April 1, 2022

Viewpoint Development
500 Terry Street
San Francisco, California 94158

Attention: Chris Livoni | Founding Partner

Subject: **4620 Pacific Highway**
San Diego, CA
Exterior Noise and Exterior Façade Acoustical Analysis
Veneklasen Project No. 8065-001

Dear Chris:

Veneklasen Associates, Inc. (Veneklasen) has completed our review of the 4620 Pacific Highway mixed-use residential project located in San Diego, California. This report predicts the exterior noise level at the site using measurements and computer modeling. Using this information, interior noise levels were calculated based on the exterior noise exposure and the construction types proposed. From this, the exterior façade design was determined. This report represents the results of our findings.

1.0 INTRODUCTION

This study was conducted to determine the impact of the exterior noise sources on the 4620 Pacific Highway mixed-use project in San Diego, California. Veneklasen's scope of work included calculating the exterior noise levels impacting the site and determining the method, if any, required to reduce the interior and exterior sound levels to meet the applicable code requirements of the State of California and the City of San Diego.

The project consists of 239-unit 8-story apartment building with amenities such as parking, lobby, leasing office, gym, pool and jacuzzi, amenity deck and common spaces. The project is bounded by San Diego Fwy (I-5) to the west, San Diego Fwy off ramps to the north, Pacific Hwy to the east, and Taylor St to the south.

2.0 NOISE CRITERIA

CNEL (Community Noise Equivalent Level) is the 24-hour equivalent (average) sound pressure level in which the evening (7 pm–10 pm) and nighttime (10 pm – 7 am) noise is weighted by adding 5 and 10 dB, respectively, to the hourly level. LDN (Day-Night Level) is the 24-hour equivalent (average) sound pressure level in which the nighttime (10 pm – 7 am) noise is weighted by adding 10 dB to the hourly level. Since these are a 24-hour metric, short-duration noise events (truck pass-by's, buses, trains, etc.) are not as prominent in the analysis.

Leq (equivalent continuous sound level) is defined as the steady sound pressure level which, over a given period of time, has the same total energy as the actual fluctuating noise.

2.1 Interior Noise Levels – Residential, State of California

The State of California Building Code (Section 1207, "Sound Transmission") and the City of San Diego Noise Element state that interior CNEL values for residential land uses are not to exceed 45 CNEL in any habitable room.

If the windows must be closed to meet an interior level of 45 CNEL, then a mechanical ventilating system or other means of natural ventilation shall be provided.

Although not a regulatory requirement, Veneklasen suggests that the maximum noise level from short-duration noise events during the night not exceed 55 dBA. This criterion is based on sleep disturbance research and our experience with similar projects.

2.2 CALGreen – Non-residential

Section 5.507.4.2 of the 2016 California Green Building Code stipulates that for buildings exposed to a noise level of 65 dB or more when measured as a 1-hour Equivalent Sound Level (Leq), the building façade, including walls, windows, and roofs, shall provide enough sound insulation so that the interior sound level from exterior sources does not exceed 50 dBA during any hour of operation. This applies to non-residential spaces such as retail space, leasing, and amenities.

3.0 EXTERIOR NOISE ENVIRONMENT

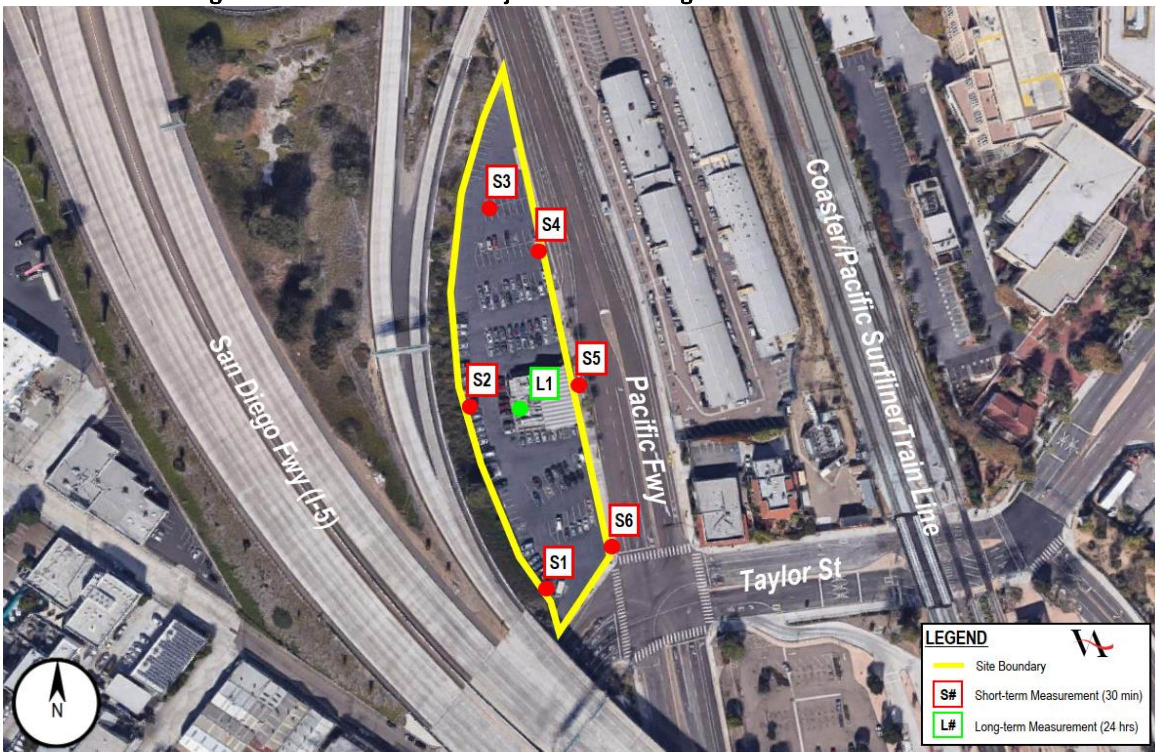
3.1 Noise Measurements

Traffic on San Diego Fwy, Pacific Hwy, Taylor St and Coaster/Pacific Surfliner Train Lines were the primary source of noise affecting the site. Veneklasen visited the site on March 29, 2022, and placed meters on the roof of the existing building located at 4620 Pacific Hwy to capture the hourly sound levels on the site for a 24-hour period. Veneklasen also completed short-term noise measurements at the project site. Table 1 and Figure 1 show the location and summary of the noise measurements. Aircraft and rail sources were also evaluated and documented below.

Table 1 – Measured Sound Levels

Location	Loudest Daytime Hour, Leq dBA	Short-Duration Train Event Noise Level, LAFMax dBA	CNEL dBA	LAeq
L1	73	88	76	-
S1	-	-	-	68
S2	-	-	-	67
S3	-	-	-	67
S4	-	-	-	67
S5	-	-	-	67
S6	-	-	-	70

Figure 1 – Aerial View of Project Site Showing Measurement Locations



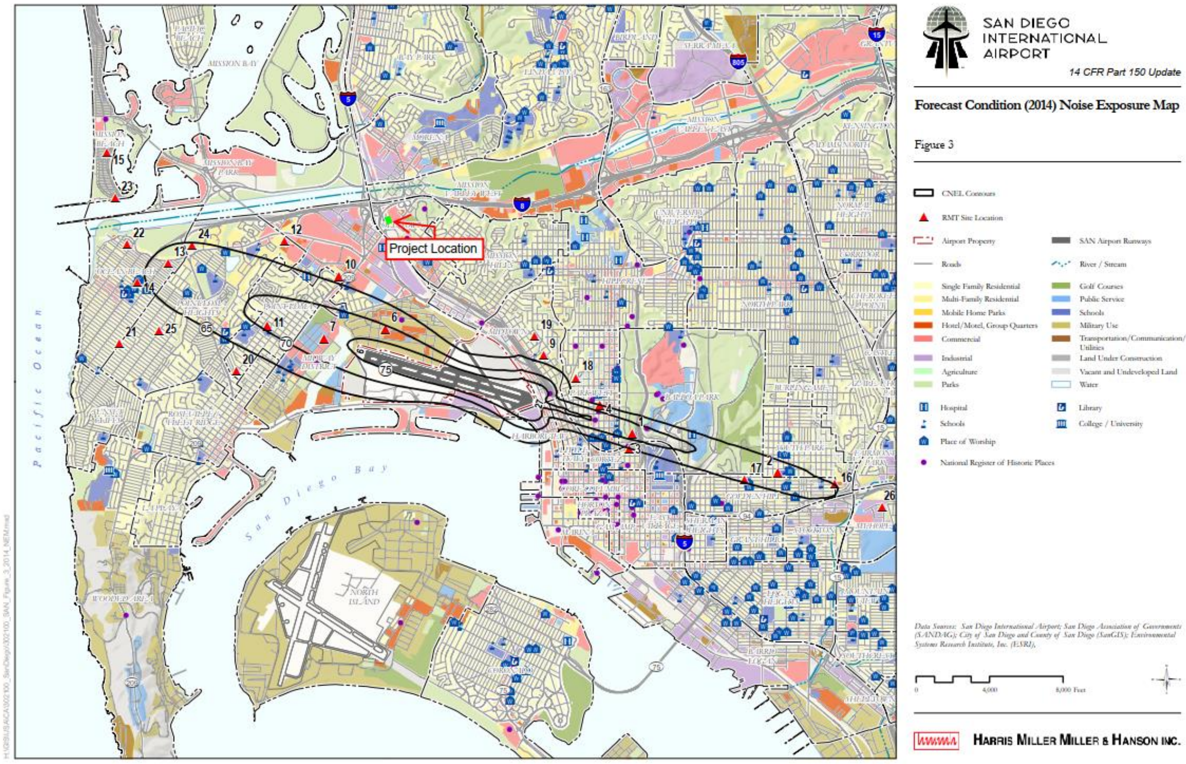
3.2 Coaster and Pacific Surfliner Train Lines

The Coaster and Pacific Surfliner Train Lines run at 340 feet to the east of the project site. The schedule indicates that the trains run every 10-15 minutes from approximately 5am-3am. The measured sound level of the train horn noise event during the night at L1 was approximately 86-88 dBA. Veneklasen utilized 87 dBA as the short-term noise event level for Zone A.

3.3 San Diego Airport

The San Diego airport is approximately 1.3 miles away from the proposed project site. Figure 2 below shows the latest noise contour map for airport activity. The proposed project site is not within any of the published noise contour lines and therefore aircraft noise does not significantly impact the site.

Figure 2 – San Diego Airport Noise Contour Map



3.4 Computer Modeling

Veneklasen has utilized the Traffic Noise Model computer software program developed by the FHWA (Federal Highway Administration TNM 2.5) in order to predict vehicular noise levels at various locations. The primary purpose of the computer model was to determine how the noise environment will change due to traffic and site changes.

Traffic counts for local streets were obtained from the Caltrans Traffic Volumes web page.

3.5 Overall Exterior Exposure

Based on the computer model and measurements, Veneklasen calculated the noise level at different locations across the project site. To simplify the presentation of the exterior noise levels, Veneklasen has separated the site into locations based on the sound exposure and required mitigation. The predicted sound levels at each zone, shown in Figure 3 and Figure 4, are listed in Table 2 below.

Table 2 – Exterior Noise Levels

Location	Floor	Exterior Noise Level, CNEL/LDN	Short-Duration Train Event Noise Level, LAFMax dBA
Zone A	All	71 – 75	87
Zone B	All	66 – 68	87

Figure 3 – Noise Zones, 1st and 2nd Floor

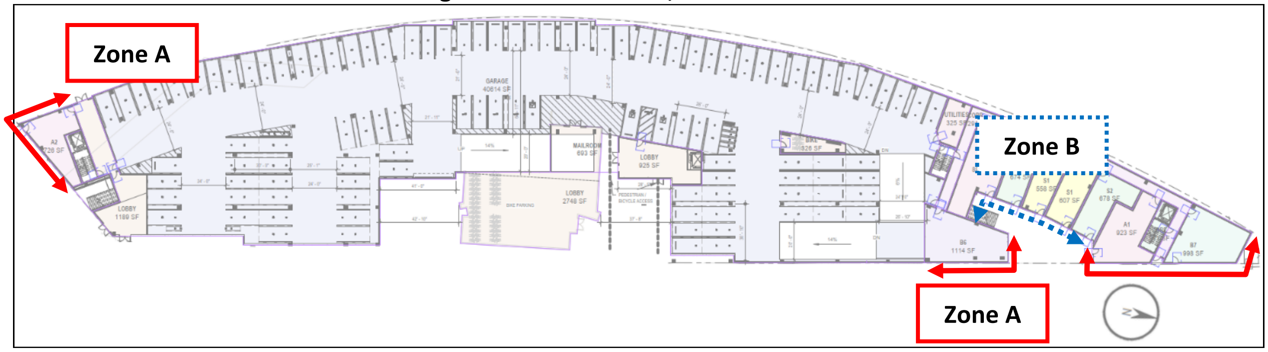
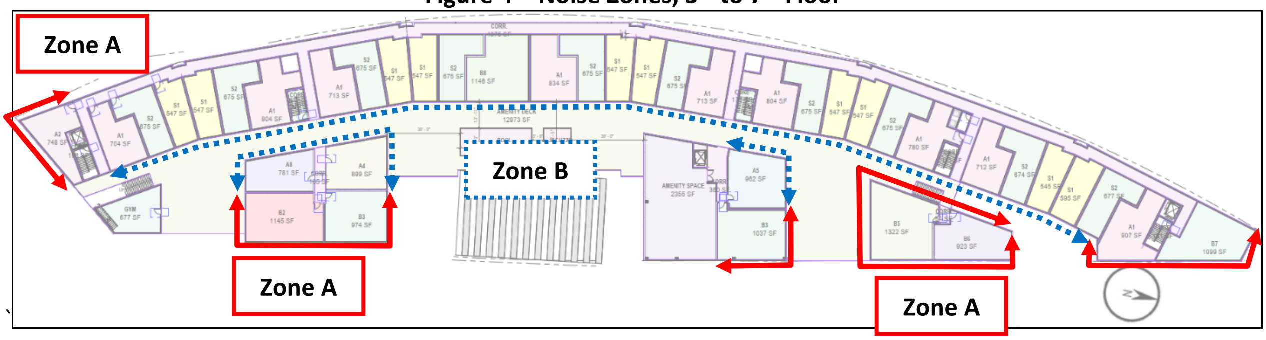


Figure 4 – Noise Zones, 3rd to 7th Floor



Plans for the residences of the building as shown in Figure 4 show a single loaded interior corridor.

4.0 INTERIOR NOISE CALCULATION

4.1 Exterior Facade Construction

Exterior wall assembly has not designed at this stage. As such, Veneklasen has anticipated that the exterior wall will be of standard construction and consist of stucco over sheathing on woods/metal studs with a single layer of gypsum board on the interior and batt insulation in the cavity.

Veneklasen's calculations included the roof path, but this was insignificant in the interior noise level calculated.

Veneklasen utilized the glazing ratings (glass, frame and seals) shown in Appendix I. Appendix I shall be the acoustical specification for the exterior windows and doors.

4.2 Interior Average Noise Level (CNEL/LDN) – Residential

Veneklasen calculated the interior level within the residential units given the measured noise environment and the exterior facade construction described above. Table 3 shows the predicted interior CNEL noise levels based on the windows and doors with STC ratings as shown and glazing construction as described in Appendix I.

Table 3 – Calculated Interior CNEL/LDN Noise Levels

Location	Floor	Exterior Noise Level, CNEL	Window/ Door Rating	Interior Noise Level, CNEL/LDN
Zone A	All	71 – 75	STC 34	45
Zone B	All	66 – 68	STC 30	≤ 45
Remaining Areas	All	-	STC 34	<45

4.3 Interior Short-duration Noise Event – Veneklasen Recommended Glazing (Optional)

In a similar manner Veneklasen calculated the interior noise levels from the single-event noise sources such as trains and heavy truck pass-by's. As described in Section 2.1, Veneklasen's recommended interior nighttime noise level criterion is 55 dBA. Table 4 shows Veneklasen's recommended mitigation to reduce the interior noise levels due to short-duration noise events.

Table 4 – Calculated Interior Short-duration Event Noise Levels

Location	Floor	Short-Duration Train Event Noise Level, LAFMax dBA	Glazing Rating	Interior Level, dBA
Zone A	All	87	STC 37	55
Zone B	All	87	STC 37	≤ 55

4.4 Mechanical Ventilation - Residential

Because the windows and doors must be kept closed to meet the noise requirements, mechanical or other means of ventilation may be required for all units in Zone A and B. The ventilation system shall not compromise the sound insulation capability of the exterior facade assembly.

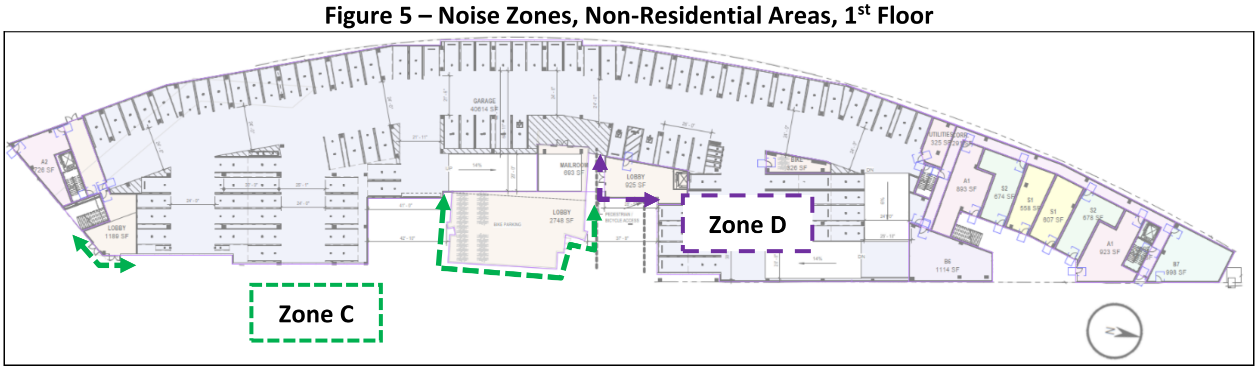
4.5 CALGreen – Non-Residential

In a similar manner, Veneklasen calculated the noise level within non-residential spaces. CALGreen is based on the loudest hourly Leq. Veneklasen utilized a statistical methodology to determine this level from the measurements[1]. The results are shown in Table 5 below.

Table 5 – Calculated Interior Average Noise Levels at Non-Residential Areas

Location	Floor	Exterior Leq, dBA Loudest hour	Minimum Glazing	Interior Leq
Zone C	1, 2, 3	73	STC 33	≤ 50
Zone D	1, 2	70	STC 30	< 50

Figure 5 – Noise Zones, Non-Residential Areas, 1st Floor



[1] LoVerde, John; Dong, Wayland; Rawlings, Samantha. "Noise Prediction of Traffic on Freeways and Arterials from Measured Data." Noise-Con 2014. Fort Lauderdale, Florida.

Figure 6 – Noise Zones, Non-Residential Areas, 2nd Floor

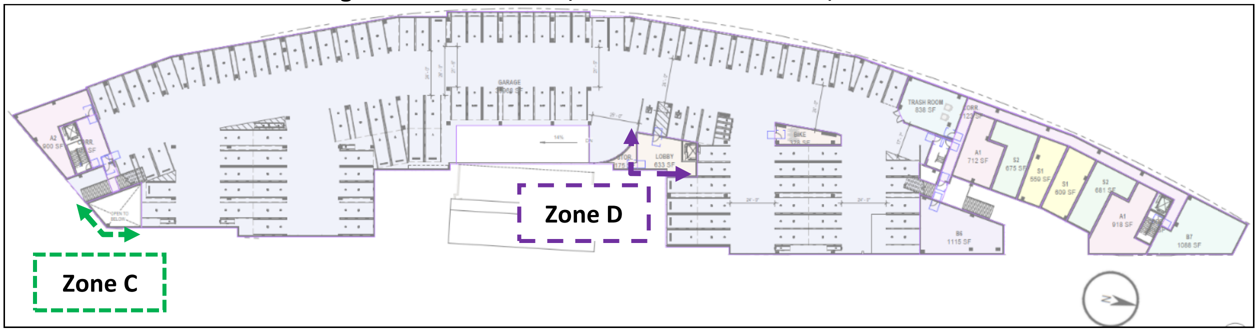
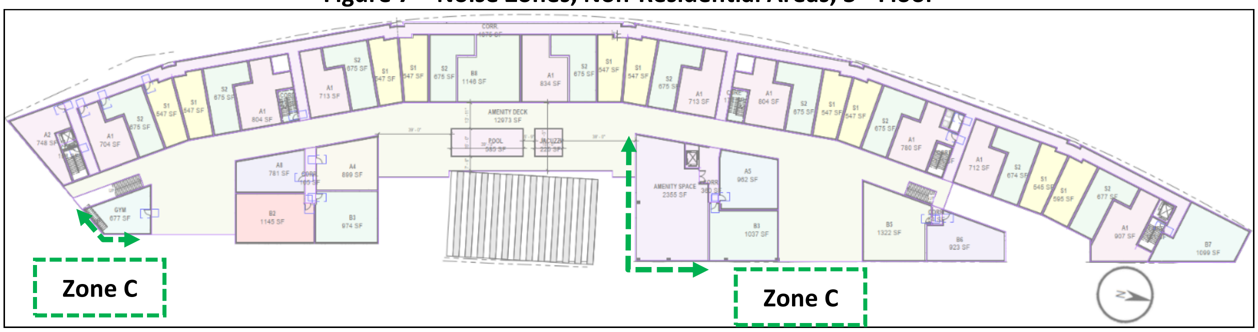


Figure 7 – Noise Zones, Non-Residential Areas, 3rd Floor



5.0 SUMMARY

The following summarizes the acoustical items required to satisfy the noise criteria as described in this report.

Residential

- Exterior wall assembly is acceptable as described in Section 4.1.
- The roof assembly was included in our calculations and is not a significant path of sound and can remain as designed.
- Windows and glass doors with minimum STC ratings as shown in Table 3 with Transmission Loss values and STC ratings specified in Appendix I are required. Appendix I shall be the acoustical specification for the exterior windows and doors.
- OPTIONAL. Table 4 can be adopted for additional protection not required by Code, but improving comfort. If adopted, Transmission Loss values and STC ratings specified in Appendix I are required. Appendix I shall be the acoustical specification for the exterior windows and doors.
- Residential mechanical ventilation, or other means of natural ventilation, may be required for all units in Zone A and B.

Non-Residential

- At retail, amenity, and other non-residential spaces, windows and glass doors as shown in Table 5 with Transmission Loss values and STC ratings specified in Appendix I are required to satisfy CALGreen. Appendix I shall be the acoustical specification for the exterior windows and doors.

Various noise mitigation methods may be utilized to satisfy the noise criteria described in this report. Alteration of mitigation methods that deviate from requirements should be reviewed by the acoustical consultant.

If you have any questions or comments regarding this report, please do not hesitate to contact us.

Sincerely,
Veneklasen Associates, Inc.

John LoVerde, *FASA*
Principal

Elias Montoya
Associate

APPENDIX I – GLAZING REQUIREMENTS

In order to meet the predicted interior noise levels described in Section 4.2, the glazing shall meet the following requirements:

Table 6 – Acoustical Glazing Requirements: Minimum Octave Band Transmission Loss and STC Rating

Nominal Thickness	Minimum Transmission Loss Octave Band Center Frequency (Hz)						Min. STC Rating
	125	250	500	1000	2000	4000	
1" dual	21	18	27	34	37	32	**30**
1" dual	22	22	31	37	38	37	**34**
1" dual	24	27	35	39	40	42	**37**

The transmission loss values in the table above can likely be met with the following glazing assemblies:

1. STC 30: 1/8" monolithic – 3/4" airspace – 1/8" monolithic
2. STC 34: 3/16" monolithic – 11/16" airspace – 1/8" monolithic
3. STC 37: 7/16" laminated – 3/8" airspace – 3/16" monolithic

An assembly's frame and seals may limit the performance of the overall system. Therefore, the window and door systems selected for the project shall not be selected on the basis of the STC rating of the glass alone, but on the entire assembly including frame and seals. Additionally, the assemblies given above are provided as a basis of design, but regardless of construction, the octave band Transmission Loss (TL) and STC value of the system selected must meet the minimum values in Table 6 above.

Independent laboratory acoustical test reports should be submitted for review by the design team to ensure compliance with glazing acoustical performance requirements. Laboratories shall be accredited by the Department of Commerce National Voluntary Laboratory Accreditation Program (NVLAP). Labs shall be pre-approved by Veneklasen Associates. Tests shall be required to be performed in North America. Lab tests and lab reports shall be in compliance with ASTM standard E90 and be no more than 10 years old from the date of submission for this project.

If test reports are not available for a proposed assembly, the assembly, including frame, seals and hardware, shall be tested at an independent, pre-approved, NVLAP accredited laboratory to demonstrate compliance with the requirements of this report. Veneklasen shall be invited to witness acoustical testing completed and reserves the right to exclude test reports from laboratories that are not pre-approved by Veneklasen.

APPENDIX II – MEASURED HOURLY NOISE LEVELS

Location	Start Time	Duration	LAeq, dBA	LAFmax, dBA
L1	10am	1:00:00	73	88 (train horn events)
	11am	1:00:00	73	
	12pm	1:00:00	73	
	1pm	1:00:00	73	
	2pm	1:00:00	73	
	3pm	1:00:00	73	
	4pm	1:00:00	73	
	5pm	1:00:00	73	
	6pm	1:00:00	72	
	7pm	1:00:00	72	
	8pm	1:00:00	70	
	9pm	1:00:00	70	
	10pm	1:00:00	69	
	11pm	1:00:00	68	
	12am	1:00:00	67	
	1am	1:00:00	64	
	2am	1:00:00	62	
	3am	1:00:00	63	
	4am	1:00:00	66	
	5am	1:00:00	69	
	6am	1:00:00	72	
	7am	1:00:00	73	
	8am	1:00:00	73	
	9am	1:00:00	72	
S1	11:10	0:10:00	68	-
S2	11:25	0:10:00	67	-
S3	11:36	0:07:00	67	-
S4	11:43	0:06:00	67	-
S5	11:49	0:10:00	67	-
S6	12:05	0:10:00	70	-

APPENDIX III GLOSSARY OF ACOUSTICAL TERMS

Term	Definition
Absorption	A property of material referring to how much sound it absorbs (as opposed to reflecting). In the context of this report, absorption refers to the total quantity of absorption within the receiving space. Absorption is measure in sabins.
A-weighting (dBA)	The sound pressure level in decibels as measured in an A-weighting filter network. The A-weighting de-emphasizes the low 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.
Decibel (dB)	A unit describing the amplitude of sound equivalent to 20 times the logarithm, to the base 10, of the ratio of the pressure of the sound to the reference pressure of 20 μPa. Used to quantify sound pressure levels.
Equivalent Sound Level (Leq)	The time-weighted average noise level during the stated measurement period.
Sabin	A unit used to describe absorption within a space. One sabin is equal to the absorption of a one-square-foot open window.
Sound Pressure Level (SPL)	The amplitude of sound when compared to the reference sound pressure level of 20 μPa. SPL is measured in dB.
Sound Transmission Class (STC)	A single-number metric used to describe the transmission loss performance of a material or assembly across the frequency spectrum. It is intended for use primarily when speech is the noise source.
Transmission Loss (TL)	A measure of the reduction in sound level as a sound wave passes through a material. The higher the transmission loss, the better the material's sound insulating properties.

APPENDIX IV – ACOUSTICAL CALCULATION METHODS

Decibel Addition

Decibels are based on a logarithmic scale; defined as the logarithmic ratio between a measured sound pressure level and a reference sound pressure level. When decibels are added, they are not combined arithmetically, but logarithmically. Decibels are added according to the following equation.

$$SPL_{tot} = 10log\left(10^{\left(SPL_1/10\right)}\right) + 10log\left(10^{\left(SPL_2/10\right)}\right)$$

Where:
SPL_{tot} = Total Sound Pressure Level (dB or dBA)
SPL_1, SPL_2 = Sound Pressure Level 1, 2 (dB or dBA)

A-Weighting

A-weighting a spectrum is completed by applying standardized weighting factors to a frequency spectrum, either in octave bands or third-octave bands. These resultant A-weighted levels are summed using decibel addition to generate the overall A-weighted level, noted as dBA. In a report, spectral data is typically presented un-weighted, and the overall level is presented with A-weighting.

The octave band A-weighting correction factors are shown in the table below:

	Octave Band Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
A-weighting Correction Factor (dB)	-26	-16	-9	-3	0	+1	+1	-1

Acoustical Shielding

The presence of adjacent buildings or facades, changes in terrain, parapets, and other similar barriers provide acoustical shielding, reducing the sound level incident on the exterior facades. Common locations where acoustical shielding occurs include, but are not limited to, the roof, the back, and sides of the building that are not directly facing the noise source.

Acoustical shielding due to building geometry can be separated into two categories: reduction due to reduced area of exposure (side of a building), and shielding from barriers (such as a parapet or sound wall).

Reduction as a result of reduced area of exposure is calculated according to the following equation:

$$\Delta SPL = 10\log_{10}\left(\frac{\theta_{exp}}{180}\right)$$

Where:
ΔSPL = Change in Sound Pressure Level (dB)
θ_{exp} = Angle of exposure (degrees)

Acoustical Attenuation due to Distance

Sound pressure level reduction due to distance is calculated according to the following equation:

$$SPL_2 = SPL_1 + C_S \log\left(\frac{r_1}{r_2}\right)$$

Where:
SPL_1 = Sound Pressure Level at Location 1 (dB or dBA)
SPL_2 = Sound Pressure Level at Location 2 (dB or dBA)
C_S = Source Coefficient; 20 for point source, 10 for a line source
r_1 = Location 1 distance from source (ft.)
r_2 = Location 2 distance from source (ft.)

In some situations, the C_S value is between 10 and 20; selection of this number is an engineering judgment based on the relationship between the source and receiver as well as the type of source.

Interior Noise Calculation

The interior noise calculation takes into account the exterior noise level, the transmission loss of the glazing (including glass, frame, and seals), wall, and roof/ceiling systems, the finishes within the space, and noise exposure due to building geometry and acoustic shielding. The interior sound level is calculated using the equation:

$$SPL_I = SPL_E + 10\, log_{10}(A) - 10 log_{10}(R) - TL + 6$$

Where:
SPL_I = the Interior Sound Pressure Level (dB or dBA)
SPL_E = Exterior Sound Pressure Level (dB or dBA)
A = Surface Area exposed to Exterior Noise (sq.ft.)
R = Room Absorption Coefficient (sabins)
TL = Sound Transmission Loss of Exterior Façade Assembly (dB)

This calculation is performed for each exposed façade individually. The total interior sound level is found by using decibel addition to sum the sound level from all exposed facades.