Appendix G

Exterior Noise and Façade Acoustical Analysis

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

October 12, 2022

City Ventures
444 Spear Street, Suite 200
San Francisco, California 94105

Attention: **Samantha Hauser | Senior Vice President of Development**

Subject: **The Gates**
Morgan Hill, California
Exterior Noise and Façade Acoustical Analysis
VA Project No. 4616-025

Dear Samantha:

Veneklasen Associates (Veneklasen) has completed our review of the exterior noise and vibration levels at the proposed The Gates development in Morgan Hill, California. This updated report represents the results of our findings, utilizing the traffic reports from Hexagon Transportation Consultants dated November 27, 2019 and July 1, 2022. Veneklasen has utilized measurements and computer modeling to assess noise levels and mitigation requirements for the exterior façade.

1.0 INTRODUCTION

This study was conducted to determine the impact of the exterior noise and vibration sources on the subject project in Morgan Hill, California, and to determine the method, if any, required to satisfy the noise and vibration standards of the State of California and the City of Morgan Hill.

The project consists of 3-story townhouse-style buildings. The project is bounded by Monterey Road to the east and north of the project boundary, Union Pacific Railroad (UPRR) to the west and south, and existing commercial land uses to the northwest.

2.0 CRITERIA

LDN (Day-Night Noise 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 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.

VdB is a measurement of ground velocity relative to 10^{-6} inches per second.

2.1 Interior Noise Levels – Residential

The State of California Building Code (Section 1207, "Sound Transmission") and the City of Morgan Hill Noise Element state that interior LDN values for residential land uses are not to exceed 45 LDN in any habitable room associated with exterior noise sources.

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

2.2 Maximum Instantaneous Noise Levels – Residential

The City of Morgan Hill Noise Element (Goal 7, "Prevention of Noise from Interfering with Human Activities or Causing Health Problems") states that noise levels in new residential development exposed to an exterior LDN 60 dBA or greater should be limited to a maximum instantaneous noise level in bedrooms of 50 dBA and

55 dBA in all other habitable rooms. Veneklasen utilized the L1 metric "instantaneous noise level" for train pass-by's.

2.3 Exterior Noise Levels – Residential

The City of Morgan Hill Noise Element sets an exterior noise level LDN goal of 60 dBA in residential areas where outdoor use is a major consideration. Where the City determines that providing an LDN of 60 dBA or lower cannot be achieved after the application of reasonable and feasible mitigation, an LDN of 65 dBA may be permitted. Also, the maximum outdoor noise level for new residences near the railroad shall be 70 dBA LDN.

It is understood that private exterior areas (balconies, patios) do not fall under this criterion.

2.4 Vibration Criteria – Residential

There are no regulatory requirements for vibration levels.

The "Transit Noise and Vibration Impact Assessment Manual" from the Federal Transit Administration, U.S. Department of Transportation, dated September 2018 ("FTA Report No. 0123") is used as a guideline. The criterion presented in Table 6-3 of that report for infrequent events (defined as fewer than 30 per day) in residences is that the vibration levels do not exceed 80 VdB.

2.5 Conditions of Approval

To date, Veneklasen has not received the conditions of approval (COAs) for the subject project.

Therefore, our comments herein are based on minimum Building Code requirements with references to the City of Morgan Hill General Plan.

3.0 EXTERIOR NOISE AND VIBRATION ENVIRONMENT

3.1 Noise and Vibration Measurements

Railroad operations from UPRR and traffic from Monterey Road are the primary sources of noise affecting the site.

Veneklasen visited the site on November 8, 2021, and placed meters at the project site to capture the hourly sound levels for a 42-hour period. Two (2) Bruel & Kjaer type 2270 sound level meters were installed to perform sound measurements. One meter was placed 40 feet from the Union Pacific Railroad, and the other meter was placed approximately 100 feet from the Monterey Road. We also carried out short measurements at four (4) locations to understand the noise distribution across the site. Lastly, Veneklasen measured the ground vibration levels at both long-term measurement locations to assess the vibration impact due to the train pass by's on the proposed site.

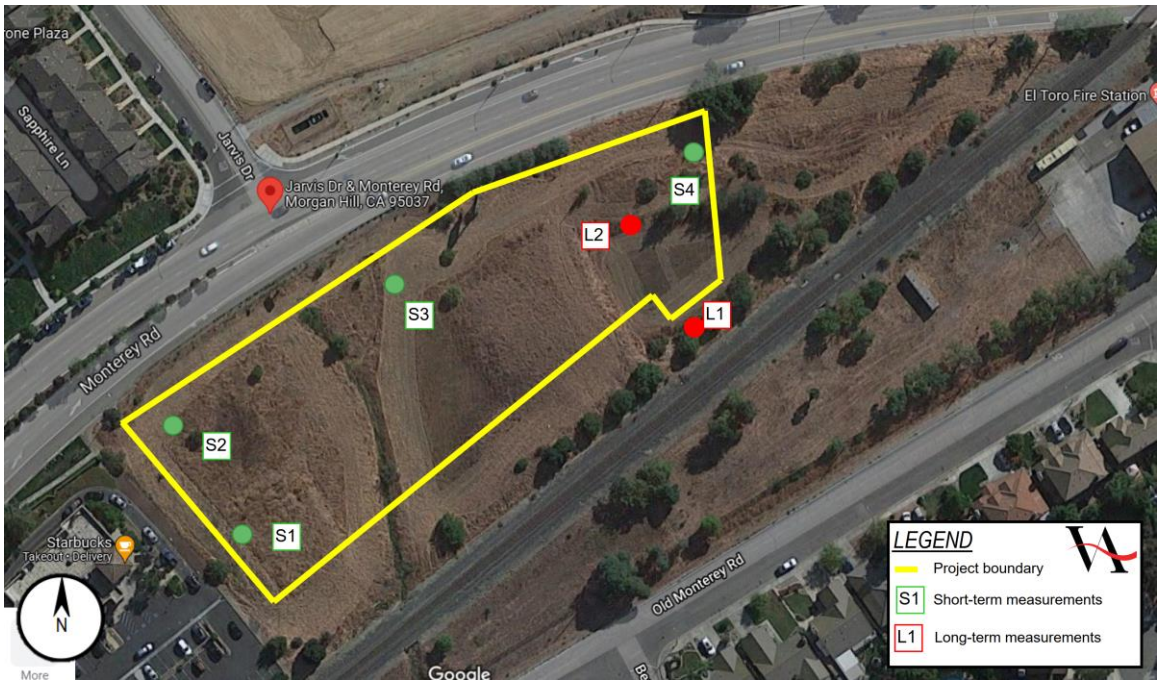
Table 1 summary of Veneklasen's noise and vibration measurements at locations shown in Figure 1.

Table 1 – Measured Sound Levels

Measurement	Vibration Velocity Level, VdB	Train Pass-by /Road Events, dBA	LDN
Noise, Train	-	90-95	66
Noise, Road	-	70-72	68
Vibration, Train	71	-	-

Veneklasen utilizes statistical methodologies[1] for establishing design levels for a project, as statistical methods provide a more reliable understanding of site environmental noise. This has been found useful for shorter environmental data sets, which are typical of this site.

Figure 1 – Project Site with Measurement Locations



3.2 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 Monterey Road were obtained from the City of Morgan Hill Public Works Department and supplemented based on the Hexagon Transportation Consultants Traffic Impact Analysis and Trip Generation and Operation Analysis reports. The Average Daily Traffic (ADT) volume on Monterey Road is approximately 14,000 (2015 count) per the City of Morgan Hill. The engineering report utilizes a 2.76% growth in traffic per year based on the City of Morgan Hill Traffic Impact Analysis report and traffic counts from 2009. Using the above information, Veneklasen predicted the traffic count level in year 2022, resulting in approximately 17,000 ADT. This is consistent with the 2022 report indicating a peak hour traffic volume of approximately 1500-2800. Since ADT is accepted as approximately 10x the peak hour volume, the ADT based on those peak hour volumes is on the same order of magnitude as obtained through the growth calculation.

Using the 17,000 ADT for 2022, the calculated sound level at a distance of 60 feet from the centerline of the road is 66-69 LDN. This corresponds with the levels that Veneklasen measured for Monterey Road. We also predicted the year 2032 noise level using a traffic level increase of 2.76% per year, and that results in an increase in sound level of 1 dB LDN.

Project-generated trips are included in this growth. Per the Hexagon report, the project is anticipated to generate 55 new vehicle trips during the AM peak hour and 84 new vehicle trips during the PM peak hour. These represent an increase in peak-hour traffic volume of 1-3% for each intersection, resulting in an increase

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

in overall sound level of 0.1 dB, which is indistinguishable to the human ear. The project-generated trips are included in the assessment but have no impact on the overall sound level.

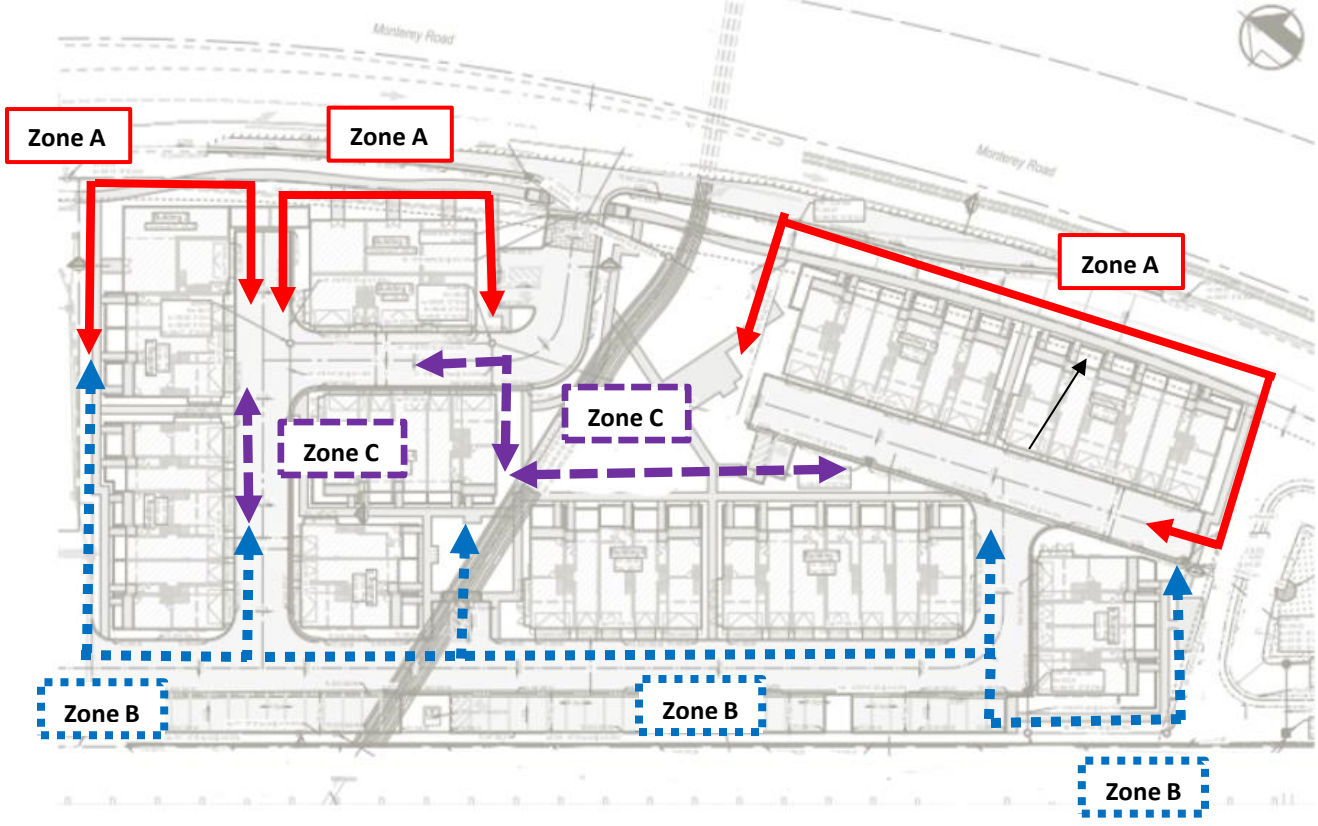
3.3 Overall Exterior Exposure

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, we have 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 2 below.

Table 2 – Exterior Noise Levels

Location	Floor	Exterior Noise Level, LDN	Train Pass-by/Road Traffic Level, dBA
Zone A	All	69-70	72-74
Zone B	All	65-67	90-94
Zone C	All	60-65	72
Remaining Units	All	< 60	< 70

Figure 2 – Noise Zones, Levels 1 to 3



4.0 INTERIOR NOISE

4.1 Exterior Facade Construction

Veneklasen anticipates the project will utilize a typical standard exterior construction which consists of a 3-coat stucco or HardiPlank lap siding finish over sheathing on wood studs with a single layer of gypsum board on the interior and batt insulation in the cavity.

Where applicable due to train pass-by events, an upgraded exterior wall assembly has been specified per the following construction:

OPTION #1

- 7/8" 3-coat exterior cement plaster at 10 psf
- 2x6 wood studs with batt insulation in the cavity
- 1-inch airspace
- 2x6 wood studs with batt insulation in the cavity
- 5/8" type 'x' gypsum board
- 5/8" type 'x' gypsum board

OPTION #2

- HardiePlank lap siding at 2.3 psf
- 5/8" DensGlass exterior gypsum sheathing at 2.5 psf
- 5/8" DensGlass exterior gypsum sheathing at 2.5 psf
- 2x6 wood studs with batt insulation in the cavity
- 1-inch airspace
- 2x6 wood studs with batt insulation in the cavity
- 5/8" type 'x' gypsum board
- 5/8" type 'x' gypsum board

Other mitigation strategies may be acceptable with approval by Veneklasen.

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 Recommended Mitigation

Veneklasen investigated barrier option to minimize the noise impact due to the train locomotive noise level inside the residential spaces. However, it required a barrier height of 15 feet at the property line. We understand there are challenges with regards to footings at this location with a barrier of this height. Inform us if a barrier solution would like to be pursued further.

As an alternative solution, Veneklasen performed calculations with an upgraded wall assembly as mentioned in the section 4.1 and high STC-rated glazing. Table 3 below shows the interior noise levels with upgraded glazing and exterior wall construction.

Table 3 - Calculated Interior Maximum Noise Levels

Location	Floor	Exterior Sound Level		Glazing Rating LR/BR*	Upgraded Exterior Wall?	Interior Sound Level		Meet the City Criteria	
		LDN	Event Level, dBA			LDN	Event Level, dBA LR/BR*	LDN	Event Level LR/BR
Zone A	All	69-70	72-74	STC 35/STC 35	No	< 45	55/50	Yes	Yes/Yes
Zone B	All	65-67	94	STC 42/STC 50	Yes	< 45	55/50	Yes	Yes/Yes
Zone C	All	60-65	70-72	STC 30/STC 30	No	< 45	55/50	Yes	Yes/Yes
Remaining Zones	All	60-67	<70	STC 30/STC 30	No	< 45	< 55/<50	Yes	Yes/Yes

* LR/BR means Living Room/Bedroom

4.3 Interior Train Pass-by Event Noise Level (dBA) – Residential

In a similar manner, Veneklasen calculated the interior noise levels as a result of the train pass-by's and traffic events. As described in Section 2.2, the event noise level criterion is 50 or 55 dBA for bedroom and living rooms, respectively.

Per the analyses of 40 hours continuous measurement data at the L-1 location, it was observed that there were nine (9) train events during the daytime (7:00 am to 10:00 pm) and five (5) events during the nighttime (11:00 pm to 7:00 am).

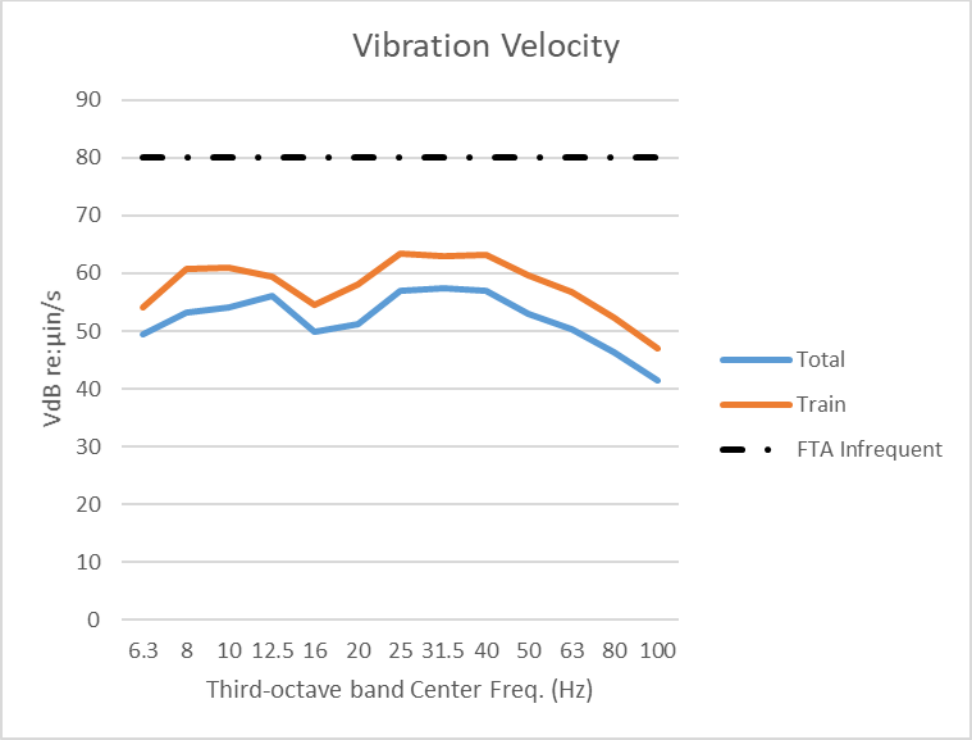
Our analysis indicates that the maximum event level was 90-94 dBA due to the train pass by's on Union Pacific Railroad. Per the analysis, significant upgrades to the exterior façade construction (i.e. double stud walls, double windows) are necessary required to meet 55 dBA interior event maximums. These recommendations are reflected above.

5.0 INTERIOR VIBRATION LEVELS (VDB)

Veneklasen evaluated the vibration levels due to the train passing by at location L1 approximately 60 feet from the Union Pacific Railroad on November 8, 2021. The vibration measurement was conducted for a period of 42-hours. The vibration levels were measured in the vertical direction.

Per Section 2.3, the railroad-induced vibration levels would be below the 80 VdB guideline for acceptability. According to the VA analysis, the measured vibration levels, the infrequent events (defined as fewer than 30 per day) in residences do not exceed 80 VdB. Figure 3 below show the reported vibration level and FWA criteria for infrequent events.

Figure 3 – Ground Vibration VdB Levels on the Project Site



It should be noted that compliance with the FTA guidelines does not indicate that vibration will not be perceptible. Events that occur at that vibration threshold would be noticeable and may cause secondary events such as the rattling of objects.

There are no regulatory requirements related to vibration from the train line; therefore, there are no mitigation requirements for this project. However, the levels are below the Infrequent Events criterion of 80 VdB as established by FTA guidelines.

6.0 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 the units in Zone A, B and C. The ventilation system shall not compromise the sound insulation capability of the exterior facade assembly.

7.0 SUMMARY

Veneklasen has assessed the exterior noise environment based on the updated plans and current project drawings. Veneklasen's conclusions are summarized below.

- All buildings comply with the residential building criteria of and exterior 70 LDN level for railroad sources.
- Provide window assemblies with minimum ratings as indicated in Table 3. Refer to Appendix I for the glazing acoustical ratings (glass, frame and seals). This is the specification of the windows and doors for the project and includes the required specified acoustical STC and Transmission Loss specified for all exterior windows and doors.
- Provide upgraded walls as indicated in Table 3 and described in section 4.1. Note that this construction is required to meet the maximum interior level due to events indicated.
- The vibration levels inside of the residential buildings are predicted to be less than the 80 VdB threshold recommended by FTA based on the number of events. There are no regulatory requirements, and therefore no mitigation is required.
- Residential mechanical ventilation, or other means of natural ventilation, may be required for all units in Zones A, B, and C.
- A disclosure of the noise levels as caused by train pass-by events for all potential occupants should be adopted, most notably for those located in Zone B. Note that interior noise levels from train events will stop activity within the unit and will cause sleep disturbance.

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

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 4 – 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	19	28	34	37	33	**30**
1” dual	25	27	33	35	38	41	**35**
Storm	27	32	37	43	49	51	**42**
Storm	35	39	45	51	54	60	**50**

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 35: 1/4" laminated – 1/2” airspace – 1/4” laminated
3. STC 42: 3/16” monolithic – 7/16” airspace – 1/8” monolithic – 2” airspace – 1/8” storm
4. STC 50: 7/32” laminated – 1/4” airspace – 7/32” laminated – 2” airspace – 3/16” storm

An assembly’s frame and seals may limit the performance of the overall system. The window systems selected for the project shall not be selected on the basis of STC rating alone but must meet the system STC rating provided in Table 4 above. Additionally, the assemblies given above are provided as a basis of design, but regardless of construction, the octave band Transmission Loss (TL) of the particular system selected must meet the minimum values in Table 4 above. Therefore, systems selected must meet the minimum Transmission Loss values and STC ratings provided in Table 4.

Independent laboratory acoustical test reports should be provided for review by the design team to ensure compliance with glazing acoustical performance requirements. Lab shall be a current member of the National Voluntary Laboratory Accreditation Program (NVLAP) under the National Institute for Standards and Technology (NIST) for accreditation and shall be pre-approved by Veneklasen Associates, Inc. Tests are required to be completed in North America. Lab reports shall be in compliance with ASTM standard E90 and be no more than 10 years old (from date of submission on specific project). VA requires invitation to witness acoustical testing completed to demonstrate compliance with the requirements of this report and reserves the right to exclude test reports from laboratories that are not pre-approved by Veneklasen Associates, Inc. for the specific test standard. The tests shall be performed on the entire assembly, including frame and seals and hardware, if applicable to be used for the project. If test reports are not available for the assembly, VA would require that the assembly be tested at a third-party independent lab accredited through NVLAP for the ASTM E90.

Veneklasen has adopted these standards as a result of variation between laboratory testing agencies. Adoption of this process improves consistency and minimizes risk to a project developer, design/construction team, glazing manufacturers, the City, and future project residents.

APPENDIX II – SAMPLE EXTERIOR TO INTERIOR CALCULATION

Project Name:	**Morgan Hill 8**												
Zone	A												
Plan, room	BR (c) 3FL												
				Room absorption	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Receiving Room Absorption				Medium	0.18	0.19	0.19	0.20	0.20	0.20	0.20	0.20	
Length	12												
Width	10			**Room Absorption**	114	121	121	127	127	127	127	127	
Height	9												
				Exterior Noise Level									
Volume	1080		Level	Source type	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
F/C area	120	**CNEL, LDN, or average:**	70	Monterey RD	76.9	74.6	63.8	63.7	66.9	62.8	53.2	44.3	**70.0**
Wall area	396												
Total area	636		Level	Source type	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
		Event:	80	Train passby max	82.9	80.9	75.2	78.8	73.5	73.0	66.7	58.3	**80.0**
Total Interior Level:	**42.3**												
(excluding 63 Hz):	40.5												
Event Level:	**50.5**												
					Average Interior Levels								
		Exterior Assemblies	Area	Assembly Type	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
		wall	156	VA Typical Wall (stucco,ply,2x4ws,5/8gyp) wyle	62.8	51.3	33.1	24.7	20.1	11.2	-0.5	-9.8	**39.2**
		glazing	42	STC 35, Milgard 1/4lam, 1/2, 1/4lam	56.5	51.0	38.2	31.9	33.1	26.0	13.4	4.5	**39.3**
		door		<N/A>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
				<N/A>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
				<N/A>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
				Total	**63.7**	**54.2**	**39.4**	**32.7**	**33.3**	**26.1**	**13.6**	**4.7**	**42.3**
				A-weighted	37.7	38.2	30.4	29.7	33.3	27.1	14.6	3.7	