Appendix E
Supporting Noise Information

Noise Report

Veneklasen Associates
Consultants in Acoustics | Noise | Vibration | AV | IT

June 16, 2021

Carmel Partners
1000 Sansome Street, First Floor
San Francisco, California 94111

Attention: Greg Pasquali | Vice President, Development

Subject: **1766 El Camino**
Burlingame, California
Exterior Noise, Vibration, and Exterior Façade Acoustical Analysis
Veneklasen Project No. 5054-022

Dear Greg,

Veneklasen Associates, Inc. (Veneklasen) has completed our review of the 1766 El Camino project located in Burlingame, California. This report predicts the exterior noise level and vibration at the site using measurements. 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 1766 El Camino project in Burlingame, 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 Burlingame.

The project consists of an 8-level mixed-use development with ground-level amenities and two levels of subterranean parking. The project is bounded by Trousdale Drive to the west, California Drive and the Caltrain line to the north, El Camino Real to the south, and existing commercial uses to the north and east.

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. Since this is 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

The State of California Building Code (Section 1206, "Sound Transmission") and the City of Burlingame 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 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.

2.3 Vibration Guidelines

There are no regulatory requirements for vibration levels. For train sources, the typical design guidelines are taken from the "Transit Noise and Vibration Impact Assessment Manual" from the Federal Transit Administration (FTA), U.S. Department of Transportation, dated September 2018. Table 6-3 from this document provides transit vibration level criteria for human annoyance based on the receiver type and frequency of events. Table 1 below is a summary of these guidelines.

Table 1 – FTA Manual Ground-Borne Vibration (GBV) Impact Criteria

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch/sec)		
	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB	65 VdB	65 VdB
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primary daytime use.	75 VdB	78 VdB	83 VdB

Note that "Frequent Events" is defined as more than 70 events per day, "Occasional Events" is defined as between 30 and 70 events per day, and "Infrequent Events" is defined as less than 30 events per day according to the FTA manual.

3.0 EXTERIOR NOISE ENVIRONMENT

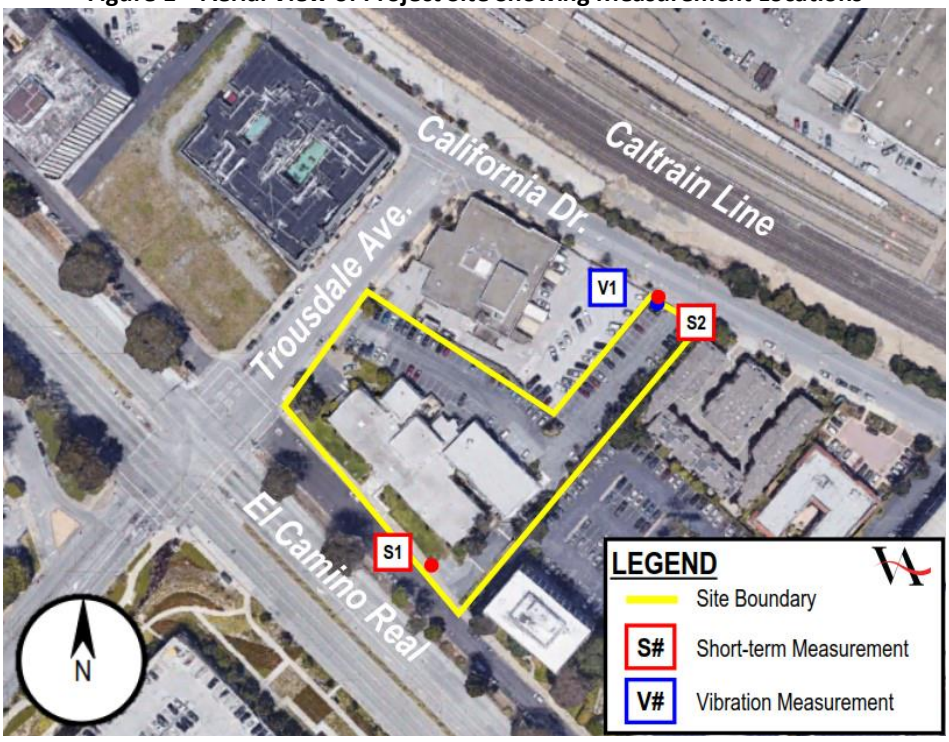
3.1 Noise Measurements

Traffic on El Camino Real and California Drive is the primary source of noise affecting the site. Veneklasen visited the site on Friday, June 11, 2021 and made short-term noise and vibration measurements. Table 2 and Figure 1 show the location and summary of the noise measurements. No aircraft noise significantly affect the site.

Table 2 – Measured Sound Levels

Location	Leq dBA	Train Event, dBA	Vibration Event, VdB
S1	60	—	—
S2	65	78-83	76

Figure 1 – Aerial View of Project Site Showing Measurement Locations



3.2 Caltrain Line

The Caltrain runs along California Drive to the north of the project site. The schedule indicates that the passenger trains run 70 times a day. There are freight trains that also use the Caltrain line. Additionally, the California High Speed Rail project has requested to add additional passenger trains to the route. The measured sound level of the noise event at S2 was approximately 78-83 dBA. Veneklasen utilized 82 dBA as the noise event level for Zone A.

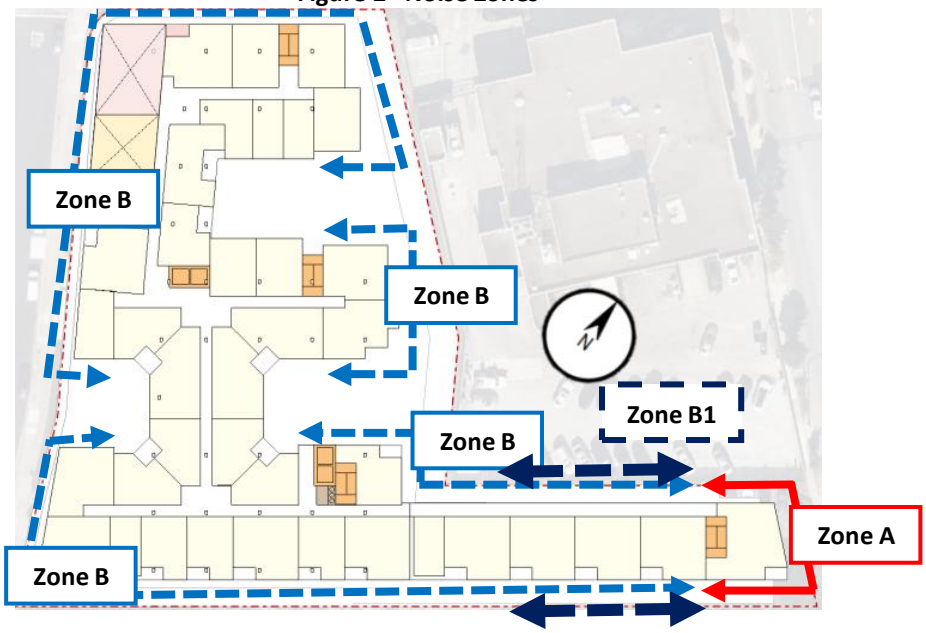
3.3 Overall Exterior Exposure

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 2, are listed in Table 3 below. Note that the high speed train is not included in this table.

Table 3 – Exterior Noise Levels

Location	Exterior Noise Level, CNEL	Train Max, dBA
Zone A	67	82
Zone B	61-65	< 75
Remaining Units	< 60	< 75

Figure 2– Noise Zones



4.0 INTERIOR NOISE CALCULATION

4.1 Exterior Facade Construction

Calculations were based on the Yield Study dated March 1, 2021. The plans do not show the exterior wall construction, so Veneklasen has assumed that the exterior wall will consist of 3-coat stucco over sheathing on wood 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 for the project.

4.2 Interior Average Noise Level (CNEL) – Residential

Veneklasen calculated the interior level within the residential units given the measured noise environment and the exterior facade construction described above. Table 4 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 4 – Calculated Interior CNEL Noise Levels

Location	Exterior Noise Level, CNEL	Window/ Door Rating	Interior Noise Level, CNEL
Zone A	67	STC 30	< 45
Zone B	62	STC 30	< 45
Remaining Units	< 60	No STC Requirement. STC 30 recommended.	

Where the noise level does not exceed 60, sound-rated assemblies are not required. However, Veneklasen recommends specifying a window with a minimum rating of STC 30 to maintain a consistent level of acoustical quality.

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 5 shows Veneklasen's recommended mitigation to reduce the interior noise levels due to short-duration noise events.

Table 5 – Calculated Interior Short-duration Event Noise Levels

Location	Exterior Level, dBA	Glazing Rating	Interior Level, dBA
Zone A	90	STC 37	55
Zone B1	< 85	STC 33	<55
Zone B	75-84	STC 30	<55

The calculations for Zone A assumed window sizes of 3 feet by 5 feet. If larger window sizes are planned, higher levels of glazing or additional layers of gypsum board on the interior wall may be required.

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 Zones A, B and B1. 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 6 below. Hourly noise level summaries and sample calculations are included in the appendices.

Table 6 – Calculated Interior Average Noise Levels at Non-Residential Areas

Location	Exterior Leq, dBA Loudest hour	Minimum Glazing	Interior Leq
Zone B	< 65	CALGreen Analysis not required.	

5.0 VIBRATION IMPACT

5.1 Calculated Structure-Borne Vibration Levels

Veneklasen conducted measurements of train activities at a distance of 100 feet from the north railroad. Veneklasen has calculated the expected transit ground-borne vibration levels at the property to be 76 VdB.

The resultant indoor floor vibration level will depend on numerous factors. The smaller and lighter the building, the more it will move in response to ground vibration. Further, the vibration level typically increases on the upper floors of the building due to building resonances, especially in lightweight wood-framed construction. Based on an 8-story multi-family home with concrete construction for the bottom floors, Veneklasen has predicted minimal vibration propagation. Note that vibration propagation and structural amplification can vary greatly and cannot be predicted with precision.

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

Per the FTA manual guidelines, summarized above in Table 1, this project would fall under Category 2 land use, and be described as 70 or more events per day or "Frequent Events". Therefore, the vibration level guideline for transit vibration should not exceed 72 VdB. Predicted vibration levels at the ground may not comply with this guideline, and predicted vibration levels on upper floors may also exceed this value.

5.2 Vibration Mitigation

The City of Burlingame has no train vibration mitigation requirements for residential buildings.

One option for reducing vibration exposure is to change the building structure so that the closest unit is further from the tracks. To ensure that the 72 VdB criterion would be satisfied on all floors would require locating the nearest home approximately 150 feet from the nearest track.

From previous projects, Veneklasen has determined that structural stiffening or building isolation can provide some mitigation of vibration (LoVerde, Dong 2016). This method primarily shifts the train vibration event frequencies up from a typical wood structure response, but it is still as perceptible as a standard construction. It is assumed that reducing the size of the building to be farther from the train line is not feasible. These solutions can be reviewed in the design, but, in essence, they mean portions of the building will perceive vibration during train pass-byes.

Even with mitigation, vibration will be perceptible for some train passby events. This condition should be disclosed to potential residents.

6.0 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 4 and defined in Appendix I are required. Appendix I shall be the acoustical specification for the exterior windows and doors for the project.
- Optional: In order to meet Veneklasen's criterion for short-duration noise events, windows and glass doors with minimum STC ratings as shown in Table 5 are recommended. This is not required by code but will increase occupant comfort. These would need to be explicitly specified in Zone A and B1. Appendix I shall be used for the acoustical specification for the exterior windows and doors for the project. Adoption of these would require STC 37 in Zone A and STC 33 in Zone B1. Zone B and the remaining units would remain the same.
- Residential mechanical ventilation, or other means of natural ventilation, may be required for all units in Zones A and B.

Non-Residential

- At retail, amenity, and other non-residential spaces, windows and glass doors as shown in Table 6 are required to meet the CALGreen interior noise criterion. Appendix I shall be used for the acoustical specification for the exterior windows and doors.

Vibration

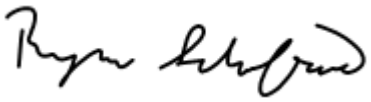
- Vibration will be perceptible within the building based on the vibration measurements performed.

- Structural stiffening or building isolation for lots closest to the railroad as described in Section 5.2 is not required by Building Code, but can be considered.
- Isolation of the building can be the utilization of a foam below the foundation or building structural stiffening to shift the frequency of vibration.

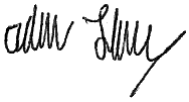
Various noise mitigation methods may be utilized to satisfy the noise criteria described in this report. Alteration of mitigation methods that deviate from requirements should be reviewed by the acoustical consultant.

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

Sincerely,
Veneklasen Associates, Inc.



Ryan Schofield
Senior Associate



Adam Thompson
Associate

APPENDIX I – GLAZING REQUIREMENTS

In order to meet the predicted interior noise levels described in Section 4.0, the glazing shall meet the following requirements:

Table 7– 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	21	30	36	37	36	**33**
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 33: 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 7 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
S1	3:00	1:00:00	60
S2	4:00	2:00:00	65

Average Daily Traffic Data Table for Existing Conditions

Average Daily Traffic Data Table for Existing Conditions

Roadway Segment	ADT
Millbrae Ave between Rollins Rd and US 101 SB Ramps	36,180
Millbrae Ave between El Camino Real and Rollins Rd	35,090
El Camino Real between Millbrae Rd and Murchison Dr	27,280
El Camino Real between Murchison Dr and Trousdale Dr	18,730
El Camino Real between Trousdale Dr and Broadway	17,980
Murchison Dr between El Camino Real and California Ave	5,250
Trousdale Dr between El Camino Real and California Ave	5,710
California Ave between Murchison Dr and Trousdale Dr	6,440
California Ave between Trousdale Dr and Broadway	11,430
Broadway between El Camino Real and California Ave	8,240
Broadway between California Ave and Rollins Rd	22,120
Broadway between Rollins Rd and US 101 SB Ramps	31,290
Broadway between US 101 SB Ramps and Bayshore Hwy	23,380
Bayshore Hwy between Broadway and US 101 NB Ramps	20,760