Traffic Noise Analysis

Anton Hacienda Apartments

Pleasanton, California

BAC Job # 2012-075

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January 22, 2013

Exhibit B6
PUD-81-30-87D
Received April 9, 2013

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Introduction

The Anton Hacienda Apartments project site is located in the City of Pleasanton, just south of the intersection of Stoneridge Drive and West Las Positas Boulevard. Traffic on West Las Positas Boulevard is considered to be a potentially significant noise source affecting the project site. As a result, the City of Pleasanton has requested an acoustical analysis to determine whether future traffic noise levels at the project site would exceed acceptable limits. This analysis has been prepared to show compliance with the City of Pleasanton Noise Element standards for acceptable exterior and interior noise levels in multi-family residential developments, as well as noise mitigation measures included in the General Plan Amendment and Rezonings Final Supplemental Environmental Impact Report (ESA, January 2012). Figure 1 shows the project site location and Figure 2 shows the proposed project site plan.

Background on Noise and Acoustical 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 are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz).

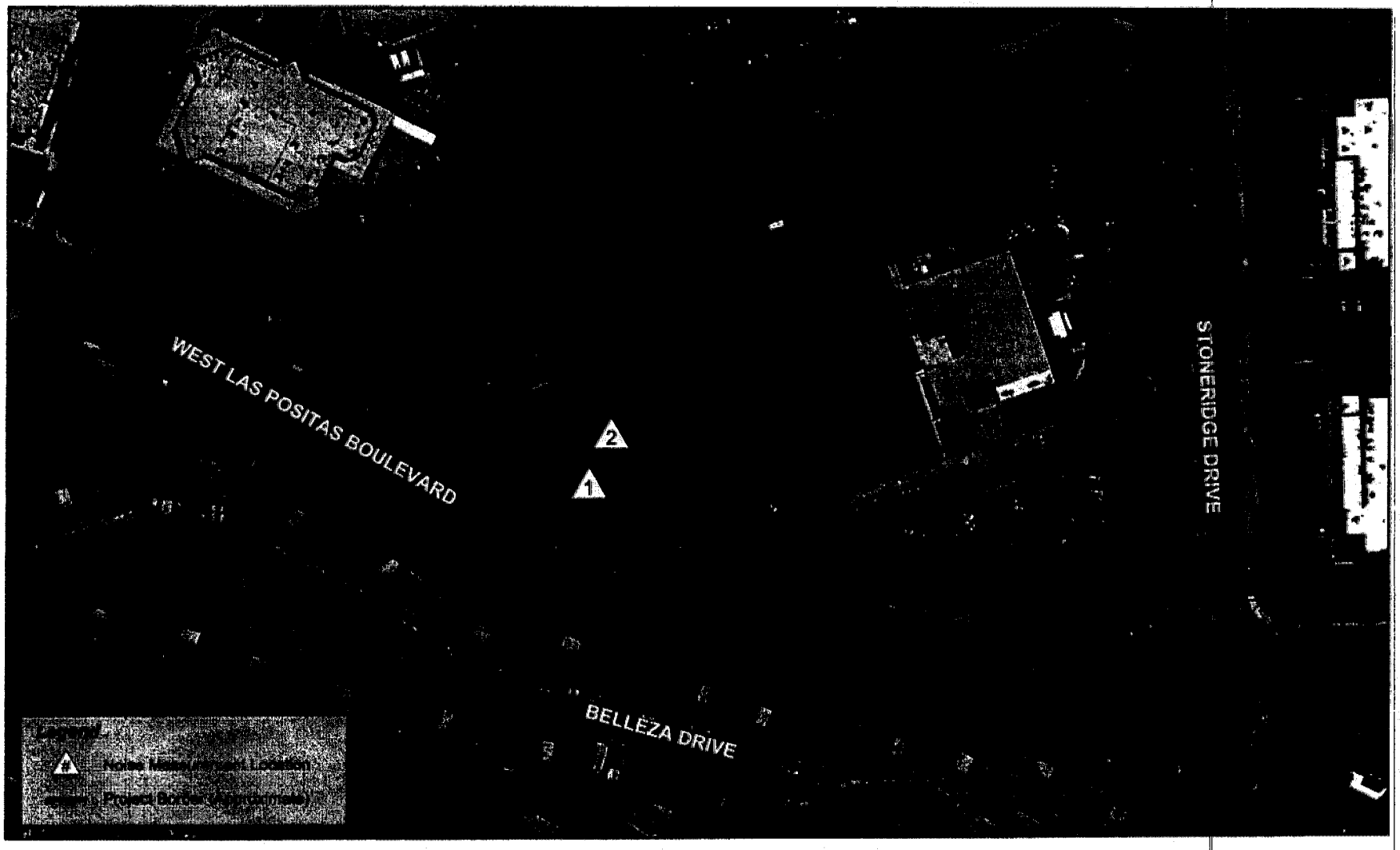
Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure), as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. 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 decibel levels correspond closely to human perception of relative loudness.

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 a standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels. Definitions of acoustical terminology are contained in Appendix A.

Figure 1

Anton Hacienda Apartments - Pleasanton, California

Project Area and Traffic Noise Level Measurement Locations



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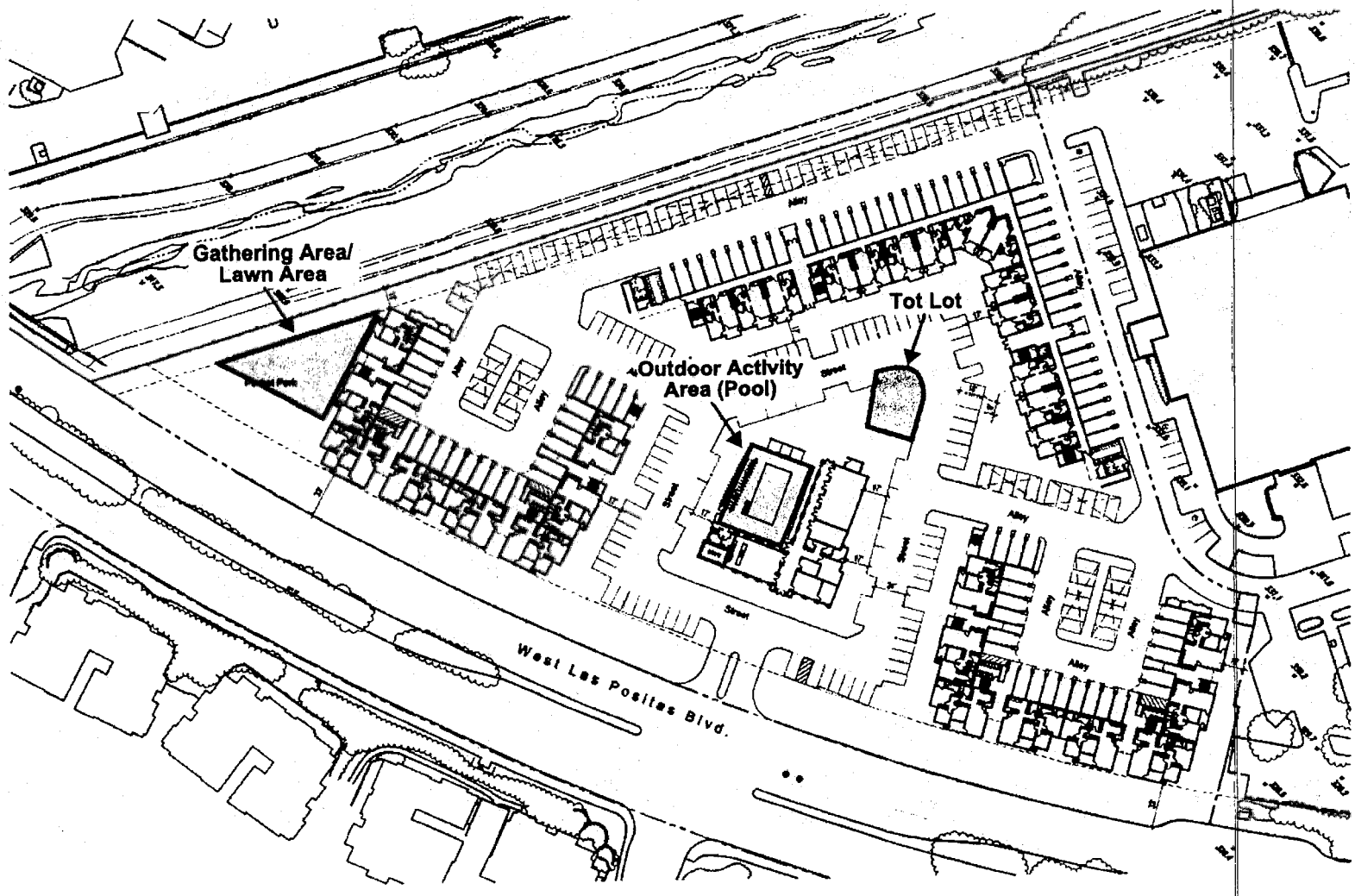
Scale (feet)
0 100 200

Figure 2

Anton Hacienda Apartments - Pleasanton, California

Proposed Project Site Plan



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Scale (feet)
0 60 120

Criteria for Acceptable Noise Exposure

City of Pleasanton Noise Element

The Noise Element of the Pleasanton General Plan, adopted July 21, 2009, contains Noise Compatibility Guidelines to ensure that City residents are not subjected to noise beyond acceptable levels. The Noise Element establishes 45 and 65 dB L_{dn} as being acceptable interior and exterior noise levels, respectively, for new multi-family residential uses affected by traffic noise sources. It should be noted that the exterior noise standards are applied at the common outdoor activity area of multi-family residential developments such as this project, not at individual patios or balconies.

General Plan Amendment and Rezonings Final Supplemental EIR

The General Plan Amendment and Rezonings Final Supplemental EIR contains noise mitigation measures which would be applicable to this project. The applicable measures are provided below:

> **Mitigation Measure 4.J-5a:** Prior to PUD approval, if a potential site for rezoning would add traffic noise in excess of 55 dBA as described in Table 4.J-6, the project applicant shall conduct an off-site noise study to determine the project's contribution to off-site roadway noise and contribute its fair-share to mitigate the established noise impact.
>
> **Mitigation Measure 4.J-5c:** Any locations of outdoor activity for sensitive uses associated with the project site shall be designed so that the noise exposure from traffic does not exceed 65dB Ldn at these activity areas. This shall be done thru site orientation (i.e., location of activity areas away from roadways or shielded by project buildings) or with the inclusion of appropriate noise barriers. Prior to PUD approval before building permits are issued, the project applicant shall be required to submit an acoustical analysis demonstrating that outdoor activity spaces associated with sensitive uses do not exceed 65 dB Ldn within these spaces
>
> **Mitigation Measure 4.J-6a:** For all of the potential sites for rezoning the City shall require site-specific acoustical assessments to determine noise exposure, impact, and mitigation regarding non-transportation sources. Noise exposure shall be mitigated to satisfy the applicable City Code criterion using appropriate housing site design.
>
> **Mitigation Measure 4.J-6c:** For all of the potential sites for rezoning, the City shall require a noise disclosures and noise complaint procedures for new residents at the project site. The requirement shall include a) a disclosure of potential noise sources in the project vicinity; b) establish procedures and a contact phone number for a site manager the residents can call to address any noise complaints.

Mitigation Measure 4.J-9: Prior to PUD approval if a potential site for rezoning would add traffic noise in excess of 55 dBA as described in Table 4.J-7, the project applicant shall conduct an off-site noise study to determine the project contribution to offsite roadway noise and contribute its fair-share to mitigate the established noise impact.

Evaluation of West Las Positas Boulevard Future Traffic Noise Levels

Traffic Noise Prediction Methodology:

The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) with the Calveno vehicle noise emission curves was used to predict traffic noise levels at the project site.

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. As a result, Bollard Acoustical Consultants, Inc. conducted a careful calibration of the FHWA Model through site-specific traffic noise level measurements and concurrent traffic counts.

This calibration process was performed at two locations on the project site on December 19th, 2012. The traffic noise measurement locations are shown on Figure 1. The detailed results of this procedure are provided in Appendix B. The FHWA Model was found to over-predict traffic noise levels at the measurement sites by approximately 3 to 5 dB. The shielding provided by the existing property line landscaping (+3 feet relative to roadway) and the depressed project site relative to West Las Positas Boulevard are believed to be the cause of the over-prediction. As a result, a -3 dB offset was applied to the prediction of future traffic noise levels at the proposed outdoor activity areas. However, in order to provide conservative estimates of future traffic noise exposure at the elevated second or third-floor building facades, 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 at the Project Site:

The FHWA Model was used with future traffic data to predict future traffic noise levels at both the proposed building façade and at the proposed outdoor activity areas (pool, tot lot, and lawn gathering area) of the Anton Hacienda Apartments. Future traffic volumes (Year 2025 buildout) on West Las Positas Boulevard were obtained from the City of Pleasanton General Plan in the form of PM Peak Hour volumes. The obtained future PM Peak Hour was multiplied by a factor of 10 to conservatively estimate the future Average Daily Traffic (ADT) volume. The FHWA Model inputs and predicted future traffic noise levels at the project site are shown in Appendix C. The predicted future traffic noise levels are summarized below in Table 1.

Table 1
Predicted Future Traffic Noise Levels
Anton Hacienda Apartments – City of Pleasanton, California

Roadway	Description	Dist. From Centerline	L_{dn}, dB
West Las Positas Boulevard	Nearest Building Facades	80 ft.	69
	Swimming Pool Area	180 ft.	60
	Tot Lot	210 ft.	59
	Lawn / Gathering Area with Seating	110	64

Note: A complete listing of FHWA Model inputs and results is provided in Appendix C.

The Table 1 data indicate that future traffic noise levels at the proposed outdoor activity areas of the development are predicted to be in compliance with the 65 dB L_{dn} exterior noise level standard applied by the City of Pleasanton to the outdoor activity areas of new multi-family residential developments. It is important to note that the future traffic noise levels at the proposed pool and tot-lot areas shown in Table 1 did not take into consideration any additional traffic noise level attenuation that would be provided by the intervening structure (see Figure 2). As a result, actual noise levels at the pool and tot lot areas are expected to be well below 60 dB Ldn. Even without consideration of this shielding, predicted future traffic noise levels at all outdoor activity areas of the proposed development are predicted to comply with City noise standards and no further mitigation measures would be warranted for this aspect of the project.

The Table 1 data indicate that future traffic noise levels at the nearest building facades of the proposed development would be expected to be 69 dB L_{dn}. A discussion of predicted interior future traffic noise levels is provided below.

Predicted Future Interior Traffic Noise Levels at the Project Site:

According to Table 1, the predicted future L_{dn} at the first-floor facades of the Anton Hacienda residences facing West Las Positas Boulevard would be approximately 69 dB. Due to reduced ground absorption of sound at elevated locations, traffic noise levels are expected to be approximately 2 dB higher at second and third floor facades (71 dB L_{dn}). Given a future worst-case exterior noise level of 71 dB L_{dn}, a building facade noise reduction of 26 dB would be required to achieve an interior noise level of 45 dB L_{dn}.

Standard residential construction (wood siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof), results in an exterior to interior noise reduction of at least 25 dB with windows closed and approximately 15 dB with windows open. Therefore, standard construction would be acceptable for shielded first-floor facades, but would fail to provide the required noise reduction at elevated (unshielded) second-floor facades. To achieve the required degree of noise reduction at the second floor facades located adjacent to West Las Positas Boulevard, all second-floor windows from which West Las Positas Boulevard is visible should be upgraded to an STC rating of 30. In addition, air conditioning should be provided to allow the occupants to close doors and windows as desired for additional acoustical isolation.

Predicted Project-Related Traffic Noise Increase

As noted in Mitigation Measure 4.J-5a, if a potential site for rezoning would add traffic noise in excess of 55 dBA as described in Table 4.J-6, the project applicant shall conduct an off-site noise study to determine the project's contribution to off-site roadway noise and contribute its fair-share to mitigate the established noise impact.

According to Table 4.J-6 of the General Plan Amendment and Rezonings Draft EIR, the project-related traffic noise increase on West Los Positas Blvd, East of Hacienda Drive, is 0 dB Ldn. The project-generated noise levels would need to be 10 dB below existing traffic noise levels in order for the increase due to the project to be reported as 0 dB. Given a reported existing traffic noise level of 63 dB Ldn for this segment, it follows that project-only traffic noise levels must be 53 dB Ldn or less. Because the project would not add traffic noise in excess of 55 dBA, an off-site noise study would not be required according to this mitigation measure.

Non-Transportation Noise Source Evaluation

The primary noise source affecting the project site is West Las Positas Boulevard traffic noise, which has been evaluated in the previous sections of this report. BAC site inspections revealed that the site is not appreciably affected by non-transportation noise sources. In addition, the proposed on-site pool and tot-lot areas are located sufficiently far away from neighboring uses so as not to present the potential for adverse noise impacts at neighboring uses. Finally, because the pool and tot-lot area usage will be limited to daytime hours, and because those areas are shielded from the other outdoor activity area on the project site (lawn area to the west), by intervening buildings, no adverse noise impacts associated with these fixed noise sources are expected at other sensitive areas of the proposed development.

Assessment of Compliance with EIR Mitigation Measures

Mitigation Measure 4.J-5a:
Based on information contained in the subject EIR, this analysis concludes that the project-generated traffic would generate off-site noise levels of approximately 53 dB Ldn or less. Because this level is below the 55 dBA mitigation measure threshold, the project applicant would not be required to conduct an off-site noise study to determine the project's contribution to off-site roadway noise.

Mitigation Measure 4.J-5c:
This analysis concludes that all proposed outdoor activity areas of the development would be exposed to future traffic noise levels below the 65 dB Ldn threshold identified in the subject EIR (see Table 1). As a result, no additional noise mitigation measures would be required for the proposed outdoor activity areas of this project.

Mitigation Measure 4.J-6a:
This analysis concludes that the project site is not adversely affected by off-site, non-transportation, noise sources, and that the proposed non-transportation noise sources associated with the project would not adversely affect other sensitive uses located either on-site or off-site. As a result, no additional noise mitigation measures would be required for this aspect of the project.

Mitigation Measure 4.J-6c: For all of the potential sites for rezoning, the City shall require a noise disclosures and noise complaint procedures for new residents at the project site. The applicant shall be responsible for providing such disclosures and developing complaint procedures for new residents of the project site.

Mitigation Measure 4.J-9:
Based on information contained in the subject EIR, this analysis concludes that the project-generated traffic would generate off-site noise levels of approximately 53 dB Ldn ~~or less. Because this level is below the 55 dBA mitigation measure threshold, the~~ project applicant would not be required to conduct an off-site noise study to determine the project's contribution to off-site roadway noise.

Conclusions

This analysis concludes that the project, as proposed, satisfies the applicable noise mitigation measures of the General Plan Amendment and Rezoning Final Supplemental Environmental Impact Report. The following specific additional noise mitigation measures are recommended to ensure compliance with the City of Pleasanton's 45 dB L_{dn} interior noise level standard for new multi-family residential developments.

- All second and third-floor windows of the residences proposed adjacent to West Las Positas Boulevard from which West Las Positas Boulevard is visible should be upgraded to a Sound Transmission Class (STC) rating of 30.

- Mechanical ventilation (air conditioning) should be provided for all residences in this development to allow the occupants to close doors and windows as desired to achieve compliance with the applicable interior noise level criteria.

These conclusions are based on the West Las Positas Boulevard traffic assumptions cited in Appendix C and on noise reduction data for standard residential dwellings. Deviations from the Appendix C data, or the project site plans shown in Figure 2, 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 residential 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.

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-1

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

Project Information:

Job Number: 2012-075
~~Project Name: Anton Hacienda Apartments~~
Roadway Tested: West Las Positas Boulevard
Test Location: Site 1
Test Date: December 19, 2012

Weather Conditions:

Temperature (Fahrenheit): 45
Relative Humidity: Moderate
Wind Speed and Direction: Calm
Cloud Cover: Cloudy

Sound Level Meter:

Sound Level Meter: LDL Model 820 #8
Calibrator: LDL Model CAL200
Meter Calibrated: Immediately before
Meter Settings: A-weighted. slow response

Microphone:

Microphone Location: On project site
Distance to Centerline (feet): 80
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): 40

Test Parameters:

Test Time: 10:00 AM
Test Duration (minutes): 15
Observed Number Automobiles: 103
Observed Number Medium Trucks: 1
Observed Number Heavy Trucks: 2
Observed Average Speed (mph): 40

Model Calibration:

Measured Average Level (L_{eq}): 54.8
Level Predicted by FHWA Model: 59.7
Difference: ***4.9 dB***

Conclusions:

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Appendix B-2

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

Project Information:

Job Number: 2012-075
Project Name: Anton Hacienda Apartments
Roadway Tested: West Las Positas Boulevard
Test Location: Site 2
Test Date: December 19, 2012

Weather Conditions:

Temperature (Fahrenheit): 45
Relative Humidity: Moderate
Wind Speed and Direction: Calm
Cloud Cover: Cloudy

Sound Level Meter:

Sound Level Meter: LDL Model 820 #9
Calibrator: LDL Model CAL200
Meter Calibrated: Immediately before
Meter Settings: A-weighted, slow response

Microphone:

Microphone Location: On project site
Distance to Centerline (feet): 180
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): 40

Test Parameters:

Test Time: 10:00 AM
Test Duration (minutes): 15
Observed Number Automobiles: 103
Observed Number Medium Trucks: 1
Observed Number Heavy Trucks: 2
Observed Average Speed (mph): 40

Model Calibration:

Measured Average Level (L_{eq}): 51.0
Level Predicted by FHWA Model: 54.4
Difference: ***3.4 dB***

Conclusions:

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Appendix C

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

Project Information:

Job Number: 2012-075
Project Name: Anton Hacienda Apartments
Roadway Name: West Las Positas Boulevard

Traffic Data:

Year:	2025
Average Daily Traffic Volume:	37,000
Percent Daytime Traffic:	83
Percent Nighttime Traffic:	17
Percent Medium Trucks (2 axle):	1
Percent Heavy Trucks (3+ axle):	1
Assumed Vehicle Speed (mph):	40
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				----------L_{dn}, dB----------			
Location:	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
1	Nearest building façade	80	0	68	57	61	69
2	Pool Area	180	-3	59	48	53	60
3	Tot Lot	210	-3	58	47	52	59
4	Lawn - Gathering Area	110	-3	62	51	56	64

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	31
70	66
65	142
60	305

Notes: The predicted noise levels at the outdoor areas of the development satisfy the City of Pleasanton 65 dB Ldn exterior noise level standards without the need for additional mitigation.

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