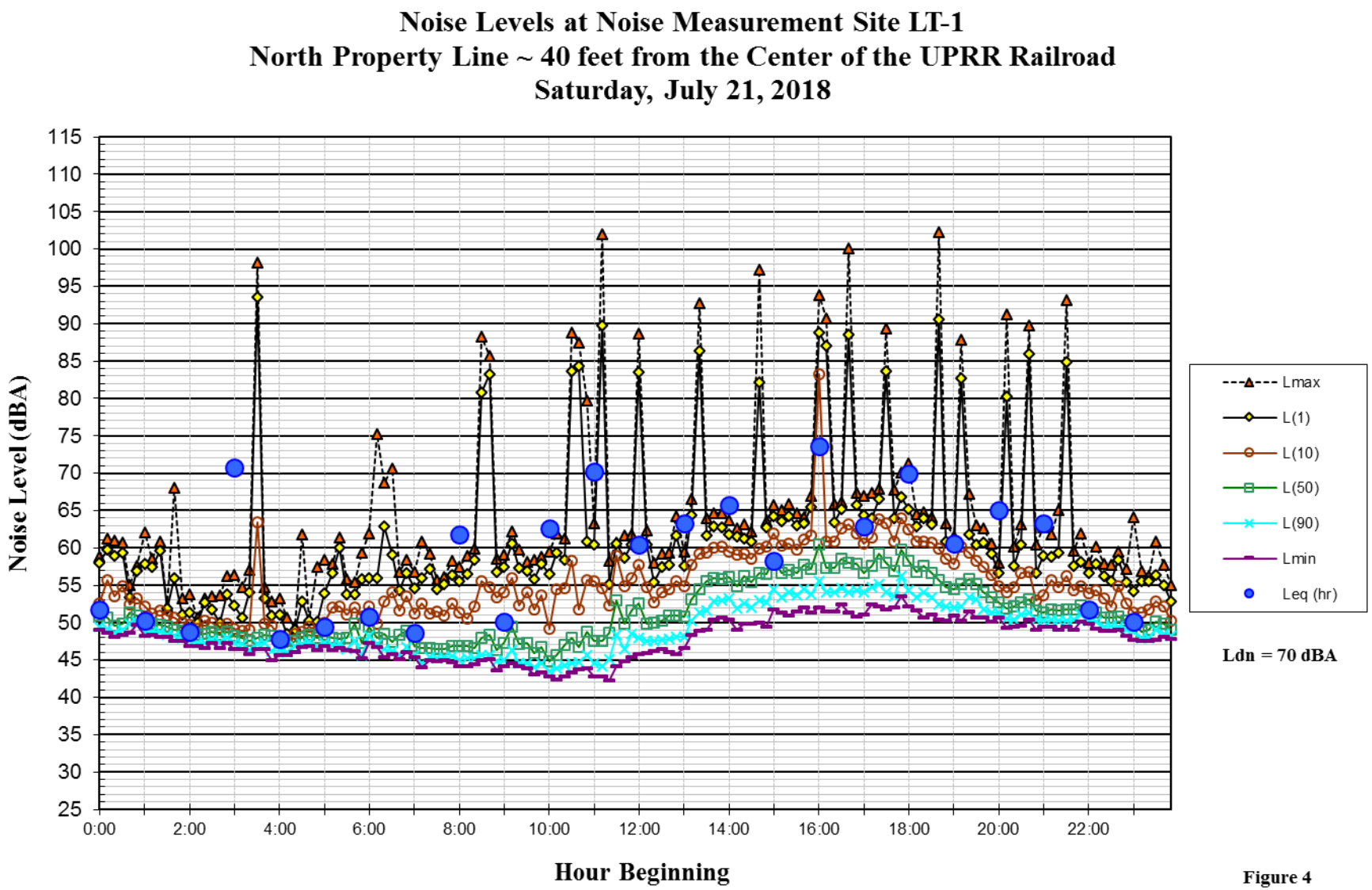
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Saturday, July 21, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 70 dBA

Figure 4

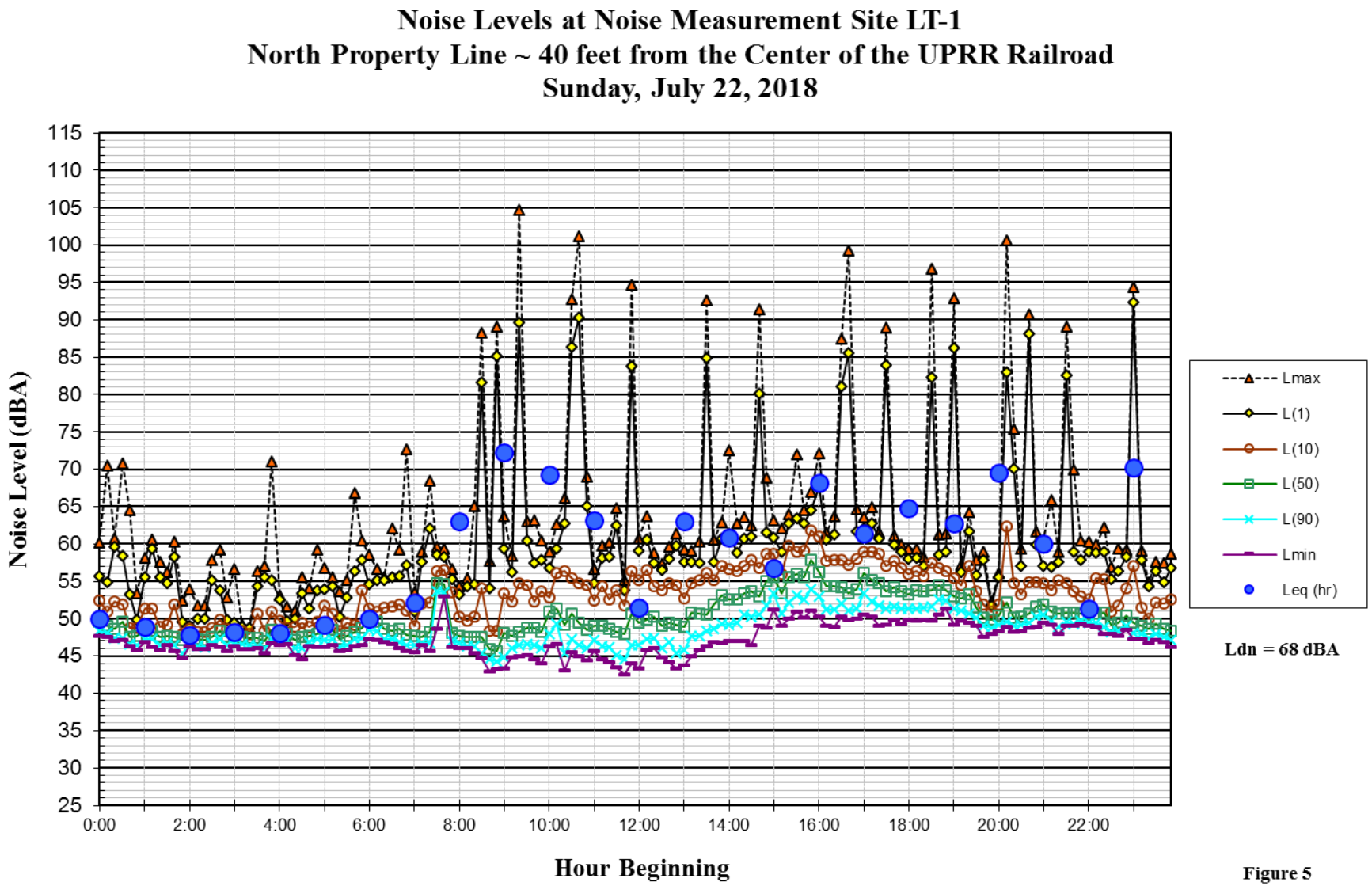
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Sunday, July 22, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 68 dBA

Figure 5

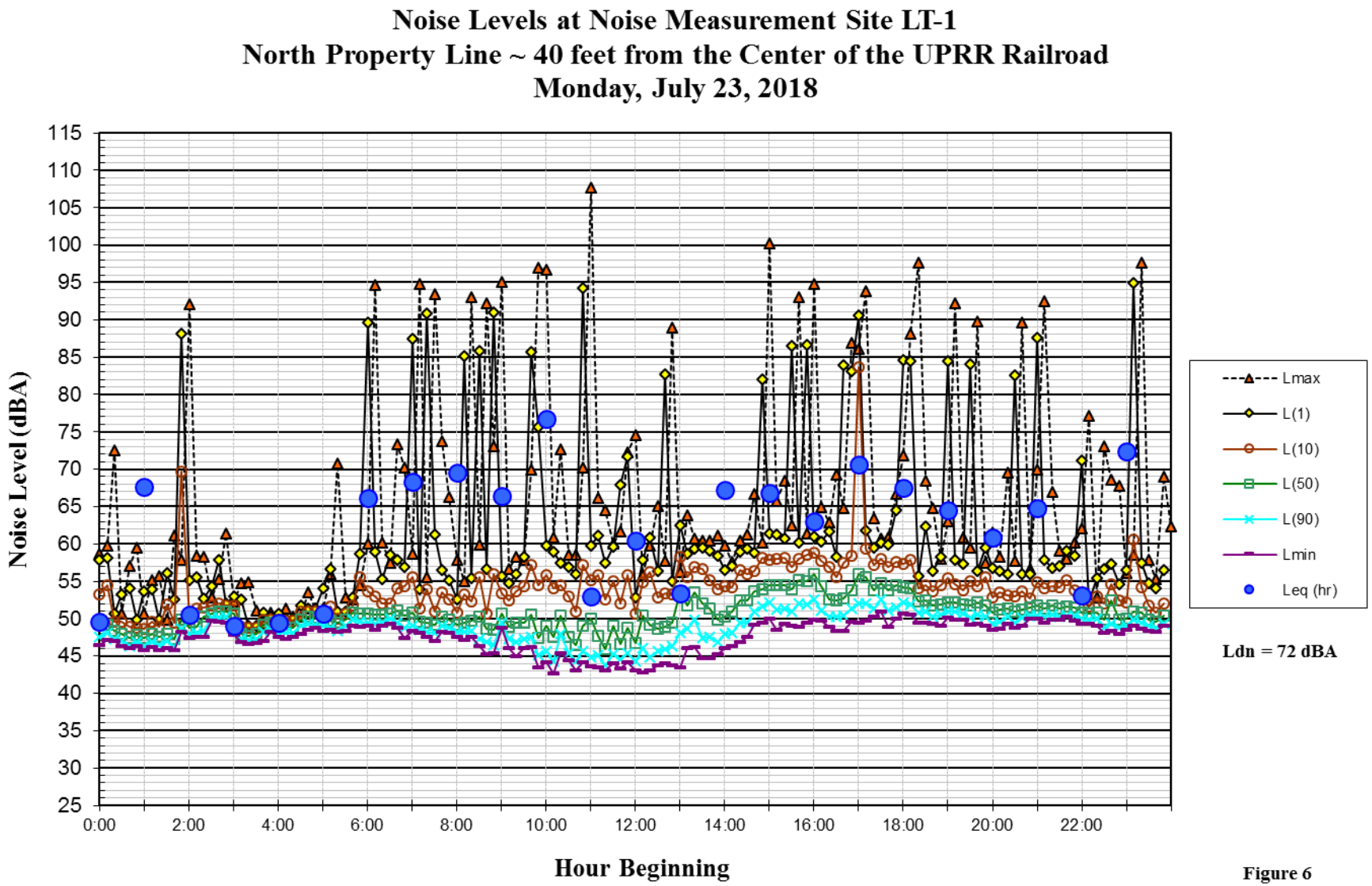
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Monday, July 23, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 72 dBA

Figure 6

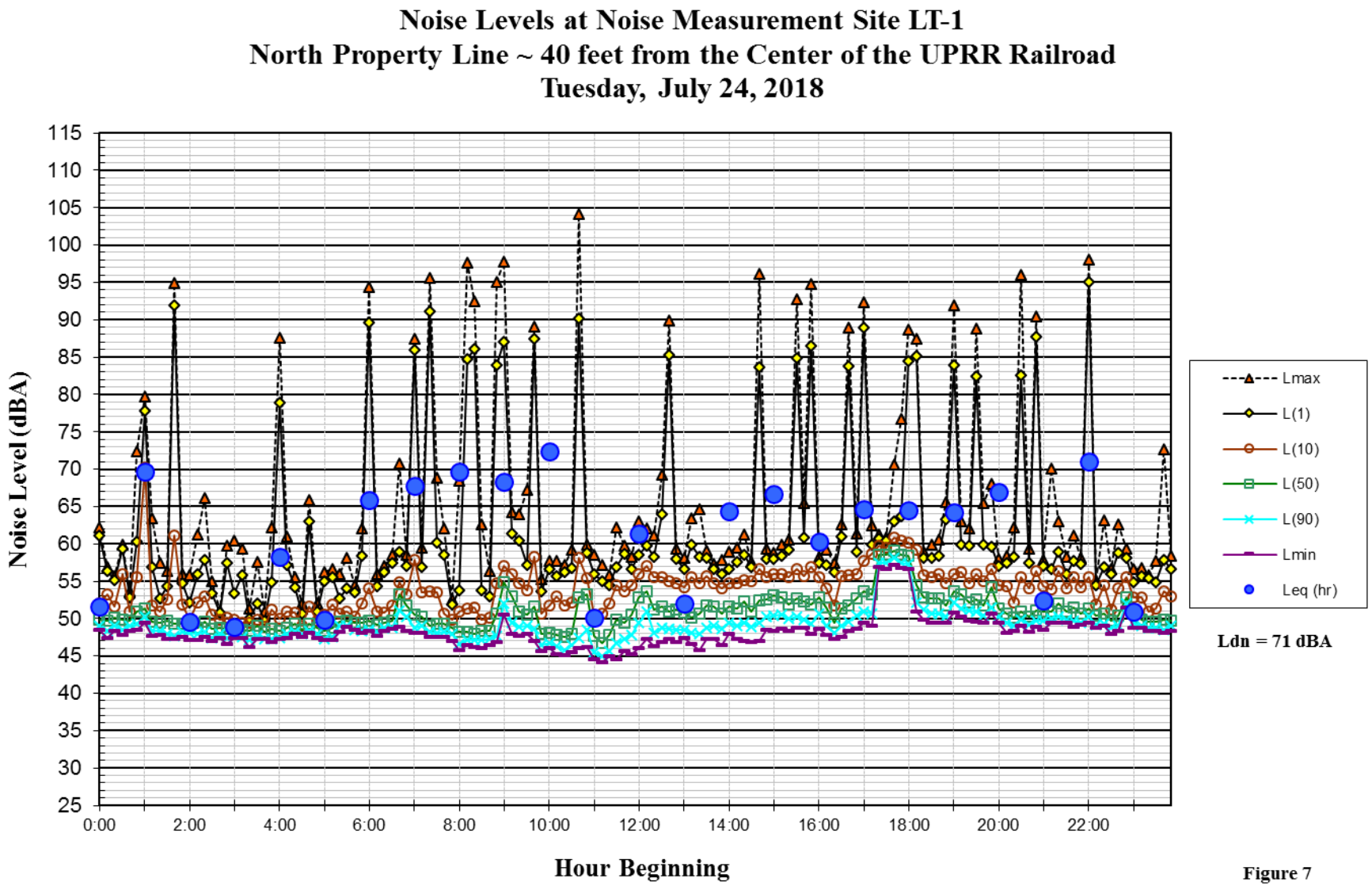
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Tuesday, July 24, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 71 dBA

Figure 7

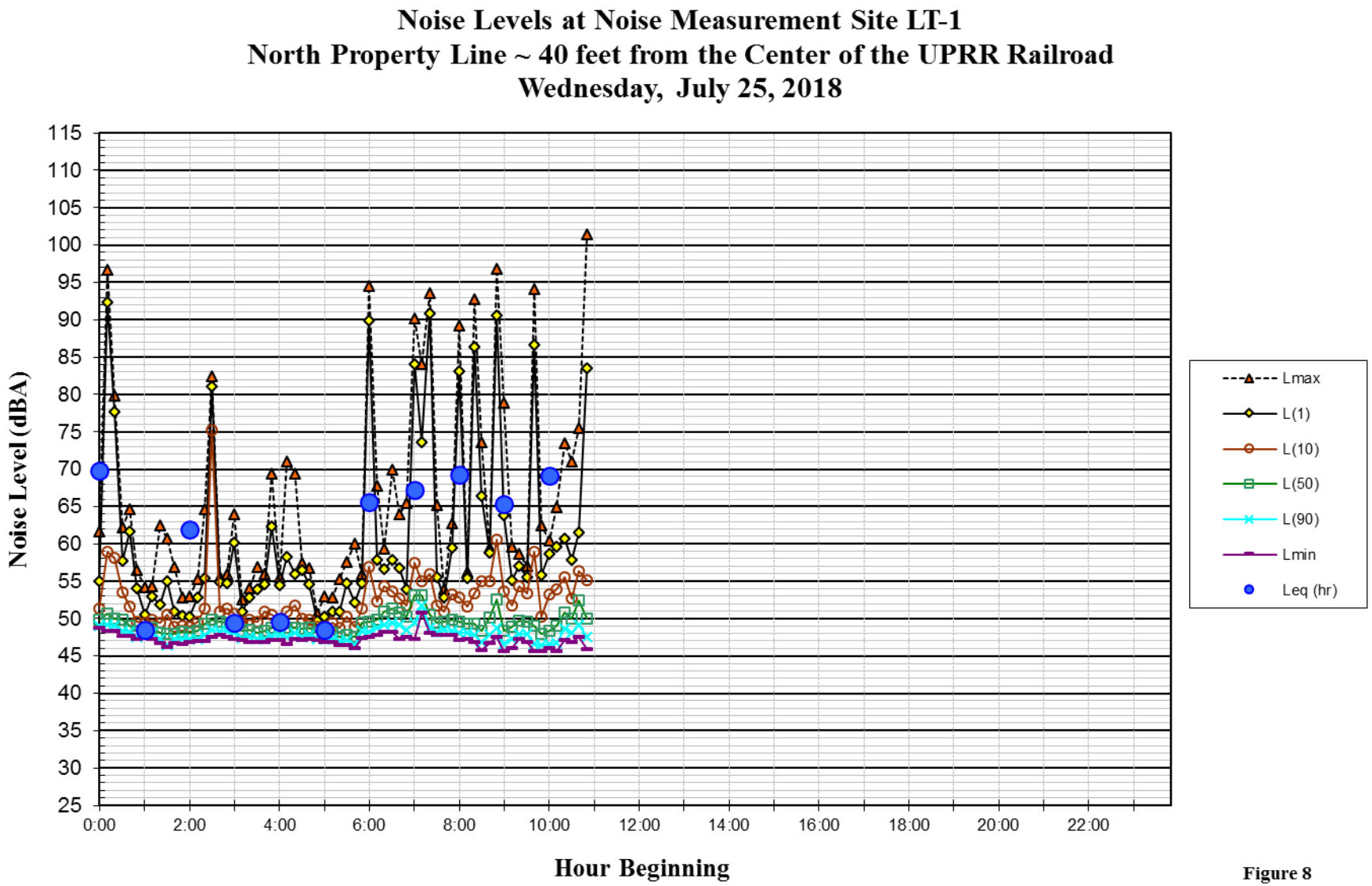
Noise Levels at Noise Measurement Site LT-1
North Property Line ~ 40 feet from the Center of the UPRR Railroad
Wednesday, July 25, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 8

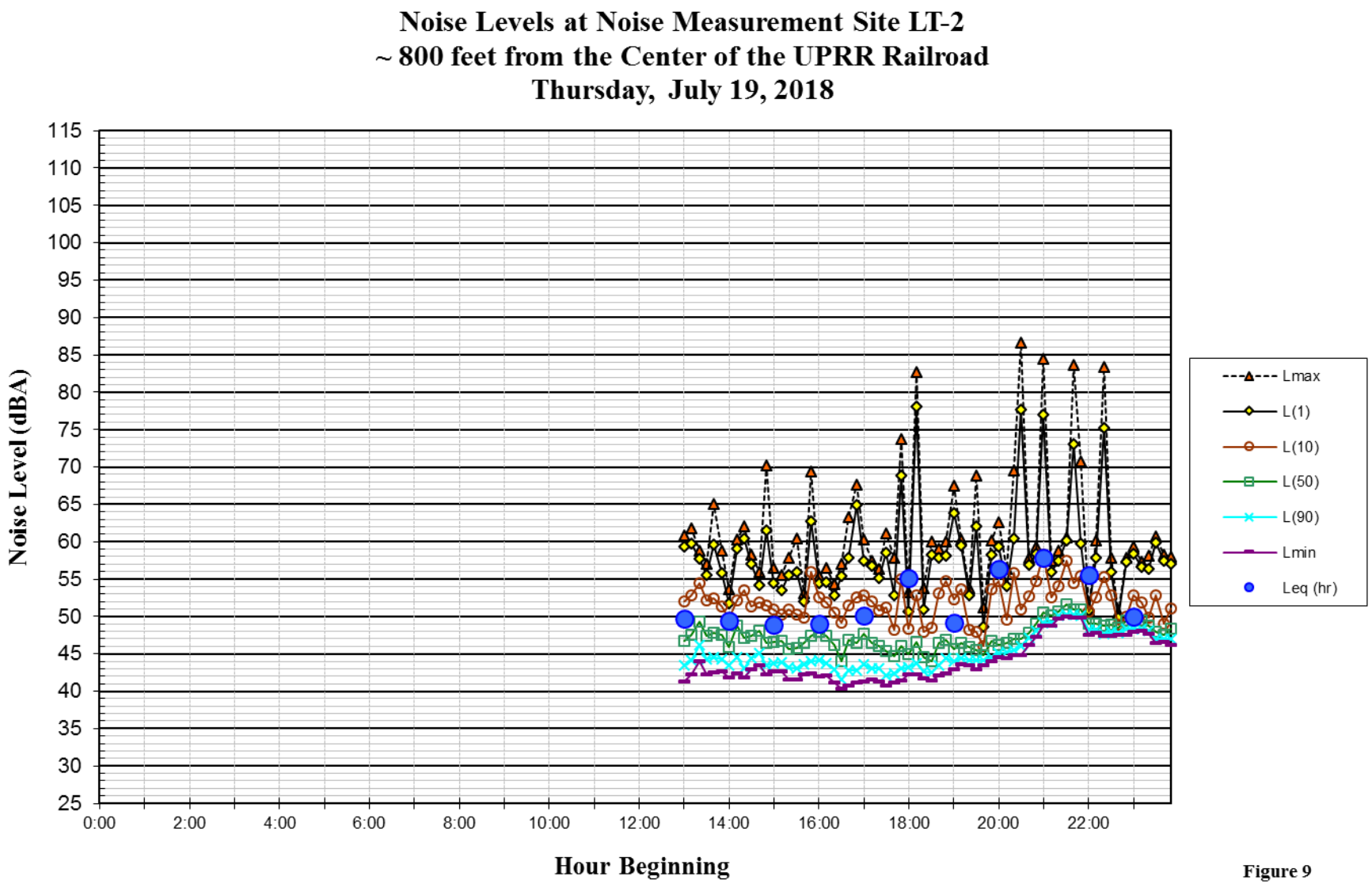
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Thursday, July 19, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 9

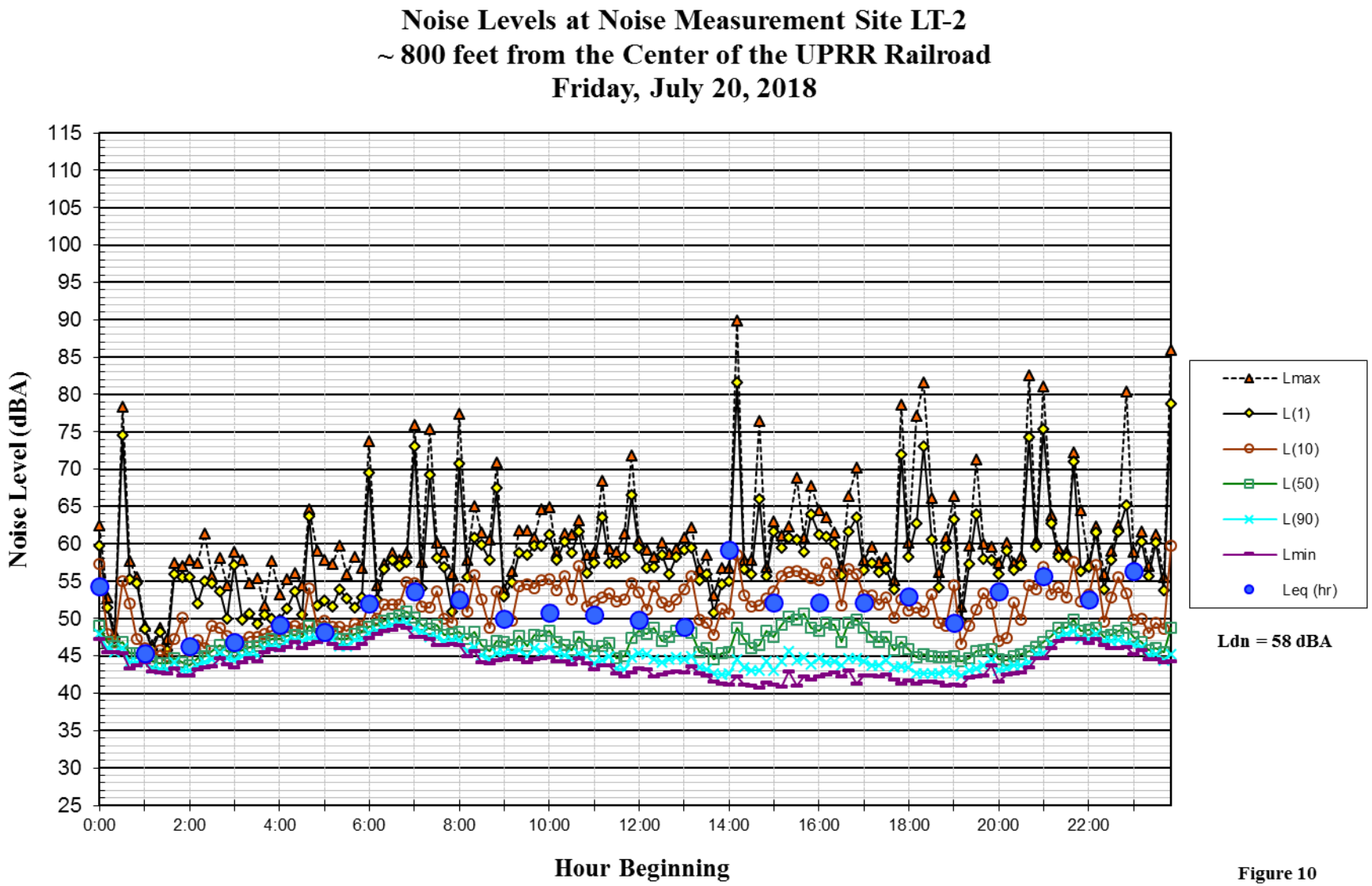
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Friday, July 20, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 58 dBA

Figure 10

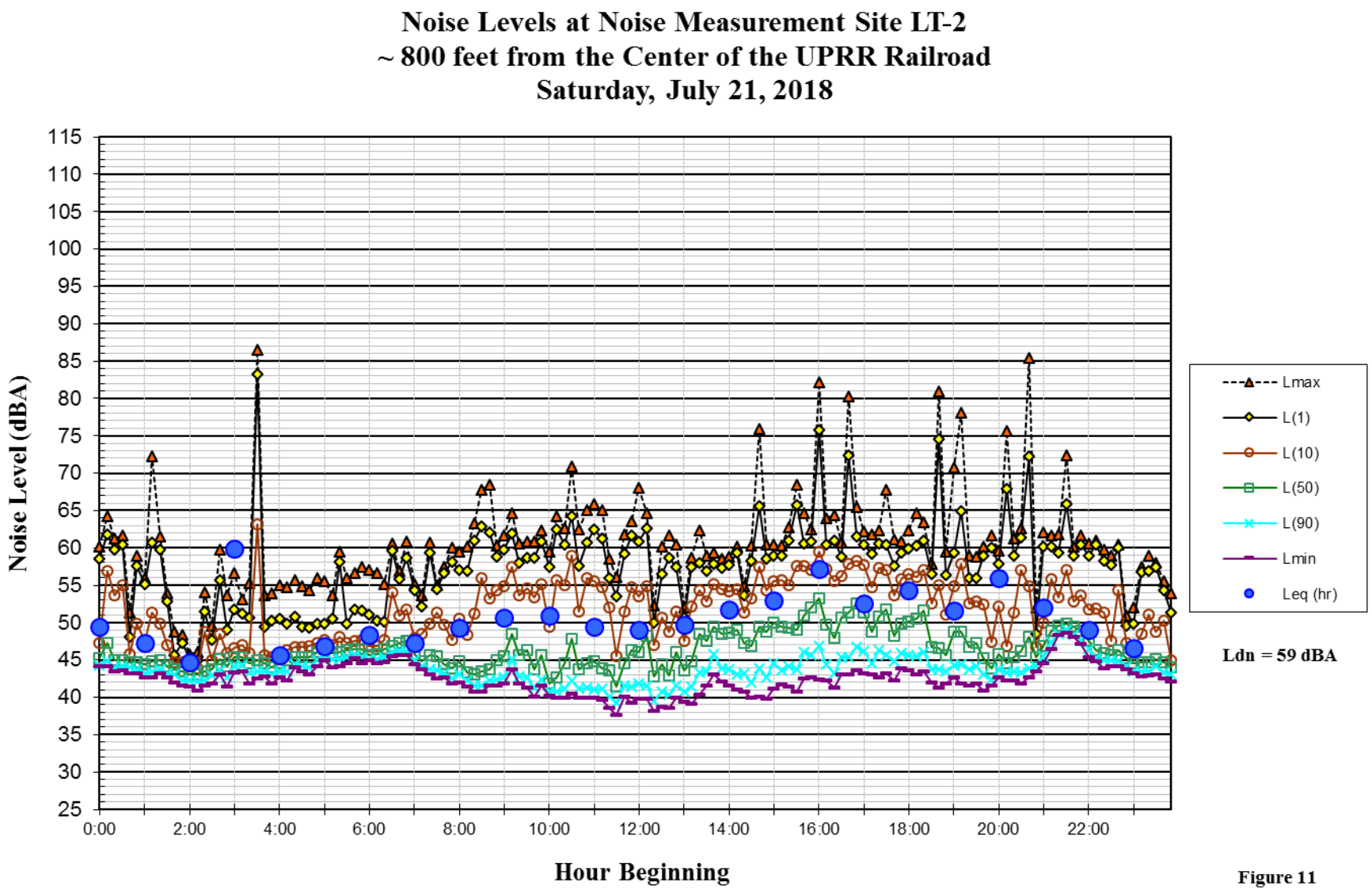
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Saturday, July 21, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 59 dBA

Figure 11

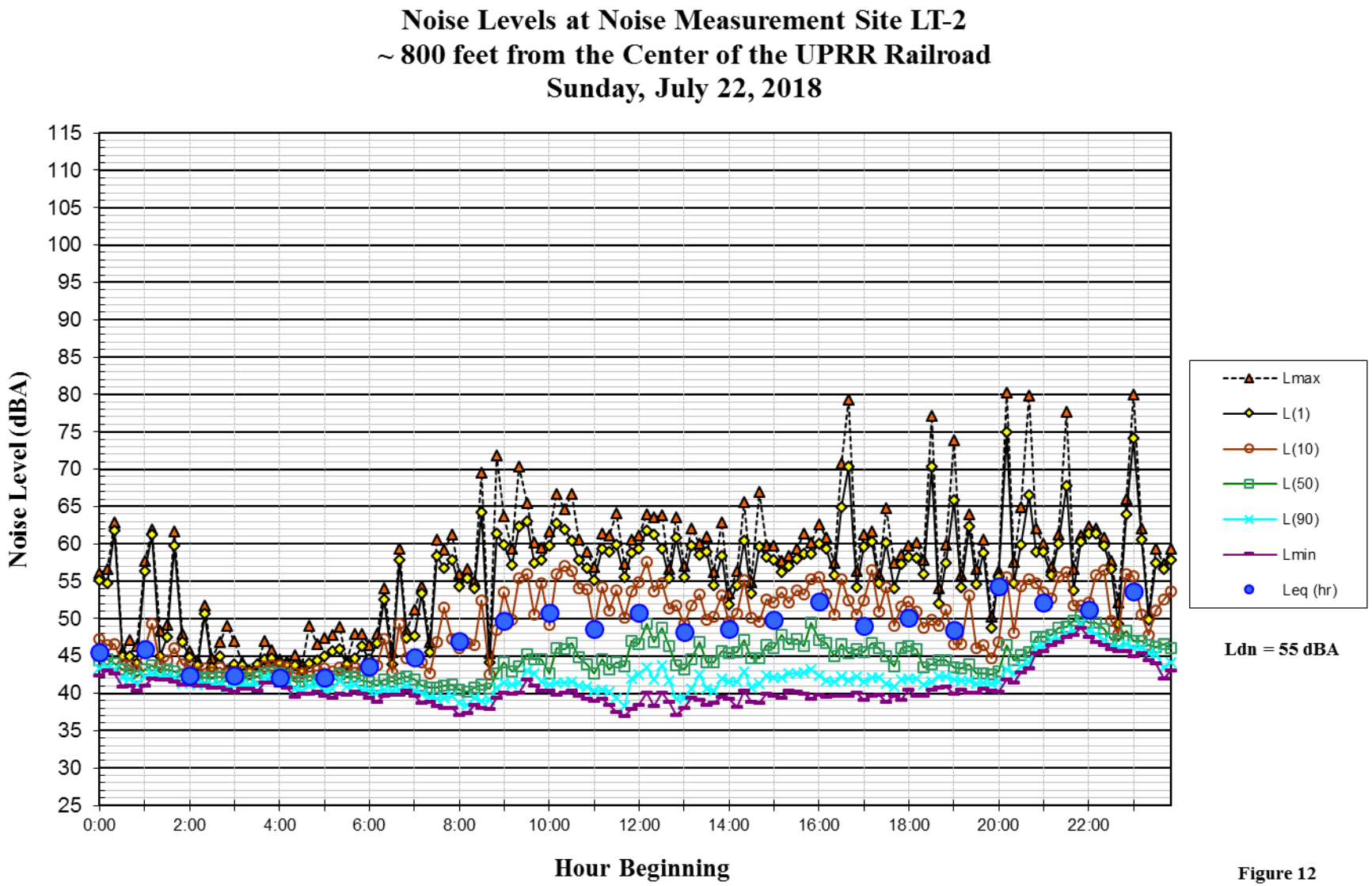
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Sunday, July 22, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 55 dBA

Figure 12

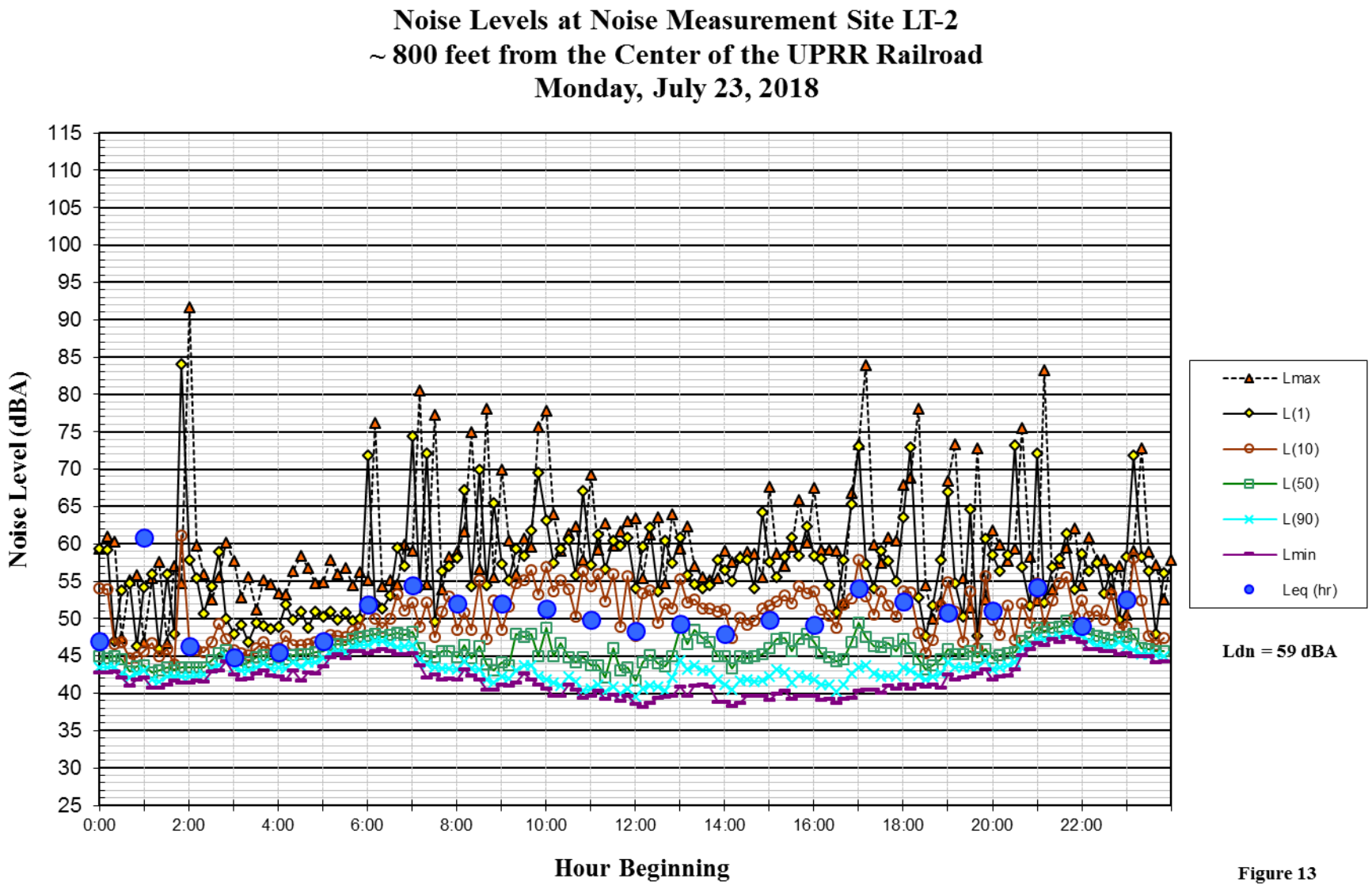
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Monday, July 23, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 59 dBA

Figure 13

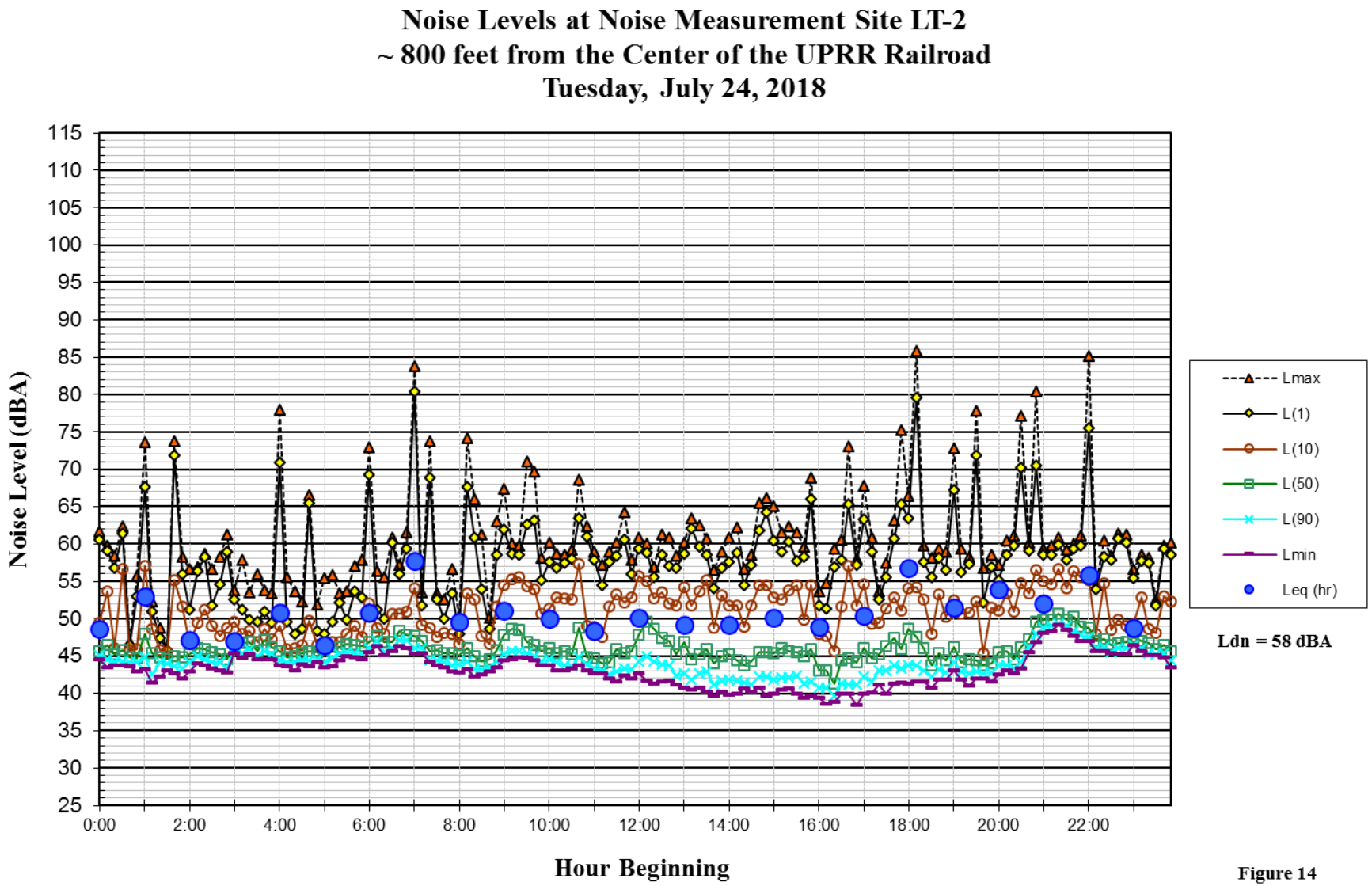
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Tuesday, July 24, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
Ldn = 58 dBA

Figure 14

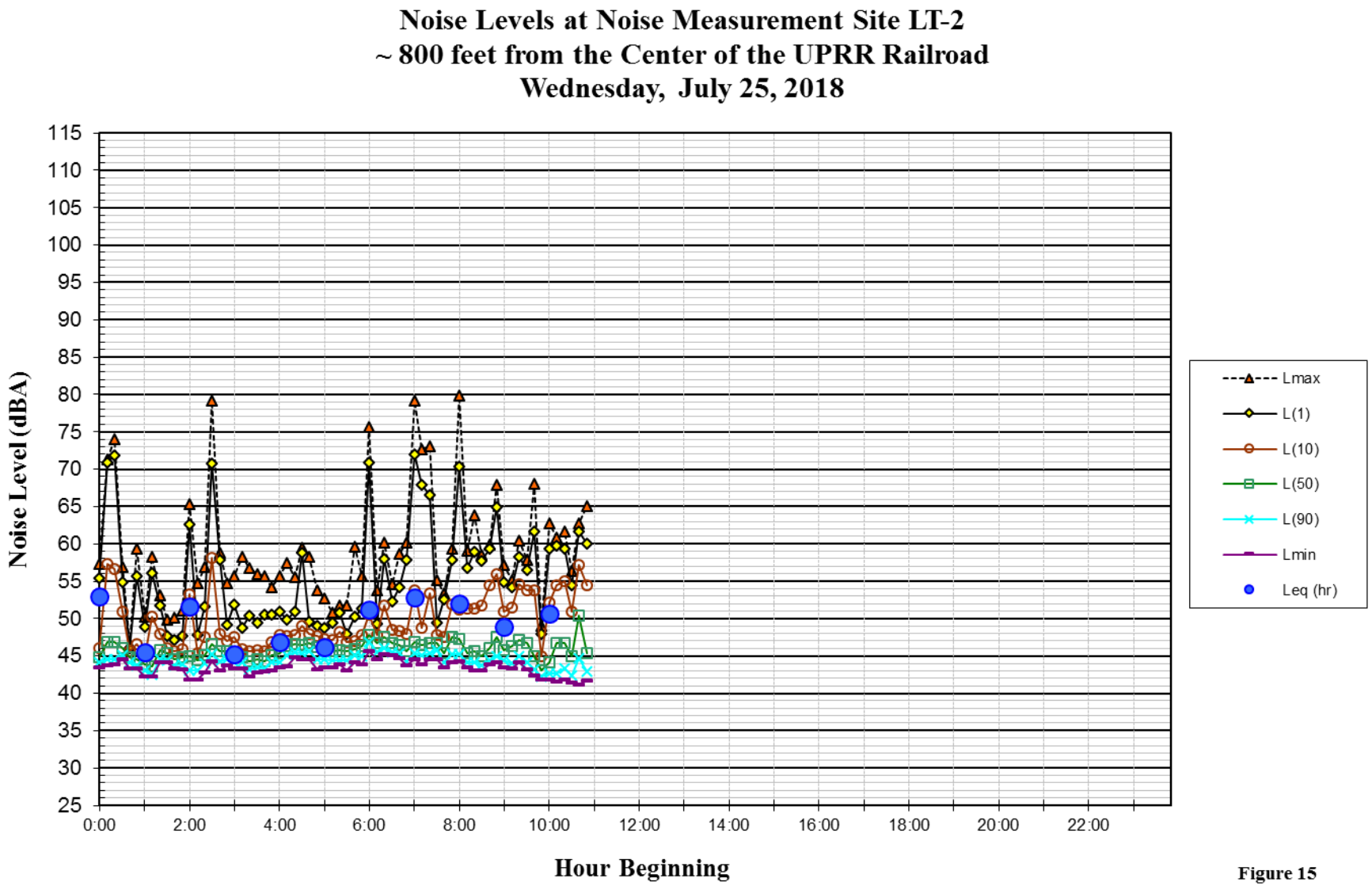
Noise Levels at Noise Measurement Site LT-2
~ 800 feet from the Center of the UPRR Railroad
Wednesday, July 25, 2018
Noise Level (dBA)
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 15

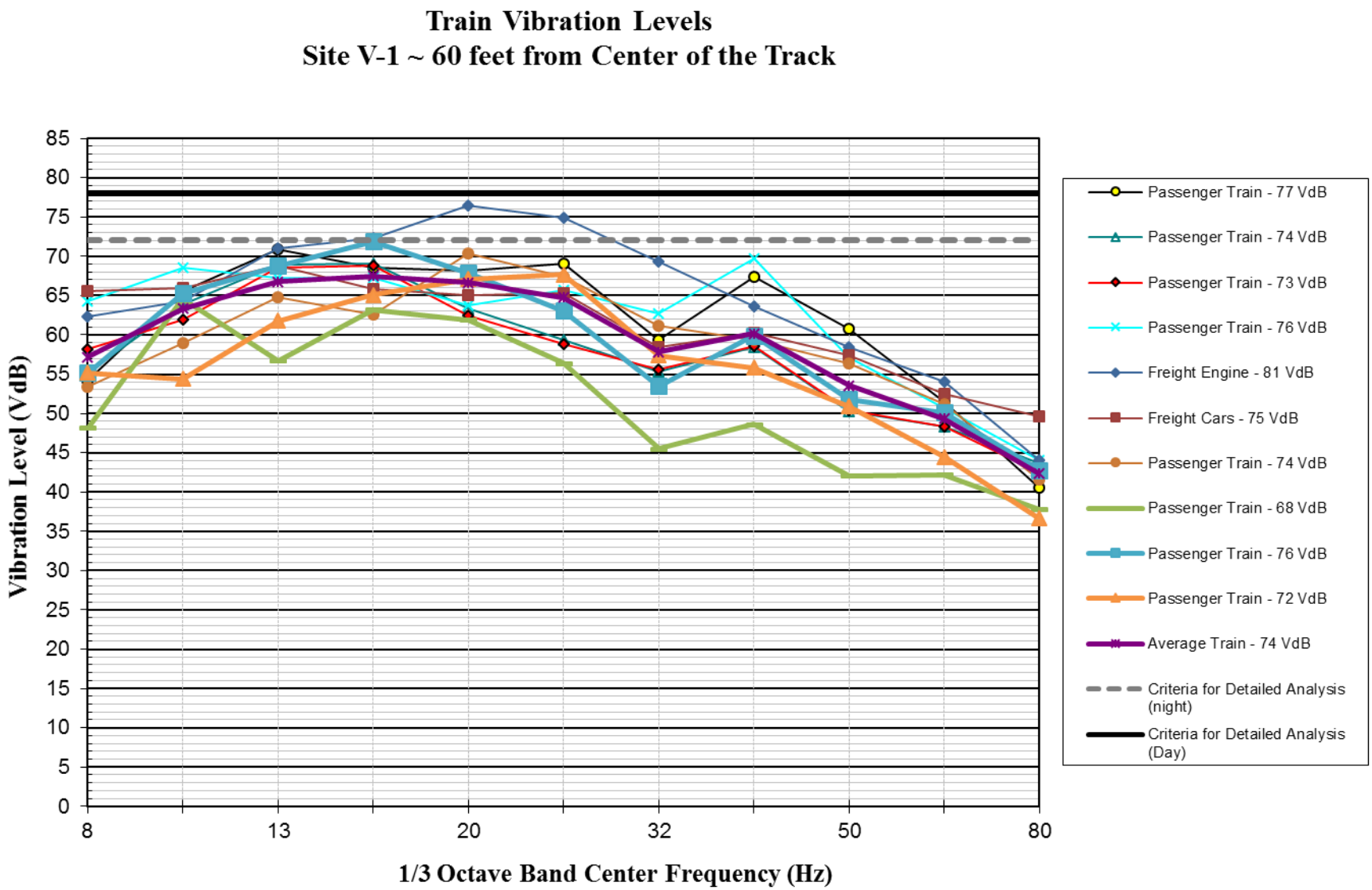
Train Vibration Levels
Site V-1 ~ 60 feet from Center of the Track
Vibration Level (VdB)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
8
13
20
32
50
80
1/3 Octave Band Center Frequency (Hz)
Passenger Train - 77 VdB
Passenger Train - 74 VdB
Passenger Train - 73 VdB
Passenger Train - 76 VdB
Freight Engine - 81 VdB
Freight Cars - 75 VdB
Passenger Train - 74 VdB
Passenger Train - 68 VdB
Passenger Train - 76 VdB
Passenger Train - 72 VdB
Average Train - 74 VdB
Criteria for Detailed Analysis (night)
Criteria for Detailed Analysis (Day)

Figure 16

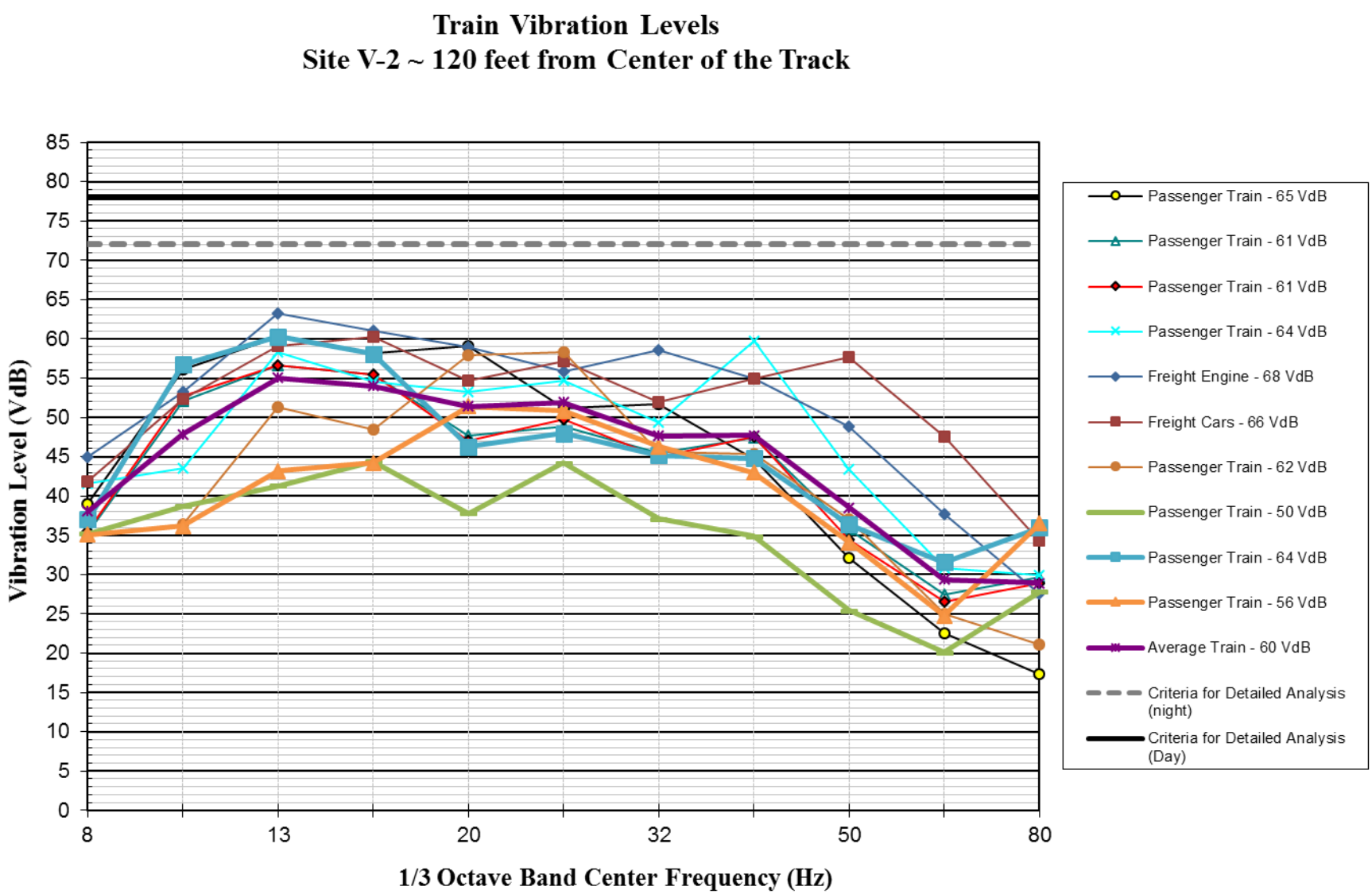
Train Vibration Levels
Site V-2 ~ 120 feet from Center of the Track
Vibration Level (VdB)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
8
13
20
32
50
80
1/3 Octave Band Center Frequency (Hz)
Passenger Train - 65 VdB
Passenger Train - 61 VdB
Passenger Train - 61 VdB
Passenger Train - 64 VdB
Freight Engine - 68 VdB
Freight Cars - 66 VdB
Passenger Train - 62 VdB
Passenger Train - 50 VdB
Passenger Train - 64 VdB
Passenger Train - 56 VdB
Average Train - 60 VdB
Criteria for Detailed Analysis (night)
Criteria for Detailed Analysis (Day)

Figure 17