

# Environmental Noise Assessment

## Vintara Park Residential Development

City of Elk Grove, California

BAC Job # 2005-602


Prepared For:

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## INTRODUCTION

The proposed Vintara Park Residential project consists of the development of single-family residential uses north of Bond Road and west of Waterman Road in the City of Elk Grove, California. The project site is bordered by existing residential uses. Future traffic on Bond Road and Waterman Road are considered to be potentially significant noise sources which could affect the project design. As a result, Bollard Acoustical Consultants, Inc. was retained by the project applicant to prepare this analysis of potential noise impacts and to provide mitigation measures where appropriate. Figure 1 shows the project site plan.

### Acoustic Terminology

Noise is often defined simply as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon. Researchers have generally agreed that A-weighted sound pressure levels (sound levels) are very well correlated with community reaction to noise. The unit of sound level measurement is the decibel (dB), sometimes expressed as dBA. Variations in sound levels over time are represented by statistical descriptors, and by time-weighted composite noise metrics such as the Day-Night Average Level (Ldn), or the Community Noise Equivalent Level (CNEL). Throughout this analysis, A-weighted sound pressure levels will be used to describe community noise unless otherwise indicated.

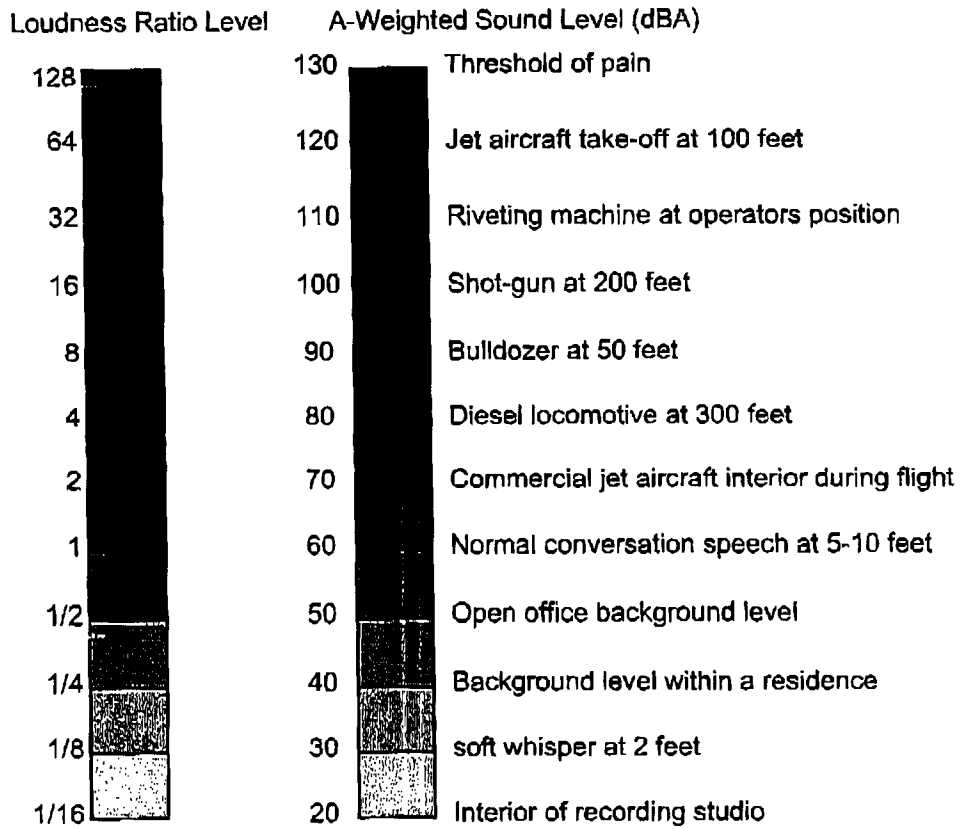
The decibel notation used for sound levels describes a logarithmic relationship of acoustical energy, so that sound levels cannot be added or subtracted in the conventional arithmetic manner. For example, a doubling of acoustical energy results in a change of 3 decibels (dBA), which is usually considered to be barely perceptible. A 10-fold increase in acoustical energy yields a 10 decibel change, which is subjectively like a doubling of loudness. Table 1 illustrates common noise levels associated with various sources.

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 (Leq), which corresponds to a steady-state sound level containing the same total energy as a time-varying signal over a given period (usually one hour). The Leq is the foundation of the composite noise descriptors such as Ldn and CNEL, and shows very good correlation with community response to noise.

Appendix A provides definitions of acoustical terms used in this report.



**Table 1**  
**Typical A-Weighted Sound Levels of Common Noise Sources**



## CRITERIA FOR ACCEPTABLE NOISE EXPOSURE

### City of Elk Grove General Plan:

The Elk Grove General Plan Noise Element establishes a 60 dB Ldn exterior noise level criterion as being acceptable for new residential uses affected by transportation noise sources. Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn or less using a practical application of the best available noise reduction measures, an exterior noise level of up to 65 dB Ldn may be allowed provided that available exterior noise reduction measures have been implemented and interior noise levels are in compliance with the applicable interior noise level standards shown in Table 2.

**Table 2  
Maximum Allowable Noise Exposure  
Transportation Noise Sources**

Land Use	Outdoor Activity Areas <sup>1</sup> Ldn/CNEL, dB	Interior Spaces	
		Ldn/CNEL, dB	Leq, dB
Residential	60 <sup>2</sup>	45	–
Residential subject to noise from railroad tracks, aircraft overflights, or similar noise sources which produce clearly identifiable, discrete noise events (the passing of a single train, as opposed to relatively steady noise sources such as roadways)	60 <sup>2</sup>	40 <sup>3</sup>	–
Playgrounds, Neighborhood Parks	70	–	--

<sup>1</sup>Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use.

Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

<sup>2</sup>Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn/CNEL or less using a practical application of the best available noise reduction measures, an exterior noise level of up to 65 dB Ldn/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

<sup>3</sup>The intent of this noise standard is to provide increased protection against sleep disturbance for residences located near railroad tracks.

## **EVALUATION OF FUTURE TRAFFIC NOISE LEVELS**

### **Traffic Noise Prediction Methodology:**

To describe projected noise levels due to traffic, Bollard Acoustical Consultants, Inc. employs the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108). The model is based upon the Calvenno reference noise 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.

On August 18, 2005, Bollard Acoustical Consultants, Inc. conducted noise level measurements and concurrent counts of Waterman Road traffic at the project site. Bond Road was not calibrated due to construction activities in progress during the site visit. The purpose of the short-term traffic noise level measurements is to determine the accuracy of the FHWA model in describing the existing traffic noise at the project site, accounting for shielding from local topography, actual travel speeds, and roadway grade. Noise measurement results were compared to the FHWA model results by entering the observed traffic volume, speed and distance as inputs to the FHWA model. Based upon the calibration results shown in Appendix B, no offsets to the FHWA model were deemed necessary.

**Predicted Future Traffic Noise Levels at the Project Site:**

Average daily traffic volumes for future conditions (2025) were obtained from traffic data, used for the Elk Grove General Plan Noise Element. The day/night distribution and truck percentages were derived from Bollard Acoustical Consultants, Inc. file data for similar roadways. Estimated future traffic speed assumptions were based on posted speed limits and field observations. The FHWA Model inputs are contained in Table 3 and Appendix C.

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**Table 3**  
**FHWA Traffic Noise Prediction Model Inputs**  
**Vintara Park Project – Elk Grove, California**

Roadway	Future ADT	Day/Night	Medium Trucks	Heavy Trucks	Speed
Bond Road	36,317	85%/15%	1%	1%	45
Waterman Road	23,843	85%/15%	1%	1%	45

Source: City of Elk Grove and Bollard Acoustical Consultants, Inc. file data.

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The FHWA model was used with the Table 3 data to predict future traffic noise levels at the project site. The results of that analysis are shown in Table 4.

**Table 4**  
**Predicted Future Traffic Noise Levels**  
**Vintara Park Project – Elk Grove, California**

Location	Noise Level, Ldn	Distance to Noise Contours <sup>1</sup>	
		60 dB Ldn	65 dB Ldn
<b>Bond Road</b>			
Nearest Building Facades/Backyards	70 dB	348'	162'
<b>Waterman Road</b>			
Nearest Building Facades/Backyards - 75' setback	68 dB	263'	122'
Nearest Building Facades/Backyards - 150' setback	64 dB		

<sup>1</sup> Predicted distances to noise level contours are from the roadway centerline.

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

The Table 4 data indicate that the residences proposed nearest to Bond Road and Waterman Road would be exposed to future traffic noise levels which exceed the City of Elk Grove 60 dB Ldn exterior noise level standard.

To achieve compliance with the City of Elk Grove 60 dB Ldn exterior noise level standard, Bollard Acoustical Consultants, Inc. evaluated the effectiveness of a solid noise barrier for reducing future traffic noise levels at the proposed residential uses adjacent to Bond Road and Waterman Road.

The FHWA Model traffic noise barrier insertion loss methodology was used to determine the noise reduction which would be provided by a noise barrier of various heights. The summarized results of the FHWA barrier analysis for the receivers located nearest to Bond Road and Waterman Road are contained in Table 5. The complete inputs and results of the barrier analysis are provided in Appendix D.

**Table 5**  
**Predicted Future Traffic Noise Levels with Various Noise Barrier Heights**  
**Vintara Park Project – Elk Grove, California**

Location	Distance (feet)	Unmitigated Exterior Noise Level, Ldn	Barrier Height (feet)	Predicted Exterior Noise Level, Ldn
Outdoor Areas Adjacent to Bond Road	80	70	6	63 dB
			7	62 dB
			8	61 dB
			9	60 dB
Outdoor Areas Adjacent to Waterman Road	75	68	6	62 dB
			7	61 dB
			8	60 dB
	150	64	6'	58 dB

Note: All barriers are assumed to be located at the property lines of the residential uses adjacent to Bond Road and Waterman Road. Barrier heights are relative to the proposed building pad elevations. Distances are measured from the roadway centerline.

The Table 5 data indicate that a barrier height of 9 feet would be required to reduce future Bond Road traffic noise levels to 60 dB Ldn or less at the adjacent proposed residential uses. The barrier could take the form of a masonry wall, earthen berm, or combination of the two.

The Table 5 data also indicate that a barrier height of 8 feet would be required to reduce future Waterman Road traffic noise levels to 60 dB Ldn or less at the adjacent proposed residential uses with a setback of 75 feet from the centerline of Waterman Road. The barrier could incrementally step down to a final height of 6 feet at a setback distance of 150 feet. The barrier could take the form of a masonry wall, earthen berm, or combination of the two.

### **Interior Traffic Noise Levels:**

The Table 4 data indicate that future Bond Road noise levels at unshielded first-floor locations of the nearest residences would be approximately 70 dB Ldn. Following construction of a property line noise barrier, future traffic noise levels at first floor facades will be approximately 60 dB Ldn. Due to reduced ground attenuation at elevated positions, second floor noise levels are generally 2-3 dB higher than unshielded first floor locations (72-73 dB Ldn).

To achieve compliance with the City of Elk Grove 45 dB Ldn interior noise level standard at exposed second floor rooms adjacent to Bond Road, building facade noise level reductions of approximately 28 dB would be required. At first floor facades, a building facade noise reduction of 15 dB would be required.

Standard residential construction (stucco, STC-28 windows, door weatherstripping, exterior wall insulation, composition plywood roof), results in an exterior to interior noise reduction of about 25 dB with windows closed, and approximately 15 dB with windows open. Therefore, standard construction would be acceptable for first floor facades since those facades would be shielded by the recommended property line noise barrier. However, improvements to second-floor bedroom window assemblies are recommended for the lots adjacent to Bond Road to achieve compliance with the City's 45 dB Ldn interior noise level standard.

To satisfy the interior noise level standard of 45 dB Ldn at the second floor rooms of the residences constructed adjacent to Bond Road, all second-floor bedroom windows from which the roadway is visible should have a minimum sound transmission class (STC) rating of 32.

STC rated 30 window assemblies are recommended for second floor rooms at the proposed residential uses closest to Waterman Road. Only the units with a setback distance of 90 feet or less would be required to have this upgrade.

As an alternative to window upgrades, a detailed interior noise analysis can be conducted when building plans become available. Specific interior mitigation measures, if required, could be made at that point.

Mechanical ventilation (air conditioning) should be provided to allow occupants to close doors and windows to achieve the desired traffic noise isolation.

## CONCLUSIONS

Portions of the Vintara Park project site will be exposed to future Bond Road and Waterman Road traffic noise levels which exceed the noise level standards applied to new residential developments by the City of Elk Grove. The following noise mitigation measures should be utilized to achieve compliance with the City's noise standards:

- A 9 foot tall noise barrier would be required along the south property lines of all proposed residential uses adjacent to Bond Road to reduce future traffic noise levels to 60 dB Ldn. The recommended barrier design is shown on Figure 1. Barriers can take the form of earthen berms, solid walls, or a combination of the two.
- An 8-foot tall noise barrier would be required to reduce future Waterman Road traffic noise levels to 60 dB Ldn or less at the adjacent proposed residential uses with a setback of 75 feet from the centerline of Waterman Road. The barrier could incrementally step down to a final height of 6 feet at a setback distance of 150 feet. The barrier could take the form of a masonry wall, earthen berm, or combination of the two.
- All second-floor windows of residences constructed adjacent to Bond Road, which have a view of the roadway, should have a minimum sound transmission class (STC) rating of 32. STC 30 rated window assemblies should be installed in all second floor windows of the proposed residential uses adjacent to Waterman Road. These measures are predicted to result in compliance with the City's 45 dB Ldn interior noise level standard.

As an alternative to window upgrades, a detailed interior noise analysis can be conducted when building plans become available. Specific interior mitigation measures, if required, could be specified at that time.

- Air conditioning should be included in all residences constructed in the Vintara Park development to allow occupants to close doors and windows as desired to achieve additional acoustic isolation from traffic noise in the project vicinity.

These conclusions are based on the site plan shown in Figure 1, Bollard Acoustical Consultants, Inc. site observations, and the traffic assumptions stated in this report. Changes to the site plan or deviations from the assumptions cited herein could cause future noise levels to differ from those predicted in this analysis. Bollard Acoustical Consultants, Inc. is not responsible for degradation in acoustic performance of the residential construction due to poor construction practices or failure to comply with applicable building code requirements.

## Appendix A Acoustical Terminology

<b>Acoustics</b>	The science of sound.
<b>Ambient Noise</b>	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.
<b>Attenuation</b>	The reduction of an acoustic signal.
<b>A-Weighting</b>	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
<b>Decibel or dB</b>	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.
<b>CNEL</b>	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.
<b>Frequency</b>	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
<b>L<sub>dn</sub></b>	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
<b>L<sub>eq</sub></b>	Equivalent or energy-averaged sound level.
<b>L<sub>max</sub></b>	The highest root-mean-square (RMS) sound level measured over a given period of time.
<b>Loudness</b>	A subjective term for the sensation of the magnitude of sound.
<b>Masking</b>	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
<b>Noise</b>	Unwanted sound.
<b>Peak Noise</b>	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.
<b>RT<sub>60</sub></b>	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
<b>Sabin</b>	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
<b>SEL</b>	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.
<b>Threshold of Hearing</b>	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
<b>Threshold of Pain</b>	Approximately 120 dB above the threshold of hearing.



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

Project Information: Job Number: 2005-602  
Project Name: Vintana Park Project  
Roadway Tested: Waterman Road  
Test Location: 1  
Test Date: August 18, 2005

Weather Conditions: Temperature (Fahrenheit): 80  
Relative Humidity: Dry  
Wind Speed and Direction: 5-10 S  
Cloud Cover: Clear

Sound Level Meter: Sound Level Meter: LDL Model 820  
Calibrator: LDL Model CA200  
Meter Calibrated: Immediately before and after test  
Meter Settings: A-weighted, slow response

Microphone: Microphone Location: Opposite Waterman Road from Project Site  
Distance to Centerline (feet): 75  
Microphone Height: 5 feet above ground  
Intervening Ground (Hard or Soft): **Soft**  
Elevation Relative to Road (feet): 0

Roadway Condition: Pavement Type Asphalt  
Pavement Condition: Good  
Number of Lanes: 2  
Posted Maximum Speed (mph): N/A

Test Parameters: Test Time: 11:49 AM  
Test Duration (minutes): 15  
Observed Number Automobiles: 75  
Observed Number Medium Trucks: 3  
Observed Number Heavy Trucks: 5  
Observed Average Speed (mph): 40

Model Calibration: Measured Average Level ( $L_{eq}$ ): 60.4  
Level Predicted by FHWA Model: 61.5  
**Difference: 1.1 dB**

Conclusions:



Appendix C-1  
**FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)**  
**Noise Prediction Worksheet**

**Project Information:**

Job Number: 2005-602  
 Project Name: Vintana Park Project  
 Roadway Name: Bond Road

**Traffic Data:**

Year: 2025  
 Average Daily Traffic Volume: 36,317  
 Percent Daytime Traffic: 85  
 Percent Nighttime Traffic: 15  
 Percent Medium Trucks (2 axle): 1  
 Percent Heavy Trucks (3+ axle): 1  
 Assumed Vehicle Speed (mph): 45  
 Intervening Ground Type (hard/soft): **Soft**

**Traffic Noise Levels:**

Location:	Description	Distance	Offset (dB)	L <sub>dn</sub> , dB			Total
				Autos	Medium Trucks	Heavy Trucks	
1	First row backyards/facades	80	0	69	57	61	70

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

L <sub>dn</sub> Contour, dB	Distance from Centerline, (ft)
75	35
70	75
65	162
60	348

**Notes:**



Appendix C-2  
**FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)**  
**Noise Prediction Worksheet**

**Project Information:**

Job Number: 2005-602  
 Project Name: Vintana Park Project  
 Roadway Name: Waterman Road

**Traffic Data:**

Year: 2025  
 Average Daily Traffic Volume: 23,843  
 Percent Daytime Traffic: 85  
 Percent Nighttime Traffic: 15  
 Percent Medium Trucks (2 axle): 1  
 Percent Heavy Trucks (3+ axle): 1  
 Assumed Vehicle Speed (mph): 45  
 Intervening Ground Type (hard/soft): **Soft**

**Traffic Noise Levels:**

Location:	Description	Distance	Offset (dB)	L <sub>dn</sub> , dB			Total
				Autos	Medium Trucks	Heavy Trucks	
1	Nearest Building Façades/Outdoor Areas - South End	75	0	67	56	60	68
2	Nearest Building Façades/Outdoor Areas - North End	150	0	63	51	55	64

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

L <sub>dn</sub> Contour, dB	Distance from Centerline, (ft)
75	26
70	57
65	122
60	263

**Notes:**

**Appendix D-1  
FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)  
Noise Barrier Effectiveness Prediction Worksheet**

**Project Information:** Job Number: 2005-602  
Project Name: Vintana Park Project  
Roadway Name: Bond Road  
Location(s): 1

**Noise Level Data:** Year: 2025  
Auto  $L_{dn}$ , dB: 69  
Medium Truck  $L_{dn}$ , dB: 57  
Heavy Truck  $L_{dn}$ , dB: 61

**Site Geometry:** Receiver Description: First row backyards/facades  
Centerline to Barrier Distance ( $C_1$ ): 60  
Barrier to Receiver Distance ( $C_2$ ): 20  
Automobile Elevation: 0  
Medium Truck Elevation: 2  
Heavy Truck Elevation: 8  
Pad/Ground Elevation at Receiver: 0  
Receiver Elevation<sup>1</sup>: 5  
Base of Barrier Elevation: 0  
Starting Barrier Height 6

**Barrier Effectiveness:**

Top of Barrier Elevation (ft)	Barrier Height <sup>2</sup> (ft)	L <sub>dn</sub> , dB				Barrier Breaks Line of Sight to...		
		Autos	Medium Trucks	Heavy Trucks	Total	Autos?	Medium Trucks?	Heavy Trucks?
6	6	62	51	56	63	Yes	Yes	Yes
7	7	61	50	56	62	Yes	Yes	Yes
8	8	60	49	55	61	Yes	Yes	Yes
9	9	59	48	54	60	Yes	Yes	Yes
10	10	58	47	53	59	Yes	Yes	Yes
11	11	57	46	52	58	Yes	Yes	Yes
12	12	56	45	51	57	Yes	Yes	Yes
13	13	55	44	50	57	Yes	Yes	Yes
14	14	55	43	49	56	Yes	Yes	Yes

**Notes:** 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)



8/30/2005  
2005-602 FHWA Bond Road

Appendix D-2

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

**Project Information:**

Job Number: 2005-602  
Project Name: Vintana Park Project  
Roadway Name: Waterman Road  
Location(s): 1

**Noise Level Data:**

Year: 2025  
Auto L<sub>dn</sub>, dB: 67  
Medium Truck L<sub>dn</sub>, dB: 56  
Heavy Truck L<sub>dn</sub>, dB: 60

**Site Geometry:**

Nearest Building Façades/Outdoor  
Receiver Description: Areas - South End  
Centerline to Barrier Distance (C<sub>1</sub>): 60  
Barrier to Receiver Distance (C<sub>2</sub>): 15  
Automobile Elevation: 0  
Medium Truck Elevation: 2  
Heavy Truck Elevation: 8  
Pad/Ground Elevation at Receiver: 0  
Receiver Elevation<sup>1</sup>: 5  
Base of Barrier Elevation: 0  
Starting Barrier Height 6

**Barrier Effectiveness:**

Top of Barrier Elevation (ft)	Barrier Height <sup>2</sup> (ft)	L <sub>dn</sub> , dB				Barrier Breaks Line of Sight to...		
		Autos	Medium Trucks	Heavy Trucks	Total	Autos?	Medium Trucks?	Heavy Trucks?
6	6	61	50	55	62	Yes	Yes	Yes
7	7	59	48	54	61	Yes	Yes	Yes
8	8	58	47	53	60	Yes	Yes	Yes
9	9	57	46	52	58	Yes	Yes	Yes
10	10	56	45	51	57	Yes	Yes	Yes
11	11	55	44	50	56	Yes	Yes	Yes
12	12	54	43	49	56	Yes	Yes	Yes
13	13	53	42	48	55	Yes	Yes	Yes
14	14	53	41	47	54	Yes	Yes	Yes

**Notes:** 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)



Appendix D-3  
**FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)**  
**Noise Barrier Effectiveness Prediction Worksheet**

**Project Information:**

Job Number: 2005-602  
 Project Name: Vintana Park Project  
 Roadway Name: Waterman Road  
 Location(s): 2

**Noise Level Data:**

Year: 2025  
 Auto  $L_{dn}$ , dB: 63  
 Medium Truck  $L_{dn}$ , dB: 51  
 Heavy Truck  $L_{dn}$ , dB: 55

**Site Geometry:**

Nearest Building Façades/Outdoor  
 Receiver Description: Areas - North End  
 Centerline to Barrier Distance ( $C_1$ ): 120  
 Barrier to Receiver Distance ( $C_2$ ): 30  
 Automobile Elevation: 0  
 Medium Truck Elevation: 2  
 Heavy Truck Elevation: 8  
 Pad/Ground Elevation at Receiver: 0  
 Receiver Elevation<sup>1</sup>: 5  
 Base of Barrier Elevation: 0  
 Starting Barrier Height 6

**Barrier Effectiveness:**

Top of Barrier Elevation (ft)	Barrier Height <sup>2</sup> (ft)	L <sub>dn</sub> , dB				Barrier Breaks Line of Sight to...		
		Autos	Medium Trucks	Heavy Trucks	Total	Autos?	Medium Trucks?	Heavy Trucks?
6	6	57	45	50	58	Yes	Yes	Yes
7	7	56	45	50	57	Yes	Yes	Yes
8	8	55	44	49	56	Yes	Yes	Yes
9	9	54	43	49	55	Yes	Yes	Yes
10	10	53	42	48	55	Yes	Yes	Yes
11	11	52	41	47	54	Yes	Yes	Yes
12	12	52	40	46	53	Yes	Yes	Yes
13	13	51	40	45	52	Yes	Yes	Yes
14	14	50	39	44	52	Yes	Yes	Yes

**Notes:** 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)

