Environmental Noise Analysis

# San Bruno Hotel

City of San Bruno, California

BAC Job # 2018-109

Prepared For:

Sierra Meadows Resort, Inc.

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July 27, 2018

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# Introduction

The proposed San Bruno Hotel (project) is located on the southeast corner of El Camino Real and San Luis Avenue in the City of San Bruno, CA. The project proposes to build a new 3-story, wood framed boutique hotel. The proposed hotel will be approximately 19,512 sq. ft., and consist of 34 guestrooms. The project area is shown on Figure 1. The project site plans are shown in Figures 2-4.

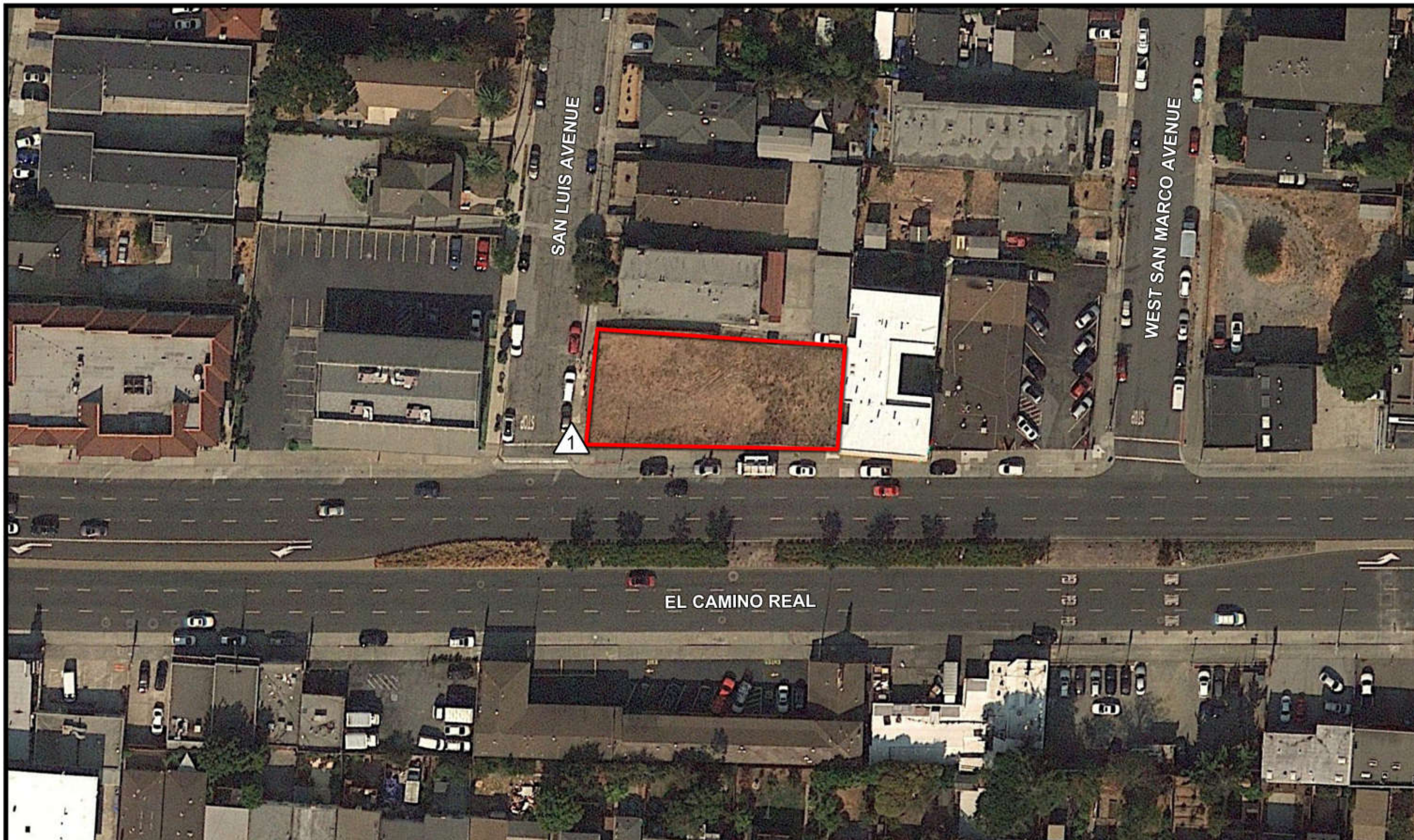
In response to project submission to the City of San Bruno Community Development Department, specific submittal requirements were outlined in a letter to the project applicant dated May 15, 2018. The specific requirements applicable to this noise assessment have been reproduced below:

**Building Division**

43. Noise Mitigation: This project appears to be sufficiently close to an exterior noise source (i.e., El Camino Real) which requires the submittal of an acoustical report. Submit such a report or confirm project structures are entirely outside the 60 dB CNEL contour lines in conformance with HSC Section 17920 through 17928.

Pursuant to the requirement of the City of San Bruno Community Development Department, specifically Comment #43, the project applicant has retained Bollard Acoustical Consultants, Inc. (BAC) to prepare this acoustical assessment. Specifically, the purposes of this assessment are to quantify noise levels associated with traffic on El Camino Real as it affects the project site, and to compare those levels against the applicable City of San Bruno criteria for acceptable noise exposure for hotel uses. Because the hotel project does not propose a common outdoor activity area, the following noise assessment focuses on traffic noise exposure at the project site relative to the City of San Bruno criteria for acceptable interior noise exposure for hotel uses.

BAC was also retained by the project applicant to prepare an architectural acoustics assessment for the proposed hotel project. The purpose of the architectural acoustics assessment is to determine if the proposed unit-separation walls and floor ceiling assemblies would provide adequate sound insulation to satisfy the applicable Sound Transmission Class (STC) and Impact Insulation Class (IIC) criteria established by brand standards and the State of California.




***Legend***

Project Border (Approximate)

Short-Term Noise Level Measurement Location (Traffic Calibration)

N

Scale (feet)

0 40 80

# San Bruno Hotel

San Bruno, California

Project Area

Figure 1

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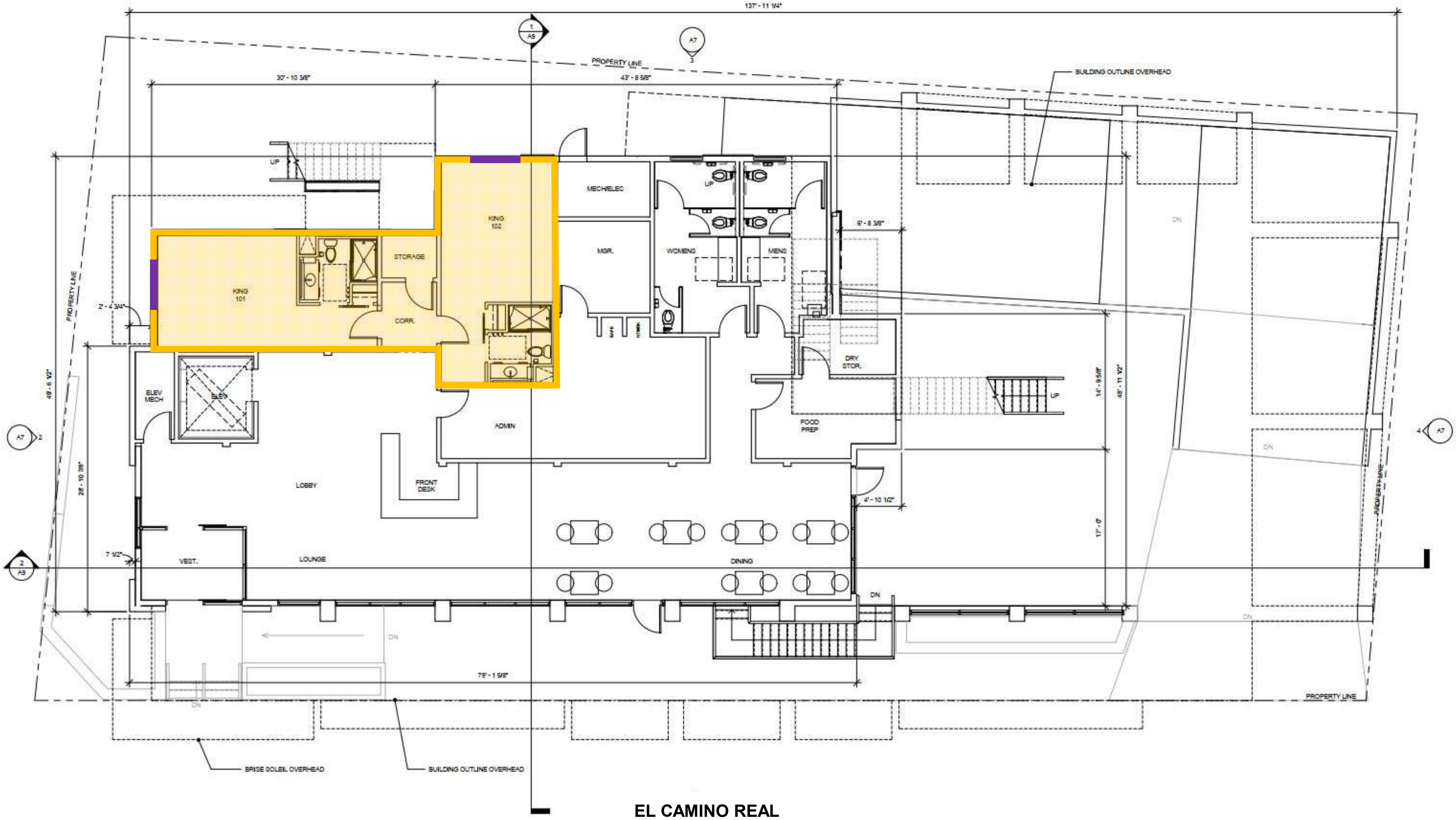


***Legend***

Guestrooms

STC-27 Windows

Scale (Feet)

0 10 20

# San Bruno Hotel

San Bruno, California

First Floor Plan

Figure 2

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***Legend***

- Guestrooms
- STC-27 Windows
- STC-32 Windows
- STC-33 Windows

Scale (Feet)

0 10 20

# San Bruno Hotel

San Bruno, California

Second Floor Plan

Figure 3

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***Legend***

- Guestrooms
- STC-27 Windows
- STC-32 Windows
- STC-35 Windows

Scale (Feet)

0 10 20

San Bruno Hotel

San Bruno, California

Third Floor Plan

Figure 4

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# Noise Fundamentals and Terminology

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard, and thus are called sound. Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in levels (dB) correspond closely to human perception of relative loudness. Appendix A contains definitions of Acoustical Terminology. Appendix B shows common noise levels associated with various sources.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels in decibels.

Community noise is commonly described in terms of the “ambient” noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level ($L_{eq}$) over a given time period (usually one hour). The $L_{eq}$ is the foundation of the Day-Night Average Level noise descriptor, $L_{dn}$, and shows very good correlation with community response to noise.

The Day-Night Average Level ($L_{dn}$) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because $L_{dn}$ represents a 24-hour average, it tends to disguise short-term variations in the noise environment. $L_{dn}$-based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

# Criteria for Acceptable Noise Exposure

## City of San Bruno General Plan

Chapter 7 of the City of San Bruno General Plan (Health and Safety Element) contains the City's noise policies. The General Plan noise standards are shown in Table 1 (GP Table 7-2). Those policies that would be pertinent to this project are reproduced below:

### Policy HS-32

Encourage developers to mitigate ambient noise levels adjacent to major noise sources by incorporating acoustical site planning into their projects. Utilize the City's Building Code to implement mitigation measures, such as:

- Incorporating buffers and/or landscaped berms along high-noise roadways or railways;
- Incorporating traffic calming measures and alternative intersection design within and/or adjacent to the project;
- Using reduced-noise pavement (rubberized asphalt); and
- Incorporating state-of-the-art structural sound attenuation measures.

### Policy HS-33

Prevent the placement of new noise-sensitive uses unless adequate mitigation is provided. Establish insulation requirements as mitigation measures for all development, per the standards in Table 7-1.

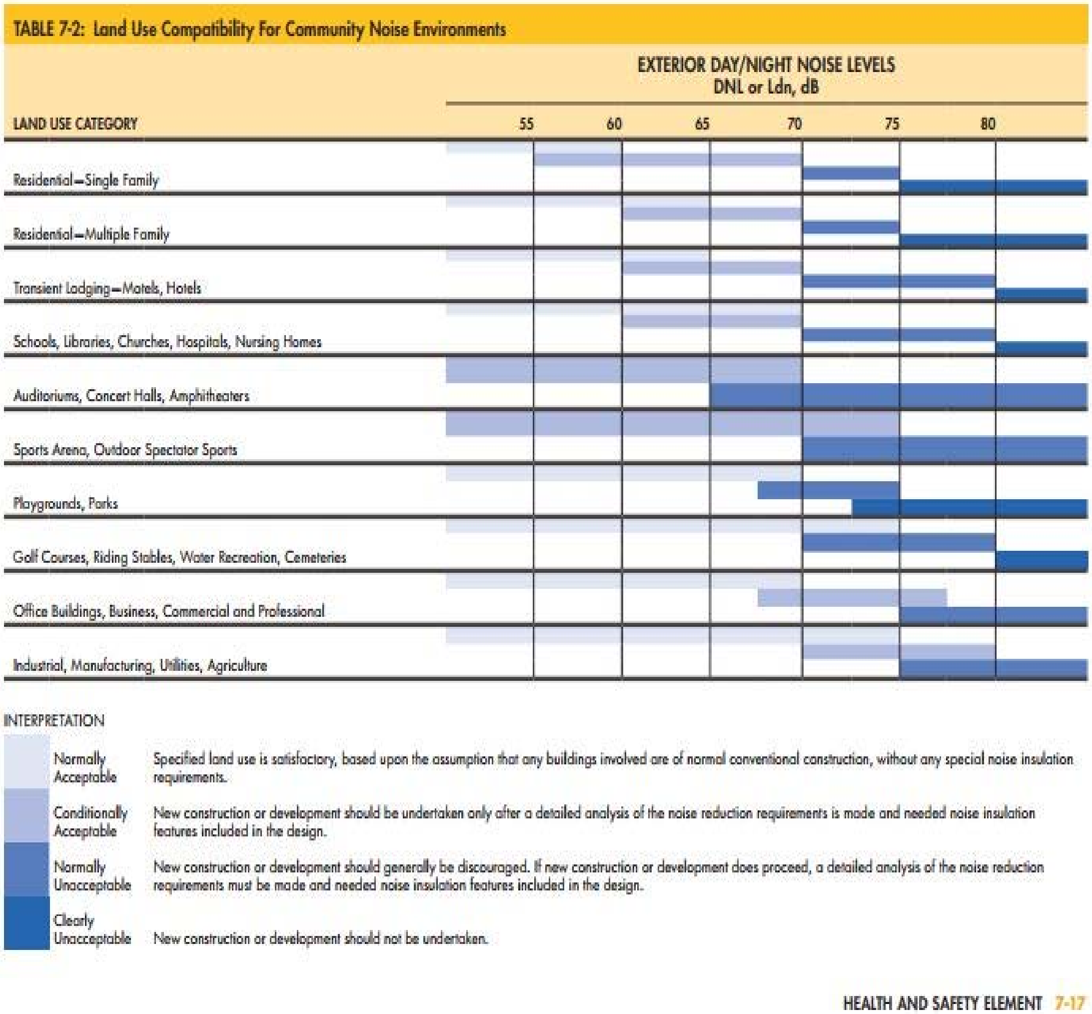
### Policy HS-34

Discourage noise-sensitive uses such as hospitals, schools, and rest homes from locating in areas with high noise levels. Conversely, discourage new uses likely to produce high levels of noise from locating in areas where noise-sensitive uses would be impacted.

### Policy HS-34

Require developers to comply with relevant noise insulation standards contained in Title 24 of the California Code of Regulations (Part 2, Appendix Chapter 12A).

**Table 1**
**Land Use Compatibility for Community Noise Environments**
**San Bruno General Plan Health and Safety Element (Table 7-2)**




Pursuant to General Plan Policy HS-24, the California Code of Regulations (Title 24) establishes an interior noise level standard of 45 dB $L_{dn}$/CNEL for any habitable room. This is the interior noise level standard applicable to the project.

### Brand Standards

The hotel project is not affiliated with a national brand. However, it is likely that the project design guidelines would be similar to those established by other national brands. As a result, the Hilton Brand Standards Sound Transmission Class (STC) and Impact Insulation Class (IIC) performance criteria have been applied to the project. The Hilton Brand noise criteria has been reproduced below in Table 2:

**Table 2**
**Acoustical Performance Minimum Criteria**
**Hilton Brand Standards**

| Location | STC/IIC |
|---|---|
| Function or meeting rooms | 54 STC |
| Meeting room-operable partitions | 52 STC |
| Meeting room-baffles above ceiling/partitions | 54 STC |
| Boardroom | 54 STC |
| Service room adjacent to meeting room | 52 STC |
| Guestroom exterior / suite to exterior | 50 STC |
| Guestroom to guestroom / suite to suite | 50 STC |
| Guestroom / suite to swimming pool or fitness center | 60 STC |
| Guestroom from public space / suite to public space | 50 STC |
| Guestroom / suite to back of house | 60 STC |
| Guestroom / suite floor/celling | 50 STC |
| Guestroom / suite to elevator lobby | 60 STC |
| Corridor to mechanical, laundry, service rooms | 50 STC |
| Floor impact: guestroom to guestroom / suite to suite | 55 IIC |
| Floor impact: guestroom / suite sleeping area to mechanical room | 55 IIC |

Source: Hilton Brand Standards, Section 2514.05.A (2018)

## Existing and Future Traffic Noise Environment

### Traffic Noise Prediction Model

The existing ambient noise environment at the project site is primarily defined by traffic on El Camino Real. The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used to predict traffic noise levels at the project site. The model is based upon the CALVENO noise emission factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA Model was developed to predict hourly $L_{eq}$ values for free flowing traffic conditions, and is considered to be accurate within 1.5 dB in most situations.

## Traffic Noise Prediction Model Calibration

The FHWA Model provides reasonably accurate traffic noise predictions under “ideal” roadway conditions. Ideal conditions are generally considered to be long straight roadway segments with uniform vehicle speeds, a flat roadway surface, good pavement conditions, a statistically large volume of traffic, and an unimpeded view of the roadway from the receiver location. Such conditions did not appear to be in effect at this project site due to nearby traffic lights. As a result, BAC conducted a calibration of the FHWA Model through site-specific traffic noise level measurements and concurrent traffic counts.

The calibration process was performed near the project site on June 5, 2018. The measurement was conducted at a height of 5 feet above existing grade to quantify traffic noise levels at the building facades of hotel rooms proposed nearest to El Camino Real. The location of the short-term noise measurement is shown in Figure 1. Photographs of the measurement site are provided in Appendix C. Detailed results of the traffic calibration procedure are provided in Appendix D.

A Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meter was used to conduct the traffic calibration noise level survey. The meter was calibrated before use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

As indicated in Appendix D, the FHWA Model was found to accurately predict El Camino Real traffic noise levels within approximately 1 dB at the project site. As a result, no calibration adjustment was applied to the FHWA Model for the prediction of future traffic noise levels at the project site.

## Predicted Future Exterior Traffic Noise Levels

The FHWA Model was used with traffic data obtained from Caltrans 2016 Traffic Counts to predict future El Camino Real traffic noise exposure at the proposed San Bruno Hotel project site. Specifically, future traffic volumes were conservatively estimated by increasing the existing traffic volume by a factor of 1.5 to account for regional growth in the next 20 years. The FHWA model was utilized to estimate the future traffic noise exposure at the hotel building facades proposed nearest to El Camino Real. Distances to the building facades were scaled using the provided site plans. The results of this analysis are summarized in Table 3, with detailed inputs and results provided in Appendix E.

**Table 3**
**Predicted Future Exterior El Camino Real Traffic Noise Exposure[1]**
**San Bruno Hotel – San Bruno, California**

| Location | Distance from Centerline of Roadway (feet)[2] | Offset (dB)[3] | Predicted Future Exterior Noise Level, $L_{dn}$ (dB) |
|---|---|---|---|
| Building facade – 1st floor guestrooms | 90 | -3 | 65 |
| Building facade – 2nd floor guestrooms | 50 | +3 | 75 |
| Building facade – 3rd floor guestrooms | 50 | +5 | 77 |

Notes:
1 A complete listing of FHWA Model inputs and results are provided in Appendix E.
2 Distances measured from the centerline of El Camino Real to nearest hotel building facades containing guestrooms.
3 Offsets of +3 dB (2nd floor) and +5 dB (3rd floor) were applied to upper-floor facades due to reduced ground absorption at elevated levels. An offset of -3 dB was applied to nearest 1st floor facade containing a guestroom (north side of building) due to reduced exposure to El Camino Real.

Source: Bollard Acoustical Consultants, Inc. (2018)

## Predicted Future Interior Traffic Noise Levels within Nearest Hotel Rooms

According to Table 3, predicted future first-floor facade noise exposure at the hotel guestrooms nearest to El Camino Real (north side of the building) would be approximately 65 dB $L_{dn}$. Due to reduced ground absorption of traffic noise at elevated locations, and because the upper-level hotel guestrooms are proposed closer to El Camino Real, traffic noise levels are expected to range from 75-77 dB $L_{dn}$ at the upper-floor facades. As a result, building facade noise reductions of 30-32 dB would be required to achieve an interior noise level of 45 dB $L_{dn}$ within the nearest upper-floor rooms, and a reduction of 20 dB would be required for the nearest first-floor room.

Standard hotel building construction consisting of exterior stucco siding, insulated walls, and dual-pane thermal windows (STC 27-28) provides a minimum 25 dB of exterior-to-interior traffic noise reduction. Therefore, standard construction practices would be adequate at the nearest first-floor guestroom of the hotel, but would fail to provide the necessary reduction at the guestrooms of the nearest upper-floor facades. As a result, upgraded construction would be necessary in order to comply with the California Code of Regulations 45 dB $L_{dn}$ interior noise level criteria at the upper-level facades of the hotel. The specific locations of recommended window upgrades are identified in Table 4, and are shown on Figures 2-4.

The recommended window upgrades at the building facades of the north-facing guestrooms take into consideration the reduced exposure to El Camino Real, and have been adjusted by -3 dB. According to the project site plans, guestroom windows are not proposed at the south-facing hotel building facades (any level), or at west-facing first-floor facades.

**Table 4**
**Interior Traffic Noise Mitigation - Guestrooms[1]**
**San Bruno Hotel – San Bruno, California**

| | Recommended Minimum Window STC Rating to Achieve 45 dB $L_{dn}$ Inside Guestrooms | | |
|---|---|---|---|
| Location | 1st Floor | 2nd Floor | 3rd Floor |
| West-facing guestroom windows | -- | 33 | 35 |
| North-facing guestroom windows | 27 | 32 | 32 |
| East-facing guestroom windows | 27 | 27 | 27 |

Notes:

[1] Recommended window STC upgrade locations are shown on Figures 2-4.

Source: Bollard Acoustical Consultants, Inc. (2018)

## Compliance with California Code of Regulations 45 dB $L_{dn}$ Interior Noise Standard

The Table 4 data shows the locations of recommended window upgrades in order to satisfy the California Code of Regulations 45 dB $L_{dn}$ noise level standard with a reasonable margin of safety. In addition, due to the elevated exterior noise environment BAC recommends that resilient channels be installed beneath the sheetrock on the exterior walls of the west-facing (nearest to El Camino Real) guestrooms on all upper-levels of the proposed hotel.

## Compliance with Hotel Brand Standards

As noted in Table 2, the Brand Standard STC rating requirement for exterior walls of guestrooms is 50. While this analysis indicates that STC ratings ranging from 27 - 35 are recommended to achieve satisfaction with the California Code of Regulations 45 dB $L_{dn}$ interior noise level standard with a reasonable margin of safety, a higher STC rating would be required to achieve a composite exterior wall STC rating of 50.

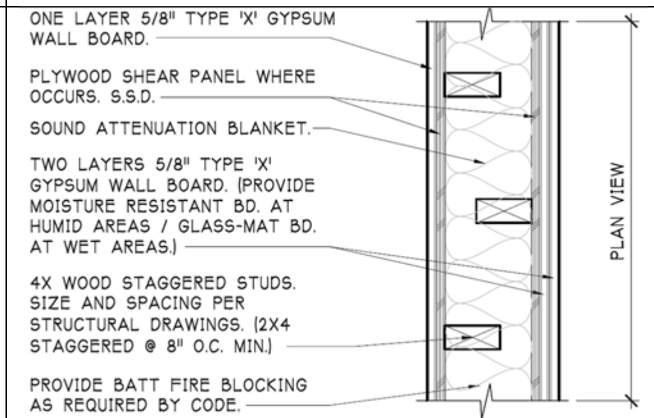
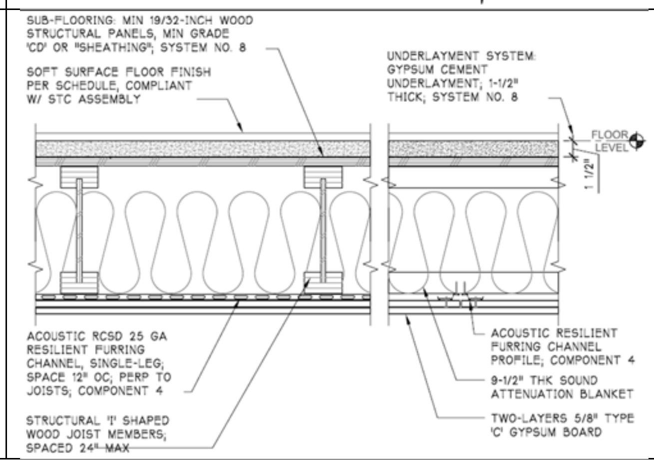
The window area of the typical guestroom represents approximately 30% of the exterior facade of the guestroom. The STC rating for the exterior wall construction is reported to be approximately 55. Based on these factors, a 45 STC rating would be required for the exterior window assemblies to ensure the composite wall/window STC rating would satisfy the 50 STC Brand Standard.

# Floor-Ceiling and Wall Assembly STC & IIC Evaluation

The proposed floor-ceiling and wall assembly details provided to BAC are shown on architectural Plan Sheets FC-2 and WDS3. BAC utilized Insul, a noise transmission modeling program by Marshall Day Acoustics (Version 8.0.11), to predict the Sound Transmission Class (STC) ratings of the subject assemblies.

Table 5 shows illustrations of the proposed assemblies, the brand standard for the assembly, and the predicted STC or IIC value for the assembly. As indicated in Table 5, the predicted STC values for both the unit separation walls and floor-ceiling assemblies would meet the brand standard requirements. However, the IIC rating for the proposed floor-ceiling assembly may fall short of the recommended minimum IIC rating of 55. As a result, BAC recommends that a layer of resilient material (i.e. Acoustimat II or Enkasonic HP), be included between the plywood subfloor and lightweight concrete. With this modification, IIC values are predicted to exceed the recommended 55 criteria.

**Table 5**
**Proposed Floor-Ceiling and Wall Assemblies, Brand Standards, and Predicted STC/IIC Values**
**San Bruno Hotel - San Bruno, California**

| Detail: Sheet | Description | Illustration | Brand Standard Requirement | Predicted/Reported STC/IIC | Proposed Assembly Satisfactory? |
|---|---|---|---|---|---|
| WDS3 | Interior Partition Wall |  | 50 STC | 56 STC<br>(See Appendix F) | Yes |
| FC-2 | Floor-Ceiling assembly with soft finish flooring |  | 50 STC<br>55 IIC | 62 STC<br>50 IIC | STC: Yes<br>IIC: No |





Source: Insul 8.0.11, published acoustical literature and ONC Catalog of STC/IIC Ratings with plans as shown

# Conclusions and Recommendations

This analysis concludes that future traffic noise will be elevated along the western facades of the proposed San Bruno Hotel building. This analysis further concludes that the proposed interior floor-ceiling and wall assemblies would be satisfactory relative to the recommended brand standards for Sound Transmission Class. However, improvements to the exterior wall construction would be required to satisfy both the recommended brand standards and the City of San Bruno General Plan (California Code of Regulations) criteria, and improvements to the floor-ceiling assembly would be required to ensure adequate impact insulation between floors. Those improvements are identified below.

**For Compliance with the California Code of Regulations 45 dB $L_{dn}$ Interior Noise Standard:**

1) All windows should meet the STC requirements illustrated on Figures 2-4 and as included in Table 4.

2) Resilient channels should be provided for all west-facing guest rooms with direct exposure to El Camino Real.

**For Compliance with the Brand Standards:**

3) All exterior windows should provide a Sound Transmission Class Rating of STC 45.

4) Resilient channels should be provided for all west-facing guest rooms with direct exposure to El Camino Real.

5) A layer of resilient material (i.e. Acoustimat II or Enkasonic HP), should be included between the plywood subfloor and lightweight concrete of the floor-ceiling assemblies.

These conclusions are based on the traffic data and assumptions cited in Appendix E, on the project site plans shown on Figures 2-4, and on noise reduction data for standard building construction and for typical STC rated window data. Deviations from the Appendix E data, or the project site plans shown on Figures 2-4, could cause future traffic noise levels to differ from those predicted in this analysis. In addition, Bollard Acoustical Consultants, Inc. is not responsible for degradation in acoustic performance of the building construction due to poor construction practices, failure to comply with applicable building code requirements, or for failure to adhere to the minimum building practices cited in this report.

This concludes BAC's traffic noise and architectural acoustics assessment for the proposed San Bruno Hotel in San Bruno, California. Please contact BAC at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this assessment.

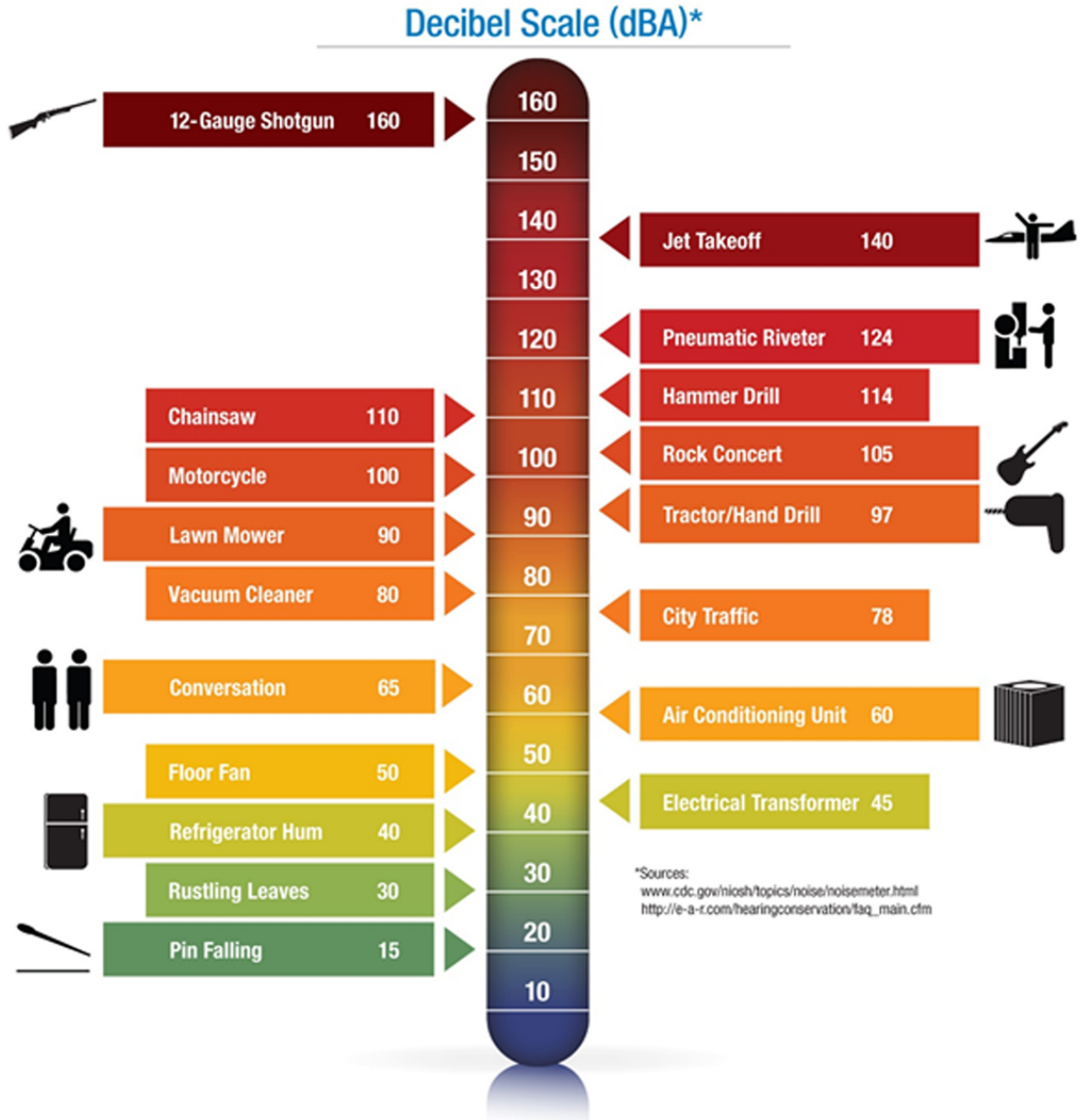
Appendix A

## Acoustical Terminology

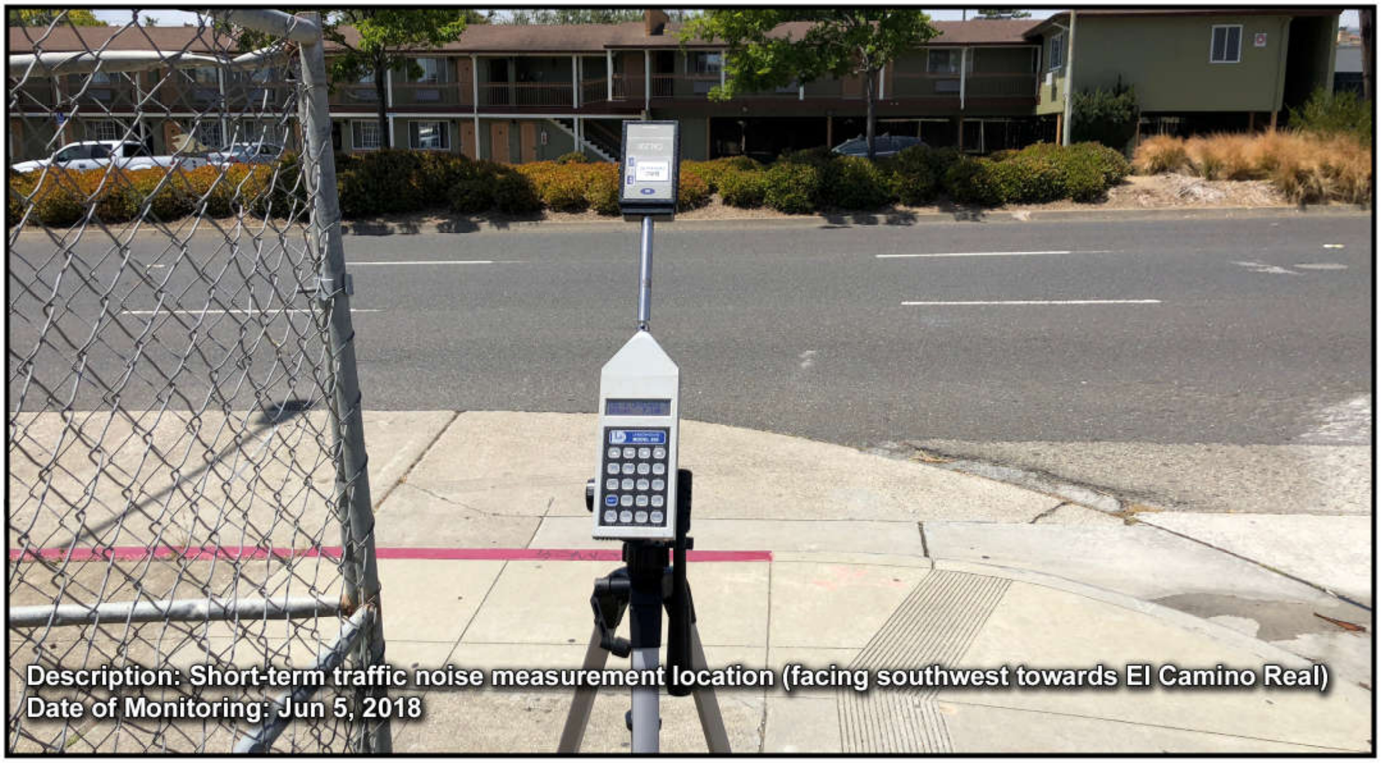
| | |
|---|---|
| **Acoustics** | The science of sound. |
| **Ambient Noise** | The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study. |
| **Attenuation** | The reduction of an acoustic signal. |
| **A-Weighting** | A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response. |
| **Decibel or dB** | Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. |
| **CNEL** | Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging. |
| **Frequency** | The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz. |
| **Ldn** | Day/Night Average Sound Level. Similar to CNEL but with no evening weighting. |
| **Leq** | Equivalent or energy-averaged sound level. |
| **Lmax** | The highest root-mean-square (RMS) sound level measured over a given period of time. |
| **Loudness** | A subjective term for the sensation of the magnitude of sound. |
| **Masking** | The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound. |
| **Noise** | Unwanted sound. |
| **Peak Noise** | The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level. |
| **$RT_{60}$** | The time it takes reverberant sound to decay by 60 dB once the source has been removed. |
| **Sabin** | The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin. |
| **SEL** | A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period. |
| **Threshold of Hearing** | The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing. |
| **Threshold of Pain** | Approximately 120 dB above the threshold of hearing. |

## Appendix B

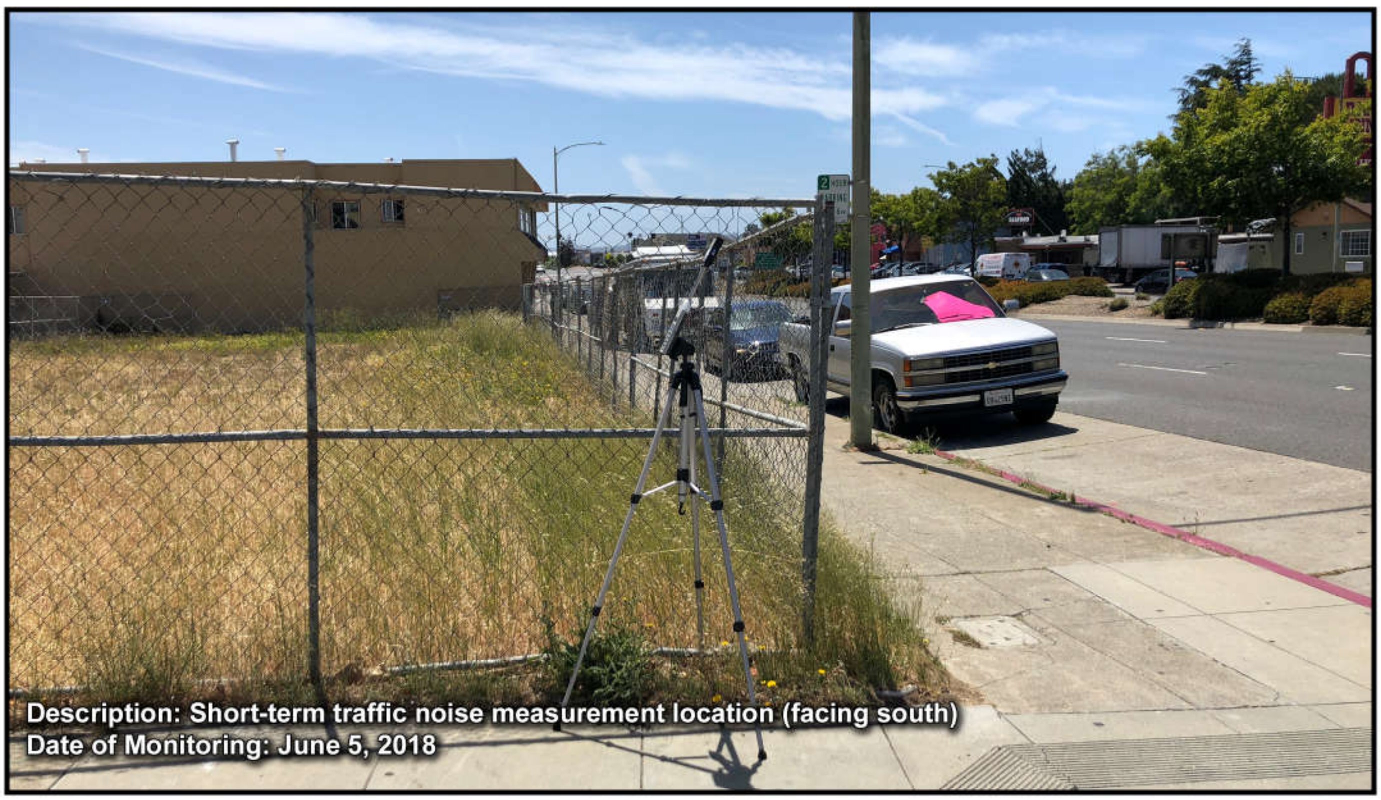
**Typical A-Weighted Sound Levels of Common Noise Sources**



# Appendix C
Photographs of Short-Term Traffic Noise Measurement Location
San Bruno Hotel - San Bruno, California



Description: Short-term traffic noise measurement location (facing southwest towards El Camino Real)
Date of Monitoring: Jun 5, 2018



Description: Short-term traffic noise measurement location (facing south)
Date of Monitoring: June 5, 2018

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**Appendix D**

## FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
## Calibration Worksheet

**Project Information:**

Job Number: 2018-109
Project Name: San Bruno Hotel
Roadway Tested: El Camino Real
Test Location: Site 1
Test Date: June 5, 2018

**Weather Conditions:**

Temperature (Fahrenheit): 59
Relative Humidity: 61%
Wind Speed and Direction: W 18mph
Cloud Cover: Partly Cloudy

**Sound Level Meter:**

Sound Level Meter: LDL Model 820 (BAC #6)
Calibrator: LDL Model CAL200
Meter Calibrated: Immediately before
Meter Settings: A-weighted, slow response

**Microphone:**

Microphone Location: On project site
Distance to Centerline (feet): 65
Microphone Height: 5 feet above ground
Intervening Ground (Hard or Soft): **Soft**
Elevation Relative to Road (feet): 5

**Roadway Condition:**

Pavement Type Asphalt
Pavement Condition: Good
Number of Lanes: 6
Posted Maximum Speed (mph): 35

**Test Parameters:**

Test Time: 12:07 PM
Test Duration (minutes): 15
Observed Number Automobiles: 513
Observed Number Medium Trucks: 7
Observed Number Heavy Trucks: 0
Observed Average Speed (mph): 40

**Model Calibration:**

Measured Average Level ($L_{eq}$): 67.7
Level Predicted by FHWA Model: 66.6
***Difference: -1.1 dB***

**Conclusions:**

The FHWA Model was found to accurately predict El Camino Real traffic noise levels within approximately 1 dB at the the project site.

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**Appendix E**

# FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
# Noise Prediction Worksheet

**Project Information:**

| | |
|---|---|
| Job Number: | 2018-109 |
| Project Name: | San Bruno Hotel |
| Roadway Name: | El Camino Real |

**Traffic Data:**

| | |
|---|---|
| Year: | Future |
| Average Daily Traffic Volume[1]: | 45,000 |
| Percent Daytime Traffic: | 80 |
| Percent Nighttime Traffic: | 20 |
| Percent Medium Trucks (2 axle): | 2 |
| Percent Heavy Trucks (3+ axle): | 1 |
| Assumed Vehicle Speed (mph): | 35 |
| Intervening Ground Type (hard/soft): | **Soft** |

**Traffic Noise Levels:**

| | | | | ----------------- $L_{dn}$, dB ------------------ | | | |
|---|---|---|---|---|---|---|---|
| **Location** | **Description** | **Distance** | **Offset (dB)[2]** | **Autos** | **Medium Trucks** | **Heavy Trucks** | **Total** |
| 1 | Building facade - 1st floor | 90 | -3 | 63 | 56 | 57 | 65 |
| 2 | Building facade - 2nd floor | 50 | 3 | 73 | 66 | 67 | 75 |
| 3 | Building facade - 3rd floor | 50 | 5 | 75 | 68 | 69 | 77 |

**Traffic Noise Contours (No Calibration Offset):**

| $L_{dn}$ Contour, dB | Distance from Centerline, (ft) |
|---|---|
| 75 | 30 |
| 70 | 66 |
| 65 | 142 |
| 60 | 305 |

**Notes:**

1. Average Daily Traffic Volume was conservatively estimated by multiplying existing traffic volumes by 1.5. Existing traffic counts were obtained from the Cal Trans Traffic Volumes (Date: 2016; ADT: 30,000 (El Camino Real - From San Mateo Avenue to Center Street); (http://www.dot.ca.gov/trafficops/census/volumes2016).
2. Offsets of +3 dB (2nd floor) and +5 dB (3rd floor) were applied to upper-floor facades due to reduced ground absorption at elevated levels. An offset of -3 dB was applied at nearest guestroom on the 1st floor due to reduced exposure to El Camino Real (north side of building).

# Sound Insulation Prediction (v8.0.11)



- Key No. 0575

Margin of error is generally within STC +/- 3 dB

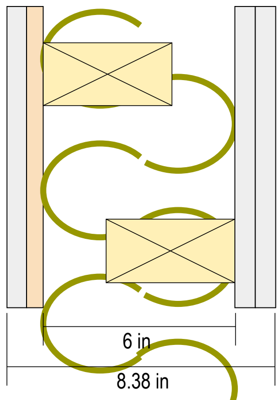
Job Name:

Job No.:2018-10 | Page No.:

Date: 27 Jul 18 | Initials:BAC-1

Notes:

File Name: Unit Separation Wall.ixl




STC 56

OITC 45

## System description

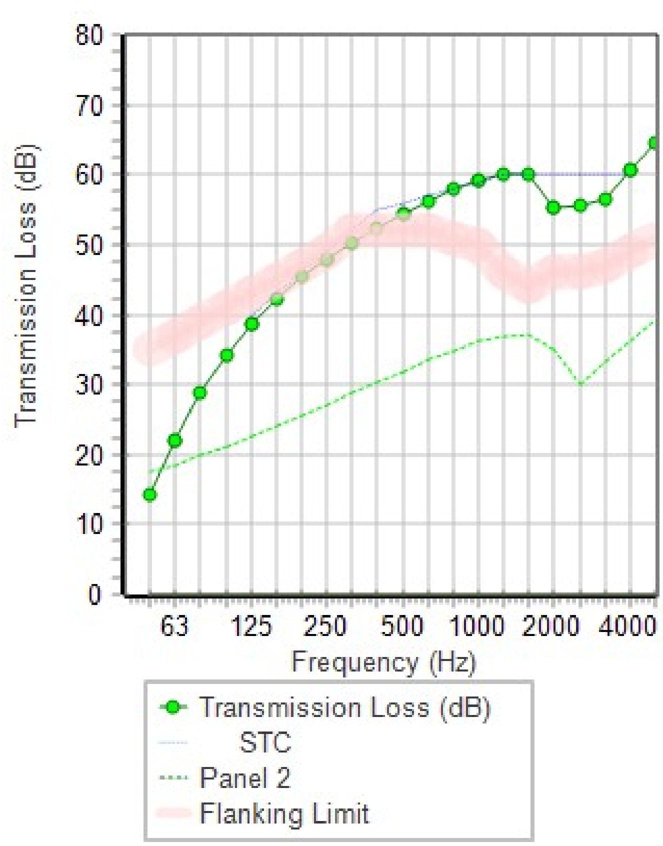
Panel 1 : 1 x 0.63 in Type X Gypsum Board + 1 x 0.50 in Plywood

Cavity: Staggered stud: Stud spacing 16 in , Infill Fibreglass (10kg/m3) Thickness 6.0 in (ρ:10 lbs/ft3, Rf:4000 Pa.s/m2 )
Panel 2 + 2 x 0.63 in Type X Gypsum Board (ρ:43.08 lbs/ft3,E:0.27psi*10^6,η:0.01, ps:2.25 lb/ft2, fc:2506 Hz)

Mass-air-mass resonant frequency =42 Hz

| frequency (Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 14 | |
| 63 | 22 | 18 |
| 80 | 29 | |
| 100 | 34 | |
| 125 | 39 | 37 |
| 160 | 42 | |
| 200 | 45 | |
| 250 | 48 | 47 |
| 315 | 50 | |
| 400 | 52 | |
| 500 | 54 | 54 |
| 630 | 56 | |
| 800 | 58 | |
| 1000 | 59 | 59 |
| 1250 | 60 | |
| 1600 | 60 | |
| 2000 | 55 | 57 |
| 2500 | 56 | |
| 3150 | 57 | |
| 4000 | 61 | 59 |
| 5000 | 65 | |

Panel Size 8.9x13 ft; Mass 8.5 lb/ft2



# Sound Insulation Prediction (v8.0.11)



- Key No. 0575

Margin of error is generally within STC +/- 3 dB

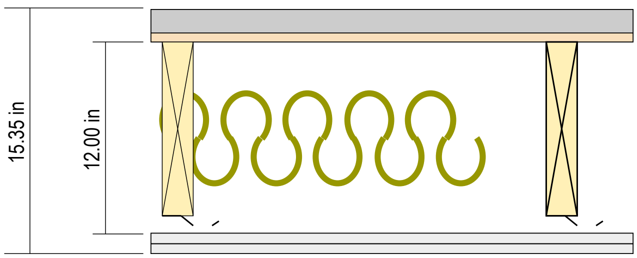
Job Name:

Job No.:2018-10 Page No.:

Date: 27 Jul 18 Initials:BAC-1

File Name: Floor-Ceiling.ixl

Notes:




STC 62

OITC 58

## System description

Panel 1 : 1 x 1.50 in Gypcrete + 1 x 0.60 in Plywood

Cavity: Resilient clip or channel: Stud spacing 24 in , Infill Fibreglass (10kg/m3) Thickness 6 in (ρ:10 lbs/ft3, Rf:4000 Pa.s/m2 )
Panel 2 + 2 x 0.63 in Type C Gypsum Board (ρ:48.94 lbs/ft3,E:0.35psi*10^6,η:0.01, ps:2.55 lb/ft2, fc:2326 Hz)

Mass-air-mass resonant frequency =21 Hz

| frequency (Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 39 | |
| 63 | 43 | 42 |
| 80 | 46 | |
| 100 | 49 | |
| 125 | 52 | 51 |
| 160 | 54 | |
| 200 | 56 | |
| 250 | 58 | 58 |
| 315 | 60 | |
| 400 | 61 | |
| 500 | 63 | 62 |
| 630 | 63 | |
| 800 | 62 | |
| 1000 | 57 | 59 |
| 1250 | 59 | |
| 1600 | 61 | |
| 2000 | 61 | 62 |
| 2500 | 63 | |
| 3150 | 70 | |
| 4000 | 74 | 73 |
| 5000 | 78 | |

Panel Size 8.9x13 ft; Mass 20.3 lb/ft2