Final

NOISE STUDY REPORT FOR INTERSTATE 5 NORTH COAST CORRIDOR WIDENING PROJECT

11-SD-5- KP R45.7/R87.9 (PM R28.4/R54.6)
11-SD-805- KP 43.6/46.5 (PM 27.1/28.9)

EA: 11-235800

Prepared for:

California Department of Transportation
District 11
4050 Taylor Street,
San Diego, CA 92110

April 2007

Prepared by:

PARSONS
100 WEST WALNUT STREET,
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April 2, 2007

Prepared by:

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Prepared By: _____ 4/2/07
Greg J. Berg — Date

Reviewed By: _____ 4/2/07
Areg Gharabegian, P.E. — Date

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MEMO to NOISE STUDY REPORT
INTERSTATE 5 NORTH COAST CORRIDOR PROJECT

For Noise Barrier S603 Option 1
August 2013

I-5 NCC Soundwalls S603A and S603B

The Noise Study Report is revised to recommend a revision to the original design of noise barrier S603 Option 1 in Noise Study report. The portion of soundwall that blocked coastal views has been assessed for removal and the soundwall would be constructed with a gap for the coastal view, creating S603A and S603B.

S603A station limits are 597+80 to 601+00

The gap station limits are 601+00 to 604+80.

S603B station limits are 604+80 to 608+15.

As shown in the attached Table receptors R6.6 through R6.9A would not receive feasible noise reduction. However, severely impacted receptors R6.4, R6.10 and R6.11 will receive feasible noise reduction.

The results of the analysis are shown in the attached two tables and two Figures.

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Via De La Valle to Lomas Santa Fe Drive - Southbound																	
R6.4A	MFR	67 E	67	72	B (67)	A/E	**67** R,T	**5**	66	6	65	7	65	7	64	8	S603A / R/W and S603B / Shoulder / R/W
R6.4 C	MFR	71 E	76	80	B (67)	A/E	**73** R,T	**7**	71	9	70	10	69	11	68	12	
R6.5	SFR	64 E	69	74	B (67)	A/E	**69** R,T	**5**	68	6	68	6	67	7	67	7	
R6.6 *	SFR	61 E	66	69	B (67)	A/E	68	1	68 T	1	68	1	67	2	67	2	
R6.7 *	SFR	64 M, ST6.3	69	71	B (67)	A/E	71 T	0	71	0	71	0	71	0	71	0	
R6.7A	SFR	64 E	69	68	B (67)	A/E	68 T	0	68	0	68	0	68	0	68	0	
R6.8	SCH	68 E, 8	73	70	B (67)	A/E	69 T	1	69	1	69	1	69	1	69	1	
R6.9	MFR	69 M, LT6.2	74	74	B (67)	A/E	71 T	3	70	4	**69** R	**5**	69	5	68	6	
R6.9A	MFR	67 E	73	73	B (67)	A/E	69 T	4	68	5	**68** R,5	**5**	67	6	66	7	
R6.10	SCH	75 E	73	76	B (67)	A/E	71	5	**70** R,T	**6**	69	7	68	8	67	9	
R6.11	SCH	76 M, ST6.7/CAL	74	75	B (67)	A/E	73	2	**70** R,T	**5**	68	7	67	8	66	9	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

R - Recommended height to meet feasibility requirements of Depatment's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

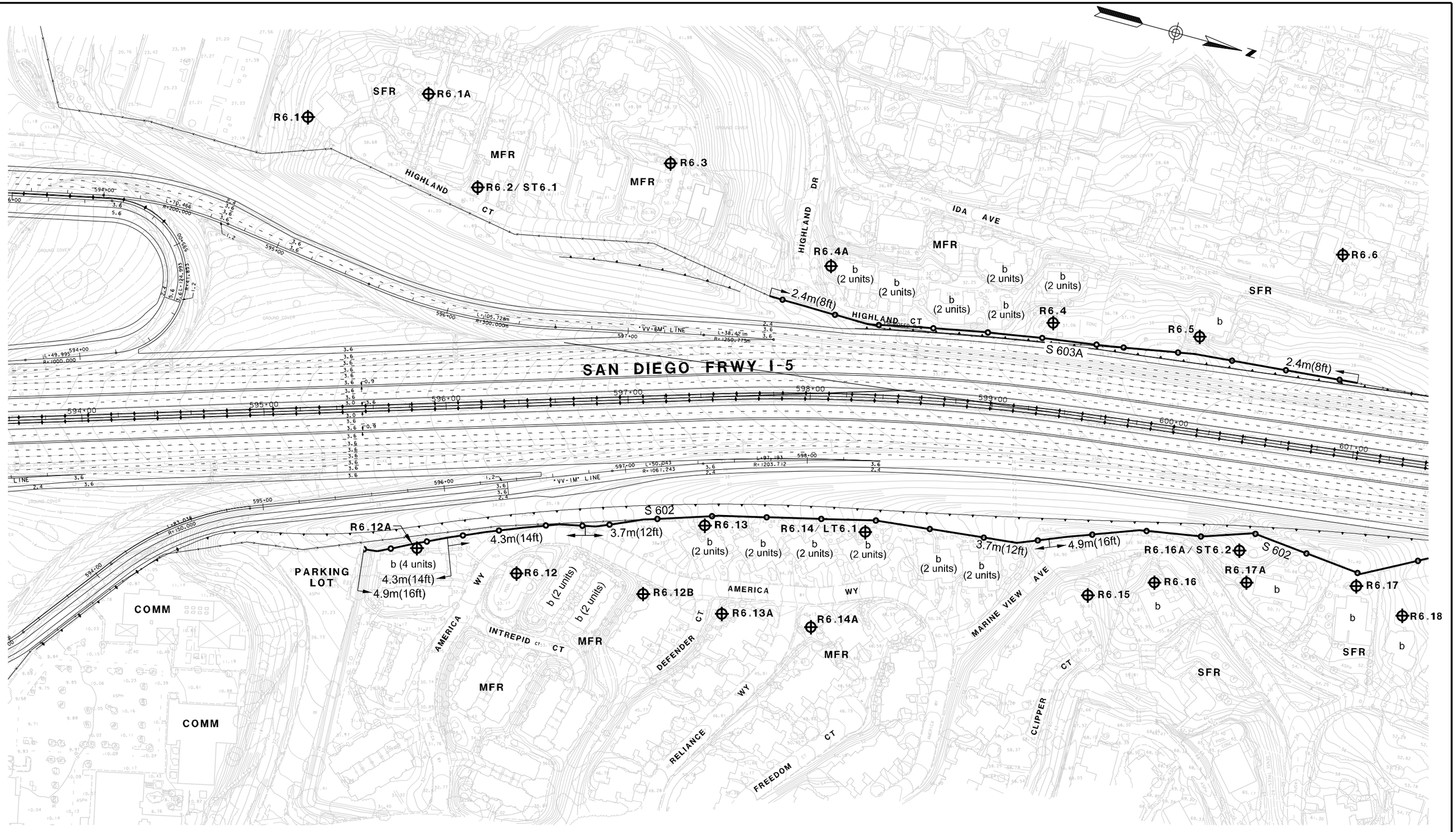
C - Critical design receiver.

* - Non first-row receptor.

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S603A	R6.4A, R6.4 - R6.5	R/W / Southbound	597+80	2.4 (8)	39.1 (128)
			598+27	2.4 (8)	37.4 (123)
			598+65	2.4 (8)	38.9 (128)
			599+00	2.4 (8)	38.4 (126)
			599+68	2.4 (8)	41.6 (137)
			600+00	2.4 (8)	43.4 (143)
			600+25	2.4 (8)	40.4 (133)
			600+80	2.4 (8)	41.9 (138)
			601+00	2.4 (8)	41.9 (138)
		Approximate Length: 327 m (1,073 ft)			
S603B	R6.9 -R6.11	Shoulder and R/W/ Southbound	604+80	3.7 (12)	42.8 (140)
			605+80	3.7 (12)	43.3 (142)
			606+30	3.7 (12)	45.1 (148)
			606+30	3.0 (10)	44.4 (146)
			606+70	3.0 (10)	47.0 (154)
			607+20	3.0 (10)	51.2 (168)
			607+55	3.0 (10)	55.7 (183)
			607+95	3.0 (10)	55.0 (181)
			608+00	3.0 (10)	53.0 (174)
			608+15	3.0 (10)	52.5 (172)
		Approximate Length: 337 m (1,106 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.



LEGEND

- R5.1 – SENSITIVE RECEPTOR SITE
- b – BENEFITED RESIDENCE
- – SOUNDWALL
- – – – – EXISTING WALL

- HM – HOTEL /MOTEL
- SFR – SINGLE FAMILY RESIDENCE
- MFR – MULTI – FAMILY RESIDENCE
- COMM – COMMERCIAL
- REC – RECREATION

1 : 2000
METERS

0 m 50 m 100 m

Caltrans Metric

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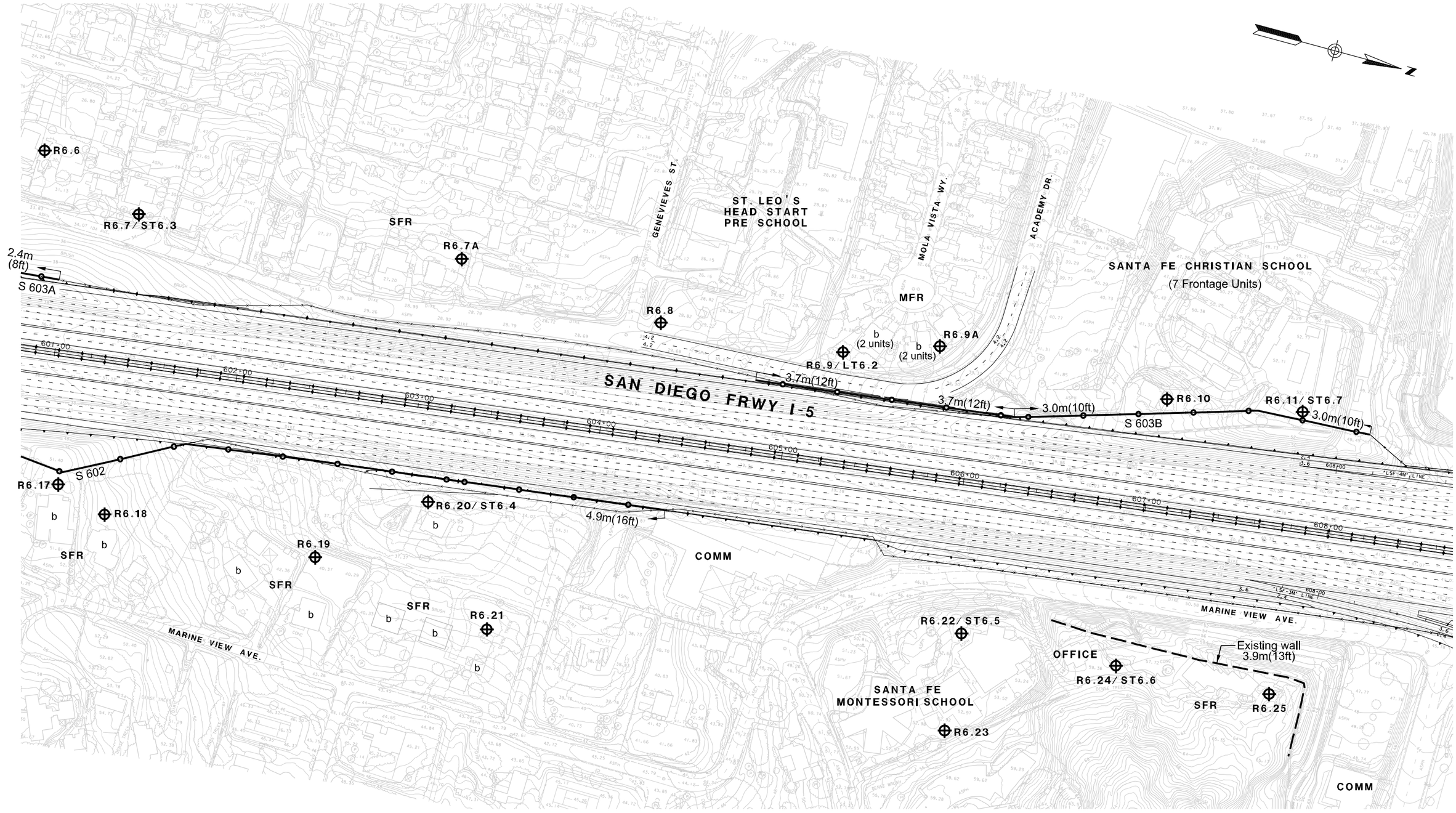
NORTH COAST I-5 CORRIDOR PROJECT
SENSITIVE RECEPTOR & NOISE BARRIER LOCATIONS

SEGMENT 6 | SHEET NO. 19 OF 20



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SENSITIVE RECEPTOR & NOISE BARRIER LOCATIONS

SEGMENT 6 | SHEET NO. 20 OF 20

EXECUTIVE SUMMARY

This noise study assesses potential noise impacts due to the proposed Interstate 5 (I-5) North Coast Corridor Widening Project in San Diego County by investigating the existing traffic noise conditions in the project area, identifying noise sensitive locations, and predicting future No-Build and Build Alternative traffic noise levels. The I-5 Improvement Project limits begin on Interstate 805 (I-805) at KP 43.9 (PM 27.3) Mira Mesa Boulevard and on I 5 from KP R45.7 (PM R28.4) La Jolla Village Drive and continue on I-5 to the city of Oceanside at KP R143.4 (PM R89.1) at Vandegrift Boulevard. At the south end of the project (begin project to the SR 56 Interchange) one High Occupancy Vehicle (HOV) lane in each direction is proposed. The project then adds two HOV lanes and one general purpose lane in each direction from the SR 56 Interchange to the SR 78 Interchange. An additional two HOV lanes in each direction with no additional general purpose lanes is proposed from the SR 78 Interchange north to the end of the project. The project also adds auxiliary lanes as well as a direct access ramp where needed in each city.

Parsons personnel conducted several visits to identify representative noise sensitive receptor locations and noise measurement sites. Existing noise level measurements were conducted during the site visits to evaluate existing background noise levels in the vicinity of the project area. Monitoring results indicate that the existing traffic noise levels already approach or exceed the Noise Abatement Criteria (NAC) at noise sensitive areas adjacent to the highway.

Existing land uses are primarily residential, with some schools, parks, and commercial land uses which include hotels, motels, restaurants, wholesale, and retail stores.

Future No-Build and Build Alternative traffic noise levels were modeled using the Level-of-Service (LOS) C traffic volumes to obtain the worst-case noise scenario. The traffic volumes of on- and off-ramps under the No-Build conditions were capped at 1,000 vehicles per hour per lane and LOS C volumes of 1,000 vehicles per hour per lane were assumed for the Build condition. The difference between the predicted No-Build and Build traffic noise levels would be three decibels or less for the vast majority of noise sensitive receptors, with one receptor being exposed to noise level increases as high as 12 dB. These noise differences between No-Build and Build conditions would be primarily due to the presence of HOV lanes and expanding the outer lanes closer to the receptors in the Build alternative. The predicted Build Alternative peak hour $L_{eq(h)}$ at the representative receptors range from 57 to 82 dBA, exceeding the NAC at most locations. Soundwall heights from 2.4 m (8 ft) up to 4.9 m (16 ft) were considered to abate the predicted traffic noise impacts at the representative noise sensitive areas within the proposed project area. The recommended noise barriers were designed to reduce traffic noise levels by at least the minimum requirement of 5 dB. In addition, the recommended wall heights are designed to block the line-of-sight to heavy truck exhaust stacks. There are 82 recommended soundwalls totaling a length of approximately 33 km (21 mi). Table ES-I summarizes the recommended barriers, benefited residences, and the reasonable allowance per barrier.

Construction noise exposure to noise sensitive areas will be intermittent. The degree of construction noise impacts may vary for different areas of the project site depending on the construction activities. During the construction period, the contractors may be required to comply with the noise ordinances of the local jurisdictions.

TABLE ES-I - SUMMARY OF RECOMMENDED BARRIERS AND BARRIER ALLOWANCES

Barrier No.	Receptor No.	No. and Type of Benefited Receptors[1]	Barrier Location	Barrier Height	Barrier Length	Reasonable Barrier Allowance Per Wall[2]
S475	R1.4	2 UH	Frontage Road/ Southbound	4.9 m (16 ft)	359 m (1,178 ft)	$96,000
S518	R2.1 to R2.5	30 MFR	R/W and Private Property/ Northbound	3.0 m (10 ft) to 3.7 m (12 ft)	427 m (1,401 ft)	$1,140,000
S526	R3.2 to R3.10A	28 SFR	R/W and Private Property / Northbound	3.0 m (10 ft) to 4.3 m (14 ft)	577 m (1,893 ft)	$1,120,000
S528	R3.13 to R3.14	2 SFR	Private Property / Northbound	3.0 m (10 ft)	116 m (381 ft)	$68,000
S541	R4.2 and R4.4	1 REC (4 Frontage Units)	Private Property / Southbound	3.0 m (10 ft)	174 m (571 ft)	$152,000
S543	R4.5	6 MFR	Private Property / Southbound	4.3 m (14 ft)	80 m (262 ft)	$300,000
S551	R4.11 to R4.22	51 SFR	Private Property / Southbound	3.7 m (12 ft) to 4.3 m (14 ft)	1,102 m (3,615 ft)	$2,550,000
S557	R4.22A, R4.23, and R4.24	10 MFR	Private Property / Southbound	3.0 m (10 ft)	271 m (889 ft)	$400,000
S561	R5.1 to R5.2	6 MFR	Private Property/ Southbound	2.4 m (8 ft)	150 m (492 ft)	$228,000
S563	R5.3	1 SCH (3 Frontage Units)	School Property/ Southbound	3.7 m (12 ft)	97 m (318 ft)	$144,000
S565	R5.5 to R5.6	1 SCH (4 Frontage Units)	School Property/ Southbound	3.0 m (10 ft)	111 m (364 ft)	$200,000
S567	R5.7A, R5.8, R5.8A	7 SFR	R/W/ Southbound	2.4 m (8 ft)	140 m (459 ft)	$336,000
S568	R5.21 to R5.23	11 SFR	R/W and Private Property/ Northbound	2.4 (8 ft) to 4.3 m (14 ft)	216 m (709 ft)	$440,000
S569	R5.9	3 SFR	R/W/ Southbound	4.9 m (16 ft)	77 m (253 ft)	$138,000
S573	R5.10 to R5.14	8 SFR	Shoulder/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)	650 m (2,133 ft)	$304,000
S589	R5.24 to R5.26	3 REC (8 Frontage Units)	Shoulder/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)	562 m (1,844 ft)	$384,000
S602	R6.12A, R6.12 to R6.21	20 MFR, 10 SFR	Shoulder and R/W/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)	887 m (2,877 ft)	$1,260,000
S603	R6.4A, R6.4 to R6.11	20 MFR, 14 SFR, and 2 SCH (10 Frontage Units)	Shoulder and R/W/ Southbound	2.4 m (8 ft) to 3.7 m (12 ft)	1048 m (3,438 ft)	$2,024,000

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH - school; HM - hotel/motel; UH - University Housing.

2- Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE ES-I - SUMMARY OF RECOMMENDED BARRIERS AND BARRIER ALLOWANCES (CONT'D.)

Barrier No.	Receptor No.	No. and Type of Benefited Receptors[1]	Barrier Location	Barrier Height	Barrier Length	Reasonable Barrier Allowance Per Wall[2]
S614	R7.14	4 SFR	R/W/ Northbound	2.4 m (8 ft) to 3.0 m (10 ft)	152 m (499 ft)	$200,000
S622	R7.18, R7.20 to R7.32	32 SFR	R/W/ Shoulder/ Private Property/ Northbound	3.0 m (10 ft) to 4.3 m (14 ft)	1,112 m (3,648 ft)	$1,600,000
S631	R8.1, R8.2 and R8.4A	22 MFR	Private Property/ Southbound	3.0 m (10 ft) to 3.7 m (12 ft)	231 m (758 ft)	$1,056,000
S633	R8.3, R8.4 and R8.5	1 SFR and 20 MFR	R/W/ Southbound	3.7 m (12 ft)	255 m (837 ft)	$1,092,000
S635	R8.6	8 MFR	Shoulder/ Southbound	4.3 m (14 ft)	98 m (322 ft)	$400,000
S640	R8.18	2 SFR	R/W/ Northbound	4.3 m (14 ft)	128 m (420 ft)	$92,000
S644	R8.23 and R8.24	3 SFR	R/W/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)	106 m (348 ft)	$156,000
S646	R8.25 and R8.26	9 SFR	Private Property/ Northbound	3.0 m (10 ft)	181 m (594 ft)	$468,000
S647	R8.10A and R8.11	5 MFR	Shoulder/ Southbound	4.3 m (14 ft)	212 m (969 ft)	$200,000
S652	R9.11 and R9.12	6 SFR	Property Line/ Northbound	2.4 m (8 ft)	124 m (407 ft)	$252,000
S653	R9.3 and R9.4	4 SFR	R/W/Southbound	3.0 m (10 ft)	216 m (709 ft)	$216,000
S654	R9.13 to R9.15	9 SFR	R/W/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)	327 m (1,073 ft)	$440,000
S658	R9.17 to R9.22	20 SFR	R/W and Shoulder/ Northbound	2.8 m (8 ft) to 3.7 m (12 ft)	651 m (2,136 ft)	$1,040,000
S671	R10.3B, R10.3A, R10.4, and R10.4A	11 SFR	Private Property and R/W/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)	262 m (860 ft)	$462,000
S675	R10.5 to R10.8	18 SFR	R/W/ Southbound	2.8 m (8 ft) to 3.0 m (10 ft)	436 m (1,430 ft)	$972,000
S664	R10.11 to R10.13	3 SFR, 8 MFR and SCH (3 Frontage Units)	R/W/ Northbound	3.7 m (12 ft) to 4.3 m (14 ft)	385 m (1,263 ft)	$700,000
S670	R10.14 and R10.15	2 REC (2 Frontage Units)	Shoulder/ Northbound	4.3 m (14 ft) to 4.9 m (16 ft)	371 m (1,217 ft)	$96,000

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE ES-I - SUMMARY OF RECOMMENDED BARRIERS AND BARRIER ALLOWANCES (CONT'D.)

Barrier No.	Receptor No.	No. and Type of Benefited Receptors[1]	Barrier Location	Barrier Height	Barrier Length	Reasonable Barrier Allowance Per Wall[2]
S680	R11.22 to R11.25	30 MFR and 1 REC (12 Frontage Units)	R/W and Private Property/ Northbound	2.4 m (8 ft) to 4.9 m (16 ft)	664 m (2,178 ft)	$1,596,000
S686A	R11.27	1 Park (2 Frontage Units)	Private Property / Northbound	2.4 m (8 ft)	110 m (361 ft)	$84,000
S686B	R11.26	5 SFR	Private Property / Northbound	3.0 m (10 ft)	104 m (341 ft)	$200,000
S686C	R11.28	3 SFR	Private Property / Northbound	3.0 m (10 ft)	50 m (164 ft)	$120,000
S688	R11.29	1 SFR	Shoulder/ Northbound	4.9 m (16 ft)	135 m (443 ft)	$50,000
S689	R11.5A to R11.20	26 SFR	Shoulder and R/W/ Southbound	3.7 m (12 ft) to 4.9 m (16 ft)	1,297 m (4,225 ft)	$1,456,000
S692	R11.31 to R11.36	10 SFR and 1 Park (6 Frontage Units)	R/W and Shoulder/ Northbound	3.7 m (12 ft) to 4.3 m (14 ft)	542 m (1,778 ft)	$864,000
S702	R12.34	1 SFR	R/W/ Northbound	4.9 m (16 ft)	175 m (574 ft)	$48,000
S706	R12.39	1 SFR	R/W/ Northbound	4.9 m (16 ft)	272 m (892 ft)	$48,000
S709	R12.5 to R12.26A	14 SFR and 11 MFR	Shoulder and R/W/ Southbound	4.3 m (14 ft) to 4.9 m (16 ft)	1665 m (5,463 ft)	$1,050,000
S719	R12.29	1 SFR	R/W / Southbound	2.4 m (8 ft)	111 m (364 ft)	$36,000
S723	R13.1 to R13.2 and R13.2A	2 SFR	Private Property/ Southbound	2.4 m (8 ft)	215 m (705 ft)	$100,000
S729	R13.3 to R13.5	12 SFR	Private Property/ Southbound	3.0 m (10 ft) to 3.7 m (12 ft)	184 m (604 ft)	$456,000
S730	R13.18 to R13.20A and R13.20	8 SFR	Private Property / Northbound	3.0 m (10 ft)	248 m (814 ft)	$288,000
S736	R13.21 to R13.26	32 SFR and 46 MFR	Private Property / Northbound	2.4 m (8 ft) to 3.7 m (12 ft)	873 m (2,864 ft)	$3,276,000
S737	R13.13 to R13.16	17 MH	R/W and Shoulder / Southbound	4.3 m (14 ft)	444 m (1,457 ft)	$850,000
S750	R14.8, R14.10 to R14.28	36 SFR and 56 MFR	R/W and Property Line/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)	1461 m (4,793 ft)	$4,784,000
S783	R15.1	1 HM	Private Property/ Southbound	4.3 m (14 ft)	120 m (394 ft)	$36,000
S796	R16.1 to R16.2	1 SFR and 1 REC (3 Frontage Units)	Shoulder / Northbound	4.3 m (14 ft)	234 m (668 ft)	$200,000

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE ES-I - SUMMARY OF RECOMMENDED BARRIERS AND BARRIER ALLOWANCES (CONT'D.)

Barrier No.	Receptor No.	No. and Type of Benefited Receptors[1]	Barrier Location	Barrier Height	Barrier Length	Reasonable Barrier Allowance Per Wall[2]
S798	R16.3, R16.3A, and R16.4A	2 SFR and 11 MFR	R/W / Northbound	2.4 m (8 ft) & 4.9 m (16 ft)	200 m (656 ft)	$702,000
S799	R16.14, R16.17, and R16.19	9 MFR and 1 REC (1 Frontage Unit)	Private Property and R/W / Southbound	2.4 m (8 ft) to 3.0 m (10 ft)	423 m (1,389 ft)	$480,000
S801	R16.8 to R16.10, and R16.13	3 SFR and 13 MFR	R/W / Southbound	2.4 m (8 ft) to 3.0 m (10 ft)	222 m (733 ft)	$672,000
S802	R16.6 to R16.7	22 MFR	R/W / Northbound	2.4 m (8 ft)	166 m (545 ft)	$1,188,000
S810	R17.1A to R17.2 and R17.4 to R17.15	10 SFR,16 MFR (2 Hotel Pools), 1 Church, 1 Daycare, School and Park (13 Frontage Units)	R/W to Shoulder / Northbound	3.0 m (10 ft) to 4.9 m (16 ft)	1170 m (3,838 ft)	$2,214,000
S811	R17.17 to R17.20 and R17.22 to R17.34	28 SFR and 116 MFR	Shoulder / Southbound	2.4 m (8 ft) to 4.9 m (16 ft)	1208 m (3,963 ft)	$7,776,000
S818	R18.1	1 SFR	Shoulder / Northbound	4.9 m (16 ft)	161 m (529 ft)	$48,000
S821	R18.15 to R18.20, R18.22, R18.24 and R18.25	17 SFR and 34 MFR	R/W to Shoulder / Southbound	3.7 m (12 ft) to 4.3 m (14 ft)	671 m (2,203 ft)	$2,550,000
S822	R18.1A to R18.3, R18.5 and R18.7	16 SFR and Park (5 Frontage Units)	R/W to Shoulder / Northbound	4.9 m (16 ft) to 4.3 m (14 ft)	664 m (2,178 ft)	$1,176,000
S826	R18.7A	1 SFR	R/W /Northbound	3.0 m (10 ft)	132 m (433 ft)	$50,000
S827	R18.11 to R18.13	3 SFR	R/W / Southbound	4.9 m (16 ft)	178 m (584 ft)	$168,000
S829	R18.10	1 SFR	R/W / Southbound	4.9 m (16 ft)	67 m (220 ft)	$46,000
S835	R19.41 to R19.47	16 SFR	R/W to Shoulder / Southbound	3.0 m (10 ft) & 3.7 m (12 ft)	448 m(1,470 ft)	$896,000
S836	R19.1 to R19.3	3 SFR	R/W to Shoulder / Northbound	4.3 m (14 ft)	212 m (695 ft)	$156,000
S840	R19.6A to R19.8	12 SFR	R/W to Shoulder / Northbound	4.9 m (16 ft)	424 m (1,390 ft)	$624,000
S841	R19.30 to R19.33, R19.35 to R19.37, R19.39, and R19.40	17 SFR and 1 REC (5 Frontage Units)	R/W to Shoulder / Southbound	3.0 m (10 ft) to 4.3 m (14 ft)	674 m (2,213 ft)	$1,188,000

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE ES-I - SUMMARY OF RECOMMENDED BARRIERS AND BARRIER ALLOWANCES (CONT'D.)

Barrier No.	Receptor No.	No. and Type of Benefited Receptors[1]	Barrier Location	Barrier Height	Barrier Length	Reasonable Barrier Allowance Per Wall[2]
S845	R19.25 to R19.28	10 SFR	R/W to Private Property / Southbound	2.4 m (8 ft)	385 m (1,264 ft)	$540,000
S846	R19.12 to R19.18	18 SFR	R/W to Private Property / Northbound	2.4 m (8 ft) to 3.7 m (12 ft)	455 m (1,494 ft)	$972,000
S849	R19.20 to R19.24	20 MH, Clubhouse (1 Frontage Units)	Shoulder / Southbound	3.6 m (12 ft) to 4.3 m (14 ft)	393 m (1,289 ft)	$1,050,000
S855	R20.23 and R20.25	4 MFR and 1 REC (1 Frontage Unit)	Shoulder / Southbound	3.0 m (10 ft) to 4.3 m (14 ft)	423 m (1389 ft)	$190,000
S859	R20.13 and R20.15	1 SFR and 1 REC (1 Frontage Unit)	R/W / Southbound	3.7 m (12 ft)	171 m (560 ft)	$96,000
S862	R20.1 to R20.3	REC (6 Frontage Units)	R/W / Northbound	3.7 m (12 ft) to 4.3 m (14 ft)	258 m (845 ft)	$300,000
S863	R20.5 to R20.8, R20.10 and R20.11	6 SFR, 5 MFR, and 1 SCH (15 Frontage Units)	R/W / Southbound	3.7 m (12 ft) to 4.9 m (16 ft)	667 m (2,189 ft)	$1,300,000
S868	R21.3 to R21.5	8 SFR and 2 MFR	R/W / Northbound	4.9 m (16 ft)	223 m (731 ft)	$480,000
S871	R21.12 to R21.18, and R21.20	9 SFR, 14 MFR, and 1 REC (6 Frontage Units)	R/W / Southbound	2.4 m (8 ft) to 3.0 m (10 ft)	535 m (1,755 ft)	$1,450,000
S875	R21.9 and R21.11	4 SFR and 1 HM	R/W / Southbound	4.3 m (14 ft) to 4.9 m (16 ft)	220 m (722 ft)	$250,000
S882	R22.2 to R22.5	11 SFR	R/W / Northbound	3.7 m (12 ft)	181 m (596 ft)	$616,000
S884	R22.6 to R22.8A	9 SFR	R/W / Northbound	3.7 m (12 ft)	223 m (730 ft)	$468,000

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

1.0 INTRODUCTION

The purpose of this noise study is to assess the potential noise impacts and recommend noise abatement measures for the Interstate 5 (I-5) North Coast Corridor Widening Project, for I-5 northbound and southbound along a segment of I-5 between La Jolla Village Drive and Harbor Drive and the Interstate 805 (I-805) from Mira Mesa Boulevard to the I-5 merge in San Diego County, California. This project is defined as Type 1 by 23 CFR 772; therefore, a full noise assessment is required. The study includes (a) long-term noise measurements; (b) short-term measurements; (c) roadway traffic noise modeling using SOUND2000; and (d) noise abatement/mitigation recommendations for soundwall placement.

2.0 PROJECT DESCRIPTION

The overall goal of the project is to reduce current and future traffic congestion on I-5 and enhance goods transportation between Mexico, San Diego, and Los Angeles, while minimizing environmental impacts and enhancing corridor scenic value and community character.

This project consists of a Build and a No-Build Alternative. At the south end of the project (begin project to the SR 56 Interchange) one high occupancy vehicle (HOV) lane in each direction is proposed. The project then adds two HOV lanes and one general purpose lane in each direction from the SR 56 Interchange to the SR 78 Interchange. An additional two HOV lanes in each direction with no additional general purpose lanes is proposed from the SR 78 Interchange north to the end of the project. The project also adds auxiliary lanes as well as a direct access ramp where needed in each city. This noise study considers each of the Alternatives.

Preliminary environmental and engineering studies are underway. Environmental studies should be completed in 2008 and construction should begin in 2009.

Figure 2-1 shows the project vicinity map.

FIGURE 2-1 – PROJECT VICINITY MAP

Due to its length the project has been divided into 22 roadway segments for organizational purposes. Table 2-1 provides the segmental distribution (by major intersections) in the project area that is used to identify the measurement locations and receptor locations for this noise study report. There were no noise sensitive areas in segment 15; therefore, no noise analysis was conducted for this segment. There were no noise sensitive areas along the I-805; therefore, no noise analysis was conducted in this area nor were there segment assignments for this area.

TABLE 2-1 – ROADWAY SEGMENTAL DISTRIBUTION

Segment No.	Major Intersection
1	La Jolla Village Drive to Genesee Avenue
2	Genesee Avenue to Carmel Mountain Road
3	Carmel Mountain Road to Carmel Valley Road
4	Carmel Valley Road to Del Mar Heights Road
5	Del Mar Heights Road to Vía de la Valle
6	Vía de la Valle to Lomas Santa Fe Drive
7	Lomas Santa Fe Drive to Manchester Drive
8	Manchester Drive to Birmingham Drive
9	Birmingham Drive to Santa Fe Drive
10	Santa Fe Drive to Encinitas Boulevard
11	Encinitas Boulevard to Leucadia Boulevard
12	Leucadia Boulevard to La Costa Avenue
13	La Costa Avenue to Poinsettia Lane
14	Poinsettia Lane to Palomar Airport Road
15	Palomar Airport Road to Cannon Road
16	Cannon Road to Tamarack Avenue
17	Tamarack Avenue to Carlsbad Village Road
18	Carlsbad Village Road to Vista Way
19	Vista Way to Oceanside Boulevard
20	Oceanside Boulevard to Mission Avenue
21	Mission Avenue to SR 76
22	SR 76 to Wire Mountain Road

3.0 FUNDAMENTALS OF TRAFFIC NOISE

A brief discussion of fundamental traffic noise concepts is provided in this section.

Sound, Noise, and Acoustics

Sound is a disturbance created by a moving or vibrating source in a gaseous or liquid medium or the elastic stage of a solid and is capable of being detected by the hearing organs. Sound may be thought of as the mechanical energy of a vibrating object transmitted by pressure waves through a medium to a human ear. For traffic sound, the medium of concern is air. *Noise* is defined as sound that is loud, unpleasant, unexpected, or undesired.

Frequency and Hertz

A continuous sound can be described by its *frequency* (pitch) and its *amplitude* (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch, like the low notes on a piano, whereas high-frequency sounds are high in pitch, like the high notes on a piano. Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as Hertz (Hz). The extreme range of frequencies that can be heard by the healthiest human ears spans from 16–20 Hz on the low end to about 20,000 Hz (or 20 kHz) on the high end.

Sound Pressure Levels and Decibels

The *amplitude* of a sound determines its loudness. The loudness of a sound increases and decreases with increasing and decreasing amplitude. Sound pressure amplitude is measured in units of micro-Newton per square meter (N/m^2), also called micro-Pascal (µPa). One µPa is approximately one hundred billionths (0.00000000001) of normal atmospheric pressure. S*ound pressure level* (L_p) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called decibels, abbreviated dB.

Addition of Decibels

Because decibels are logarithmic units, sound pressure levels cannot be added or subtracted by ordinary arithmetic means. When two sounds of equal L_p are combined, they will produce a combined L_p, which is 3 dB greater than the original individual L_p. In other words, sound energy must be doubled to produce a 3-dB increase. If two sound levels differ by 10 dB or more, the combined L_p is equal to the higher L_p; in other words, the lower sound level does not increase the higher sound level.

A-Weighted Decibels

Sound pressure level alone is not a reliable indicator of loudness. The frequency, or pitch, of a sound also has a substantial effect on how humans will respond. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear. In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, and it perceives a sound within that range as being more intense than a sound of higher or lower frequency with the same magnitude. A series of L_p adjustments is usually applied to the sound level at different frequencies to approximate the frequency response of the human ear. These adjustments are referred to as a *weighting network*. The A-scale weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. Noise levels for traffic noise reports

are typically reported in terms of A-weighted decibels (dBA). In environmental noise studies, A-weighted L_ps are commonly referred to as noise levels. Figure 3-1 shows typical A-weighted noise levels.

Human Response to Changes in Noise Levels

It is widely accepted that the average healthy ear can barely perceive noise level changes of 3 dB. A change of 5 dB is readily perceptible, and a change of 10 dB is perceived as being twice or half as loud. As discussed previously, doubling of sound energy results in a 3 dB increase in the sound level, which means that doubling of sound energy (e.g., doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

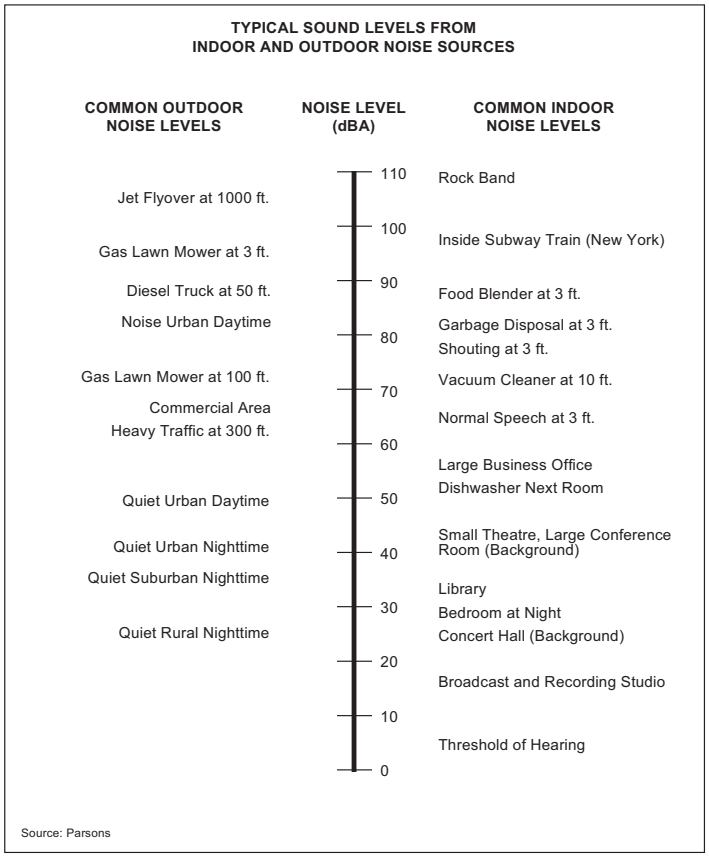

FIGURE 3-1 – TYPICAL A-WEIGHTED NOISE LEVELS

Noise Descriptors

Noise in our daily environment fluctuates over time. Some noise levels occur in regular patterns, others are random. Some noise levels fluctuate rapidly, others slowly. Some noise levels vary widely, others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels. The following is a list of the noise descriptors most commonly used in traffic noise analysis:

- **Equivalent Sound Level ($L_{eq(h)}$)** - $L_{eq(h)}$ represents an average of the sound energy occurring over a specified period. $L_{eq(h)}$ is, in effect, the steady-state sound level that, in a stated period, would contain the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level, $L_{eq(h)}$, is the energy average of the A-weighted sound levels occurring during a 1-hour period and is the basis for Noise Abatement Criteria (NAC) used by the Department and the FHWA.
- **Maximum Sound Level (L_{max})** - L_{max} is the highest instantaneous sound level measured during a specified period.
- **Insertion Loss (I.L.)** – I.L. is the actual noise level reduction at a specific receiver due to construction a noise barrier between the noise source (traffic) and the receiver. Generally, it is the net effect of the soundwall attenuation and the loss due to ground effects.

Sound Propagation

When sound propagates over a distance, it changes in both level and frequency content. The manner in which noise reduces with distance depends on the following factors:

- ***Geometric spreading*** - Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (or drops off) at a rate of 6 dB for each doubling of distance. Highway noise is not a single, stationary point source of sound. The movement of the vehicles on a highway makes the source of the sound appear to emanate from a line (i.e., a line source) rather than a point. This line source results in cylindrical spreading rather than the spherical spreading that results from a point source. The change in sound level from a line source is 3 dB per doubling of distance.
- ***Ground absorption*** - Most often, the noise path between the highway and the observer is very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. For acoustically hard sites (i.e., those sites with a reflective surface, such as a parking lot or a smooth body of water, between the source and the receiver), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees, between the source and the receiver), an excess ground attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance for a line source and 7.5 dB per doubling of distance for a point source.
- ***Atmospheric effects*** - Research by The Department and others has shown that atmospheric conditions can have a significant effect on noise levels when noise receptors are located more than 60 meters (200 feet) from a highway. Wind has been shown to be the most important meteorological factor within approximately 150 meters (500 feet) of the source, whereas vertical air temperature gradients are more important for greater distances. Other factors such as air temperature, humidity, and turbulence also have significant effects.

4.0 FEDERAL AND STATE POLICIES AND PROCEDURES

Federal and state regulations, standards, and policies relating to traffic noise are discussed in detail in the Protocol. Transportation projects affected by the Protocol are referred to as Type 1 projects. A Type 1 project is defined in Title 23, Part 772 of the Code of Federal Regulations (23 CFR 772) as a proposed federal or federal-aid highway project for the construction of a highway on a new location or the physical alteration of an existing highway that significantly changes either the horizontal or vertical alignment or increases the number of through traffic lanes. FHWA has clarified its interpretation of Type 1 projects by stating that a Type 1 project is any project that has the potential to increase noise levels at adjacent receptors. This includes projects to add interchange, ramp, auxiliary, or truck-climbing lanes to an existing highway. A project to widen an existing ramp by a full lane width is also considered to be a Type 1 project. The Department extends this definition to include state-funded highway projects. The proposed project build alternative evaluated in this report is considered to be Type 1 because it involves constructing a new freeway.

The following is a brief discussion of applicable federal and state regulations, standards, and policies:

National Environmental Policy Act

NEPA is a federal law that establishes environmental policy for the nation, provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account. Under NEPA, impacts and measures to mitigate adverse impacts must be identified, including the identification of impacts for which no mitigation or only partial mitigation is available.

FHWA Regulations

Title 23, Part 772 of the Code of Federal Regulations (23 CFR 772) provides procedures for conducting highway-project noise studies and implementing noise abatement measures to help protect the public health and welfare, supply NAC, and establish requirements for information to be given to local officials for use in planning and designing highways. Under this regulation, noise abatement must be considered for a Type 1 project if the project is predicted to result in a traffic noise impact. A traffic noise impact is considered to occur when the project results in a substantial noise increase or when the predicted noise levels approach or exceed NAC specified in the regulation. 23 CFR 772 does not specifically define what constitutes a substantial increase or the term approach; rather, it leaves interpretation of these terms to the states.

FHWA Regulations 772.11

Noise abatement measures that are reasonable and feasible and likely to be incorporated into the project shall be identified. Noise impacts for which no apparent solution is available shall also be identified. Table 4-1 summarizes the FHWA NAC.

California Environmental Quality Act

CEQA is the foundation of environmental law and policy in California. The main objectives of CEQA are to disclose to decision makers and the public the significant environmental effects of proposed activities and to identify ways to avoid or reduce those effects by requiring implementation of feasible alternatives or mitigation measures. Under CEQA, a substantial noise increase may result in a significant adverse environmental effect; if so, the noise increase must be mitigated or identified as a noise impact for which it is likely that only partial (or no) mitigation measures are available. Specific economic, social, environmental, legal, and technological conditions may make noise mitigation measures infeasible and unreasonable.

TABLE 4-1 – NOISE ABATEMENT CRITERIA

Activity Category	Noise Abatement Criteria, $L_{eq(h)}$, dBA	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR Part 772, 2006

5.0 STUDY METHOD AND PROCEDURES

This section describes the methods and procedures followed for the noise study, including the selection of representative sensitive receptor sites, noise measurement procedures, and traffic noise modeling required to conduct the analysis.

Selection of Sensitive Receptor Sites

Noise measurement sites are locations where noise measurements are taken in order to determine existing noise levels and to verify or calibrate computer noise models. These sites are chosen as being representative of similar sensitive sites in the area. Locations that are expected to receive the greatest noise impacts, such as the first row of houses from the noise source, are generally chosen. Noise measurements were conducted in frequent outdoor human-use areas and indoor classroom locations. All measurement sites were selected so that there would be no unusual noises from sources such as dogs, pool pumps, or children that could affect the measured levels. It is also desirable to choose sites that are free of major obstructions or contamination.

Noise Measurement Procedures

Noise measurements were taken at selected locations to evaluate the existing noise environment. Noise measurements were conducted in conformance with the Department's Technical Noise Supplement (Caltrans, 1998) and the guidelines outlined in the FHWA's "Measuring of Highway Related Noise," FHWA-DP-96-046. The following are brief descriptions of the measurement procedures used for this project:

- Microphones were primarily placed approximately 1.5 meters (5 feet) above the ground or in some instances on top of walls and were positioned at least 3 meters (10 feet), when placed on the ground, from any wall or building to prevent reflections or unrepresentative shielding of the noise.
- Sound level meters were calibrated before and after each set of measurements.
- Following the calibration of equipment, a wind screen was placed over the microphone.
- Frequency weighting was set on "A", and the slow detector response was used.
- Results of the short-term noise measurements were recorded on data sheets in the field. Long-term measured data were downloaded to the computer for tabulation.
- During the short-term noise measurements, any noise contaminations such as barking dogs, local traffic, lawn mowers, etc. were noted.
- Traffic was counted for model calibration measurements using a video camera. Vehicle types were separated into three vehicle groups: heavy trucks, medium trucks, and autos. Average traffic speeds were measured using a radar gun.

- Wind speed, temperature, humidity, and sky conditions were observed and documented during the short-term noise measurements.

The instruments used for the noise measurements included the following:

- Integrating Sound Level Meters – Larson Davis models 700 (ANSI Type 2), 820 (ANSI Type 1), 870 (ANSI Type 1), and Rion model NL 15 (ANSI Type 1) Sound level Meters.
- Microphone Systems – LD 820 System – Larson Davis model PRM 828 microphone preamps; Larson Davis model 2560, ½-inch pressure microphone. LD 870 System - Larson Davis model 900B microphone preamps; Larson Davis model 2559, ½-inch pressure microphone.
- Acoustic Field Calibrator – Larson Davis model CA250 constant pressure microphone calibrator.
- Wind Monitor/Temperature and Humidity Gauge – Kestrel 3000 Pocket Weather Meter.

Traffic Noise Modeling

The Department's highway noise prediction computer model, SOUND2000, Version 3.3, was used for the noise computations (Caltrans, 2004). SOUND2000 is based on the highway traffic noise prediction method specified in FHWA-RD-77-108 (FHWA, 1978). The SOUND2000 input requirements and basic computational procedures are outlined in this section.

SOUND2000 input is based on a three-dimensional grid created for the study area to be modeled. All roadway, barrier, and receiver points are defined by their x, y, and z coordinates. Roadways and barriers are coded into SOUND2000 as line segments defined by their end points. Receivers, defined as single points, are typically located at sensitive receptors such as residences, schools, and churches. Receivers are modeled at a height of 1.5 meters (5 feet) above ground elevation.

The SOUND2000 computer program requires inputs of traffic volumes, speeds, and roadway grade adjustments to determine traffic noise levels. The highest traffic noise levels are generated by conditions where traffic volumes are heavy, but still free flowing. Traffic volumes of LOS C are used to obtain the worst case for potential noise impacts. SOUND2000 also allows for the input of percentages for three standard vehicle types: cars, medium trucks and heavy trucks, each corresponding to different noise emission levels.

The propagation path between source and receiver is modeled in SOUND2000 through the use of shielding factors and propagation constants. These may be coded separately for every roadway and receiver pair. Shielding factors are useful for modeling the shielding effect of rows of houses or building structures, special terrain features, and even barriers. Propagation constants are used to model the varying propagation rates between the source and the receiver.

Generally, two basic propagation rates are used in SOUND2000: hard ground and soft ground. Hard ground propagation is used when either the source or the receiver is elevated or when the propagation path is over a hard surface such as asphalt, and it produces a 3-dB drop-off per doubling of distance. Soft ground propagation is used to model the greater propagation loss over grass or soft earth, and it produces a 4.5 dB drop-off per doubling of distance.

6.0 EXISTING NOISE ENVIRONMENT

Noise measurements were taken at sensitive locations within the project limits to establish the baseline conditions, to calibrate the future traffic noise model, to determine the interior noise levels in classrooms, and to determine the drop-off rate from the front to backyard at certain residences. Parsons personnel conducted site surveys and noise measurements in March, April, and June of 2004.

Measurements were taken at a total of 123 locations for purposes of evaluating the existing noise environment and calibrating the noise model. Short-term measurements were conducted at 80 sites for 20-minutes each, and long-term noise measurements were conducted at 43 sites for a minimum of 24 hours each. The results for the short-term and long-term measurements are presented in Tables 6-1 and 6-2, respectively. Appendix A includes noise measurement data sheets recorded in the field, as well as the hourly L_{eq} graphs for the long-term measurements, and Appendix B presents photographs taken at each of the measurement sites. Locations of the measurement sites for both figures and aerials drawings are also shown on Sheets 1 through 60 in Appendix C.

Existing Noise Level

Some of the short-term measurements were conducted during time intervals outside of the peak noise hour. These measurements have been adjusted to reflect peak hourly noise levels using the results of the nearby long-term noise measurements. The peak noise hour was determined by a long-term measurement taken on the same day as each short-term measurement. The difference in noise level between the hour in which the short-term level was recorded and the hour that the actual peak hour level occurred was then applied to each of the short-term levels to adjust it to the peak hour.

Model Calibration

Since there will only be lane additions to the I-5 project without any major changes to the profile of the existing alignment, it is appropriate to calibrate the traffic noise computer model using the measured field data. Noise measurements for the calibration were conducted at 37 of the short-term measurement sites with simultaneous traffic counts using a video camera recorder and a radar gun for traffic speed measurements. The video recordings of freeway traffic were reviewed and tabulated according to three vehicle types, including automobiles, medium trucks (2-axle with 6-wheels but not including dually pick-up trucks), and heavy trucks (3 or more axle vehicles). The field observations and measured data were used to calibrate the traffic noise model.

Table 6-3 presents the results of the model calibration along with the traffic counts taken during each of the calibration measurements. According to the Department's Technical Noise Supplement, given the inherent uncertainties in the measurements and calibration procedures, model calibration should definitely not be attempted when calculated and measured noise levels agree within ±1 dB; however, if the modeled and measured values are between one and two dB and there is great confidence in the accuracy and results of the measurements, calibration may be attempted (Caltrans, 1998).

For this project, any differences between the measured and modeled values found to be more than ±1.7 dB were applied to the noise model in an attempt to enhance the accuracy of the noise prediction. The results at 35 of the sites were found to be within ±1.7 dB. Calibration results at sites that varied by 1.8 dB or more are discussed below:

- A calibration or "K" factor of +2 dB has been applied to the residences represented by measurement site ST11.1 (R11.22 and R11.23). The difference between the measured and modeled values at this location is likely due to reflections from multi-story residential buildings close to the measurement position. These reflections are not accounted for in the model.
- A calibration or "K" factor of +1.8 dB has been applied to the residences represented by measurement site ST16.2 (R16.6 and R16.7). The difference between the measured and modeled values at this location is likely due to reflections from multi-story residential buildings behind the measurement position and an existing 1.5 m (5 ft) wood wall in front of the measurement position. These environmental conditions are not accounted for in the model.

TABLE 6-1 – SHORT-TERM NOISE MEASUREMENT RESULTS

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Measured Leq(h), dBA[2]	Adjusted Peak-Hour Leq(h), dBA[3]	Adjusted to Long-Term Site
ST1.1	Building 100 Pepper Canyon Apartments, San Diego	MFR	B (67)	Front Yard	3/31/04	10:32	66.5	70	LT4.1
ST2.1	Torrey Villa Resort Apartments, San Diego	MFR	B (67)	Rear Yard	3/31/04	09:43	67.9	68	LT3.1
ST3.1	13680 Torrey View Center, San Diego	MFR	B (67)	Rear Yard	4/02/04	09:00	65.0	67	LT3.1
ST4.1	2784 Camino San Marino, Del Mar	MFR	B (67)	Side Yard	3/31/04	09:05	68.6	69	LT4.1
ST4.2	13080 Camino Cristobal, Del Mar	MFR	B (67)	Front Yard	3/31/04	08:35	68.3	68	LT4.1
ST4.3	13231 Portofino Drive, Del Mar	SFR	B (67)	Rear Yard	3/31/04	14:13	68.0	69	LT4.1
ST4.4	Apt. Building 13691, Casa Del Mar Apartments, Del Mar	MFR	B (67)	Rear Yard	3/31/04	14:11	76.5	77	LT4.1
ST5.1	East Bluff Community, 3528 Voyager Circle, Del Mar	MFR	B (67)	Rear Yard	4/01/04	10:42	66.5	68	LT5.1
ST5.2	14065 Bella Del Mar Apartment Homes, Del Mar	MFR	B (67)	Rear Yard	4/01/04	11:25	69.5	71	LT5.1
ST5.4	13204 Overpark Road, Del Mar	SFR	B (67)	Rear Yard	4/01/04	10:45	64.7	66	LT5.1
ST6.1	15863 Highland Court, Solana Beach	SFR	B (67)	Front Yard	3/30/04	13:16	59.9	65	LT6.1
ST6.2	695 Marine View Avenue, Solana Beach	SFR	B (67)	Side Yard	3/30/04	13:20	74.5	79	LT6.2
ST6.3	709 Ida Avenue, Solana Beach	MFR	B (67)	Front Yard	3/30/04	09:06	58.6	64	LT6.2
ST6.4	Genevieve/Marine View Center, Solana Beach	SFR	B (67)	Side Yard	3/29/04	16:45	69.2	73	LT6.2
ST6.5	Santa Fe Montessori School, 1010 Solana Drive, Solana Beach	SCH	B (67)	School Yard	3/29/04	16:25	65.4	69	LT6.2

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- All short-term measured noise levels were measured for a 20-minute period.

3- Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq(h)}$ based on a comparison with long-term noise levels measured at a nearby measurement site, listed in the last column.

TABLE 6-1 – SHORT-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC( )	Meter Location	Measurement Dates	Start Time	Measured Leq(h), dBA[2]	Adjusted Peak-Hour Leq(h), dBA[3]	Adjusted to Long-Term Site
ST6.6	200 Marine View Avenue, Solana Beach	SFR	B (67)	Side Yard	3/30/04	09:44	60.8	66	LT6.2
ST6.7	Santa Fe Christian School, 838 Academy, Solana Beach	SCH	B (67)	School Yard	3/30/04	13:17	71.5	76	LT6.2
ST7.1	307 Santa Helena, Solana Beach	SFR	B (67)	Yard	3/29/04	17:41	62.5	68	LT7.2
ST7.2	624 Ridgeline Center, Solana Beach	SFR	B (67)	Rear Yard	3/29/04	15:45	51.5	61	LT7.2
ST7.3	757 Santa Rosarita, Solana Beach	SFR	B (67)	Rear Yard	3/29/04	15:20	69.0	72	LT7.1
ST7.4	717 Santa Florenia, Solana Beach	SFR	B (67)	Rear Yard	3/29/04	16:50	61.5	68	LT7.2
ST8.1	2463 Caminito Ocean Cove, Encinitas	MFR	B (67)	Rear Yard	3/26/04	11:00	71.0	72	LT8.1
ST8.2	2431 Caminito Ocean Cove, Encinitas	MFR	B (67)	Rear Yard	6/10/04	12:39	56.8	57	LT8.1
ST8.3	1101 Lagoon View Center Court, Encinitas	SFR	B (67)	Rear Yard	3/26/04	09:35	61.0	63	LT8.1
ST8.4	2010 Bulrush Lane, Encinitas	SFR	B (67)	Rear Yard	3/26/04	09:37	69.4	71	LT8.1
ST8.5	Cardiff By The Sea Apartment Complex, 2274 D, Encinitas	MFR	B (67)	Rear Yard	3/26/04	09:29	69.0	70	LT8.2
ST8.6	1830 Playa Riviera, Encinitas	SFR	B (67)	Rear Yard	3/26/04	10:38	69.7	71	LT8.2
ST9.1	804 Nolbly Street, Encinitas	SFR	B (67)	Front Yard	3/25/04	16:12	70.0	70	LT9.1
ST9.2	1511 Villa Cardiff Drive, Encinitas	SFR	B (67)	Front Yard	4/01/04	09:09	63.5	64	LT9.2

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- All short-term measured noise levels were measured for a 20-minute period.

3- Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq(h)}$ based on a comparison with long-term noise levels measured at a nearby measurement site, listed in the last column.

TABLE 6-1 – SHORT-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Measured Leq(h), dBA[2]	Adjusted Peak-Hour Leq(h), dBA[3]	Adjusted to Long-Term Site
ST9.3	553 Faith Street, Encinitas	SFR	B (67)	Front Yard	4/01/04	09:53	71.1	71	LT9.2
ST10.1	1125 Regal Road, Encinitas	SFR	B (67)	Front Yard	4/01/04	12:15	75.0	76	LT9.2
ST10.2	Seacoast Community Church, 1050 Regal Road, Encinitas	SCH	B (67)	School Yard	3/26/04	11:43	74.5	76	LT9.2
ST10.3	Regal Apartments, Encinitas	MFR	B (67)	Playground	3/26/04	14:36	69.0	70	LT9.2
ST10.4	611 Stratford Drive, Encinitas	SFR	B (67)	Side Yard	3/25/04	11:49	62.7	68	LT10.1
ST10.5	212 D Street, Encinitas	SFR	B (67)	Front Yard	3/26/04	13:53	67.0	71	LT10.1
ST11.1	West Hampton Cove Apartments, 165 Magano Circle, Encinitas	MFR	B (67)	Rear Yard	4/02/04	10:39	70.0	70	LT11.1
ST11.2	438 Ocean View Terrace Court, Encinitas	SFR	B (67)	Front Yard	3/25/04	14:28	69.0	69	LT11.1
ST11.3	Saxony Condos, 342 Carmel Creeper Place, Encinitas	MFR	B (67)	Side Yard	3/31/04	17:22	68.5	70	LT11.1
ST11.4	453 Ocean View Avenue, Encinitas	SFR	B (67)	Rear Yard	4/01/04	08:25	70.3	75	LT11.1
ST11.5	541 Guidero Way, Encinitas	SFR	B (67)	Front Yard	3/25/04	14:28	70.5	71	LT11.2
ST11.6	Poinsetta Park Homes, Encinitas	SFR	B (67)	Park Area	3/31/04	16:40	68.1	69	LT11.1
ST11.7	818 Clark Avenue, Encinitas	SFR	B (67)	Front Yard	3/26/04	15:45	69.5	74	LT11.2
ST12.1	949 Piraeus Street, Encinitas	SFR	B (67)	Front Yard	3/31/04	15:40	61.5	64	LT12.1

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- All short-term measured noise levels were measured for a 20-minute period.

3- Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq(h)}$ based on a comparison with long-term noise levels measured at a nearby measurement site, listed in the last column.

TABLE 6-1 – SHORT-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Measured Leq(h), dBA[2]	Adjusted Peak-Hour Leq(h), dBA[3]	Adjusted to Long-Term Site
ST12.2	1040 Orpheus Avenue, Encinitas	SFR	B (67)	Front Yard	3/25/04	12:01	74.0	76	LT12.2
ST12.3	633 Sparta Drive, Encinitas	SFR	B (67)	Side Yard	3/25/04	15:15	66.3	68	LT12.2
ST12.4	1593 Eulus Avenue, Encinitas	SFR	B (67)	Rear Yard	3/25/04	15:14	72.5	75	LT12.2
ST12.5	1660 Leora Lane, Encinitas	SFR	B (67)	Back Yard	3/25/04	10:39	56.8	60	LT12.2
ST12.6	Leucadia Park, Encinitas	Park	B (67)	Pool Area	4/02/04	12:02	65.5	67	LT12.3
ST13.1	510 Weston, Encinitas	SFR	B (67)	Front Yard	3/24/04	14:45	74.0	75	LT13.2
ST13.2	880 Piovana Center, Encinitas	SFR	B (67)	Front Yard	3/23/04	10:48	65.5	66	LT13.2
ST13.3	1427/1429 Linden Terrace, Encinitas	SFR	B (67)	Side Yard	3/23/04	14:38	66.7	68	LT13.2
ST13.4	7441 Neptune Drive, Carlsbad	MFR	B (67)	Front Yard	3/23/04	11:00	56.9	58	LT13.2
ST13.5	Mobile Home Park, 7340 San Bartolo Street, Carlsbad	MH	B (67)	Side Yard	3/23/04	14:38	56.2	57	LT13.2
ST14.1	804 Bluewater Road, Carlsbad	SFR	B (67)	Front Yard	3/23/04	13:52	70.7	71[4]	LT14.1
ST14.2	Poinsetta Station Apartment Homes, Embarcadero Lane, Carlsbad	MFR	B (67)	Front Yard	3/23/04	11:50	60.5	62[4]	LT14.1
ST14.3	Poinsetta Station Apartment Homes, Apartment 133, Embarcadero Lane, Carlsbad	MFR	B (67)	Side Yard	3/23/04	11:49	56.6	58[4]	LT14.1
ST14.4	801/803 Caminito Del So, Carlsbad	SFR	B (67)	Rear Yard	3/23/04	13:51	72.5	73[4]	LT14.1
ST14.5	Discovery Isle Child Development Center, 6130 Paseo Del Norte, Carlsbad	SCH	B (67)	Front Yard	3/24/04	17:02	66.0	67	LT13.1

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- All short-term measured noise levels were measured for a 20-minute period.

3- Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq(h)}$ based on a comparison with long-term noise levels measured at a nearby measurement site, listed in the last column.

4- Peak-hour adjustment based on long-term data that was not measured simultaneously with short-term measurement.

TABLE 6-1 – SHORT-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Measured Leq(h), dBA[2]	Adjusted Peak-Hour Leq(h), dBA[3]	Adjusted to Long-Term Site
ST16.1	Windsong Papagallos Apartments, Carlsbad	MFR	B (67)	Pool Area	3/23/04	16:02	70.5	73	LT16.2
ST16.2	The Woodridge Village Apartments, Chinquapin Avenue, Carlsbad	MFR	B (67)	Side Yard	3/23/04	16:02	71.8	75	LT16.1
ST17.1	Saint Patrick's School, 3820 Pio Pico Drive, Carlsbad	SCH	B (67)	Front Yard	3/24/04	08:26	72.0	73	LT17.4
ST17.2	3736 Harding Street, Carlsbad	SFR	B (67)	Rear Yard	3/24/04	11:43	70.3	72	LT17.2
ST17.3	Sierra Pines Apartments, 3610 Pio Pico Drive, Carlsbad	MFR	B (67)	Front Yard	3/24/04	11:42	75.4	75	LT17.1
ST17.4	945 Chestnut Avenue, Carlsbad	MFR	B (67)	Side Yard	3/24/04	08:55	67.5	70	LT17.2
ST18.1	1022 Grand Avenue, Carlsbad	SFR	B (67)	Front Yard	3/24/04	17:36	63.5	64	LT18.1
ST18.2	Carlsbad Retirement Community 1088 Laguna Drive, Carlsbad	MFR	B (67)	Front Yard	3/24/04	10:53	69.5	70	LT18.1
ST18.3	Buena Vista Elementary School, baseball field, Carlsbad	SCH	B (67)	Baseball Field	3/24/04	09:31	66.6	67	LT18.1
ST18.4	2443 Tuttle, Carlsbad	SFR	B (67)	Front Yard	3/24/04	10:18	66.9	67	LT18.1
ST18.5	2380 Jefferson Street, Carlsbad	SFR	B (67)	Side Yard	3/24/04	10:54	67.8	68	LT19.3
ST19.1	1734 Soto Street, Oceanside	SFR	B (67)	Front Yard	3/24/04	17:33	70.0	70	LT19.3
ST19.2	1637 Green Street, Oceanside	SFR	B (67)	Front Yard	3/23/04	09:25	70.0	71	LT19.5
ST19.3	1501 Valencia Street, Oceanside	SFR	B (67)	Front Yard	3/23/04	09:29	68.8	70	LT19.3
ST19.4	1326 Selma Drive, Oceanside	SFR	B (67)	Front Yard	3/23/04	08:20	67.8	69	LT19.1
ST19.5	340 Blue Springs Lane, Oceanside	MH	B (67)	Front Yard	3/23/04	08:19	68.0	69	LT19.3

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- All short-term measured noise levels were measured for a 20-minute period.

3- Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq(h)}$ based on a comparison with long-term noise levels measured at a nearby measurement site, listed in the last column.

TABLE 6-1 – SHORT-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Measured $L_{eq(h)}$, dBA[2]	Adjusted Peak-Hour $L_{eq(h)}$, dBA[3]	Adjusted to Long-Term Site
ST20.1	Village North Apartments, Vine Street, Oceanside	MFR	B (67)	Front Yard	3/24/04	14:12	66.9	69	LT20.1
ST20.2	Ron Ortega Recreation Park, Oceanside	REC	B (67)	Park Area	3/24/04	16:42	75.0	76	LT20.1
ST21.1	Bush Street Community Garden, Oceanside	REC	B (67)	Park Area	3/22/04	14:40	73.0	75	LT21.2
ST22.1	501 San Louis Rey Drive, Oceanside	SFR	B (67)	Front Yard	3/23/04	11:00	80.0	80	LT22.1
ST22.2	Sandy Shores Mobile Home Park, Lot #1 Sandy Shores, Oceanside	MH	B (67)	Front Yard	3/22/04	11:39	61.6	62	LT22.1
ST22.3	451 Koelper Street, Oceanside	SFR	B (67)	Front Yard	3/22/04	12:40	58.6	59	LT22.1

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH – school; HM - hotel/motel.

2- All short-term measured noise levels were measured for a 20-minute period.

3- Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq(h)}$ based on a comparison with long-term noise levels measured at a nearby measurement site, listed in the last column.

TABLE 6-2 – LONG-TERM NOISE MEASUREMENT RESULTS

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Duration, No. of Hours	Measured Peak Hour Leq(h), dBA[2]	Peak-Hour Time(s)
LT3.1	13715 Torrey View Court, San Diego	MFR	B (67)	Rear Yard	3/30 - 4/01/04	17:20	64	65	9AM, 12PM
LT4.1	13505 Portofino Drive, Del Mar	SFR	B (67)	Rear Yard	3/30 - 3/31/04	16:20	25	68	6AM
LT5.1	3285 Lower Ridge Road, Del Mar	SFR	B (67)	Rear Yard	3/30 - 4/01/04	15:07	43*	64	12PM
LT5.2	14175 Minorca Cove, Del Mar	SFR	B (67)	Rear Yard	3/29 - 3/31/04	13:00	50	72	6AM
LT5.3	13413 Racetrack View Court, Del Mar	SFR	B (67)	Rear Yard	3/31 - 4/01/04	09:49	28	68	10AM
LT6.1	1013 America Way, Solana Beach	MFR	B (67)	Rear Yard	3/29 - 3/30/04	12:35	25	67	7PM
LT6.2	865 Mola Vista Way, Solana Beach	SFR	B (67)	Rear Yard	3/29 - 3/30/04	11:40	27	69	6AM
LT7.1	325 Santa Helena Drive, Solana Beach	SFR	B (67)	Rear Yard	2/19 - 2/20/04	09:16	24	65	1PM
LT7.2	679 Solana Glen Court, Solana Beach	SFR	B (67)	Rear Yard	3/29 - 3/30/04	10:40	27	69	6AM
LT8.1	2136 Bullrush Lane, Encinitas	SFR	B (67)	Rear Yard	3/25 - 3/26/04	12:37	27	75	12PM
LT8.2	1932 Playa Rivera Drive, Encinitas	SFR	B (67)	Rear Yard	3/25 - 3/26/04	10:51	28	78	11AM
LT9.1	1633 MacKinnon Avenue, Encinitas	SFR	B (67)	Rear Yard	3/25 - 3/26/04	10:19	28	70	6AM
LT9.2	1360 Loch Lomond Drive, Encinitas	SFR	B (67)	Rear Yard	3/31 - 4/01/04	16:40	24	71	9AM, 10AM 3PM
LT10.1	826 Devonshire Drive, Encinitas	SFR	B (67)	Rear Yard	3/25 - 3/26/04	11:48	26	71	8PM, 9PM
LT10.1A	768 Devonshire Drive, Encinitas	SFR	B (67)	Front Yard	9/21 - 9/23/04	19:05	35	77	5PM, 6PM, 6AM, 12PM
LT11.1	709 Ocean View Avenue, Encinitas	SFR	B (67)	Rear Yard	3/31 - 4/02/04	11:00	50	78	5AM, 9AM, 10AM
LT11.2	796 Clark Avenue, Encinitas	SFR	B (67)	Rear Yard	3/25 - 3/26/04	12:00	28	70	9AM, 10AM

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence.

2- The highest measured hourly noise level recorded during the long-term measurement period.

TABLE 6-2 – LONG-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Duration, No. of Hours	Measured Peak Hour Leq(h), dBA[2]	Peak-Hour Time(s)
LT12.1	1362 Orpheus Avenue, Encinitas	SFR	B (67)	Front Yard	3/31 - 4/01/04	12:00	25	73	5AM, 9AM, 10AM, 11AM
LT12.2	1437 Piraeus Street, Encinitas	SFR	B (67)	Front Yard	3/25 - 3/26/04	10:00	29	71	9AM, 10AM
LT12.3	583 Nantucket Court, Encinitas	MFR	B (67)	Patio	3/31 - 4/02/04	18:20	42	65	5AM, 1PM
LT12.4	1940 Leucadia Scenic Court, Encinitas	SFR	B (67)	Rear Yard	4/01 - 4/02/04	09:04	28	65	5AM, 6AM
LT13.1	7452 Neptune Drive, Carlsbad	MFR	B (67)	Side Yard	3/24 - 3/25/04	16:20	24	54	4PM
LT13.2	7141 Linden Terrace, Carlsbad	SFR	B (67)	Rear Yard	3/23 - 3/24/04	15:18	24	68	12PM, 3PM
LT14.1	803 Camino Azul, Carlsbad	MFR	B (67)	Rear Yard	2/19 - 2/20/04	12:09	27	75	12PM , 1PM, 2PM
LT16.1	4125 Harrison Street, Carlsbad	SFR	B (67)	Rear Yard	3/22 - 3/23/04	14:42	26	80	7AM – 3PM
LT16.2	827 Citrus Place, Carlsbad	SFR	B (67)	Rear Yard	3/22 - 3/23/04	15:20	25	71	6AM
LT17.1	1016 Magnolia Avenue, Carlsbad	SFR	B (67)	Rear Yard	3/29 - 3/30/04	18:00	24	70	10AM, 12PM, 1PM, 2PM
LT17.2	3630 Harding Street, Carlsbad	SFR	B (67)	Rear Yard	3/22 - 3/25/04	18:30	41*	71	8AM
LT17.3	1144 Pine Avenue, Carlsbad	SFR	B (67)	Rear Yard	3/30 - 3/31/04	18:47	24	69	9AM, 10AM, 12PM
LT17.4	985 Oak Avenue, Carlsbad	SFR	B (67)	Rear Yard	3/23 - 3/24/04	17:50	24	70	7AM, 6PM
LT18.1	1255 Cynthia Lane, Carlsbad	SFR	B (67)	Rear Yard	3/23 - 3/24/04	18:19	24	69	3PM, 4PM
LT18.2	2425 Davis Avenue, Carlsbad	SFR	B (67)	Rear Yard	3/29 - 3/30/04	16:53	24	71	5AM, 7AM – 10AM, 2PM – 4PM
LT19.1	1501 Krim Place, Oceanside	SFR	B (67)	Front Yard	3/30 - 3/31/04	09:00	24	69	2PM, 5PM
LT19.2	1250 Krim Place, Oceanside	SFR	B (67)	Rear Yard	3/30 - 3/31/04	09:50	24	73	7AM

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence.

2- The highest measured hourly noise level recorded during the long-term measurement period.

* There was a break in the measurement intervals due to power failure.

TABLE 6-2 – LONG-TERM NOISE MEASUREMENT RESULTS (CONT'D.)

Site No.	Street Address, City	Land Use[1]	Activity Category and NAC ( )	Meter Location	Measurement Dates	Start Time	Duration, No. of Hours	Measured Peak Hour $L_{eq(h)}$, dBA[2]	Peak-Hour Time(s)
LT19.3	1613 Lopez Street, Oceanside	SFR	B (67)	Rear Yard	3/23 - 3/24/04	20:00	24	67	3PM
LT19.4	1310 Kerr Way, Oceanside	SFR	B (67)	Rear Yard	3/24 - 3/25/04	11:00	30	75	6AM, 7AM
LT19.5	1464 Moreno Street, Oceanside	SFR	B (67)	Rear Yard	3/23 - 3/24/04	20:00	24	70	6AM, 7AM
LT19.6	1437 Belleaire Street, Oceanside	SFR	B (67)	Rear Yard	6/9 - 6/10/04	11:15	26	68	5PM – 6PM
LT20.1	324½ Garfield Street, Oceanside	SFR	B (67)	Rear Yard	3/23 - 3/24/04	17:20	26	73	6AM – 7AM
LT21.1	1306 Buena Street, Oceanside	SFR	B (67)	Side Yard	3/22 - 3/23/04	14:00	26	78	6AM, 3PM, 4PM
LT21.2	910 Winward Way, Oceanside	SFR	B (67)	Side Yard	3/22 - 3/23/04	13:00	26	76	6AM
LT22.1	519 Monterey Drive, Oceanside	SFR	B (67)	Side Yard	3/22 - 3/23/04	09:25	26	80	6AM, 11AM

Notes:

1- Land Use: SFR - single-family residence; MFR - multi-family residence.

2- The highest measured hourly noise level recorded during the long-term measurement period.

TABLE 6-3 – NOISE MODEL CALIBRATION

Site No.	Roadway Segment	Date	Time	Noise Levels, $L_{eq(h)}$, dBA		Deviation, dB	Direction	Total Hourly Volume	Cars Vol (%)	Medium Trucks Vol (%)	Heavy Trucks Vol (%)
				Measured	Modeled						
ST3.1	Carmel Mtn Road to Carmel Valley Road	4/2/04	9:01	65.0	64.9	-0.1	NB	7398	6825 (92.3)	300 (4.1)	273 (3.7)
							SB	10065	9504 (94.4)	273 (2.7)	288 (2.9)
ST4.3	Carmel Mtn Road to Del Mar Hghts Road	3/31/04	14:14	68.0	67.8	-0.2	NB	7902	7383 (93.4)	276 (3.5)	243 (3.1)
ST4.4				76.5	76.3	-0.2	SB	6702	6111 (91.2)	324 (4.8)	267 (4.0)
ST5.1	Del Mar Hghts Road to Via de la Valle	4/1/04	10:43	66.5	66.7	0.2	NB	5637	5079 (90.1)	180 (3.2)	378 (6.7)
ST5.4				64.7	66.2	1.5	SB	6699	6165 (92.0)	273 (4.1)	261 (3.9)
ST5.2	Del Mar Hghts Road to Via de la Valle	4/1/04	11:26	69.5	70.1	0.6	NB	6066	5544 (91.4)	213 (3.5)	309 (5.1)
							SB	6672	6087 (91.2)	228 (3.4)	357 (5.4)
ST6.2	Via de la Valle to Lomas Santa Fe Drive	3/30/04	13:18	74.5	73.5	-1.0	SB	6411	5859 (91.4)	285 (4.4)	267 (4.2)
ST6.7				71.5	72.6	1.1	NB	6825	6285 (92.1)	255 (3.7)	285 (4.2)
ST7.3	Lomas Santa Fe Drive to Manchester Drive	3/29/04	15:22	69.0	68.9	-0.1	NB	8451	8091 (95.7)	225 (2.7)	135 (1.6)
							SB	7449	7029 (94.4)	246 (3.3)	174 (2.3)
ST8.6	Manchester Drive to Birmingham Drive	3/26/04	10:41	69.7	70.0	0.3	NB	6045	5544 (91.7)	216 (3.6)	285 (4.7)
							SB	6429	5931 (92.3)	243 (3.8)	255 (4.0)
ST9.1	Birmingham Drive to Santa Fe Drive	4/1/04	9:54	70.0	70.9	0.9	NB	5394	4857 (90.0)	285 (5.3)	252 (4.7)
ST9.3				71.1	72.3	1.2	SB	6270	5760 (91.9)	213 (3.4)	297 (4.7)
ST10.2	Santa Fe Drive to Encinitas Boulevard	3/26/04	11:44	74.5	74.7	0.2	NB	7488	6897 (92.1)	261 (3.5)	330 (4.4)
ST10.4				62.7	64.4	1.7	SB	6810	6219 (91.3)	273 (4.0)	318 (4.7)
ST11.1	Encinitas Boulevard to Leucadia Boulevard	4/2/04	10:41	70.0	68.0	-2.0	NB	5919	5403 (91.3)	240 (4.1)	276 (4.7)
							SB	6762	6252 (92.5)	225 (3.3)	285 (4.2)
ST11.2	Encinitas Boulevard to Leucadia Boulevard	3/25/04	14:29	69.0	67.9	-1.1	NB	6777	6387 (94.2)	192 (2.8)	198 (2.9)
ST11.5				70.5	71.7	1.2	SB	6297	5901 (93.7)	207 (3.3)	189 (3.0)
ST12.4	Leucadia Boulevard to La Costa Avenue	3/25/04	15:16	72.5	74.1	1.6	NB	6825	6285 (92.1)	255 (3.7)	285 (4.2)
							SB	6411	5859 (91.4)	285 (4.4)	267 (4.2)
ST12.6	Leucadia Boulevard to La Costa Avenue	4/2/04	12:03	65.5	65.8	0.3	NB	8451	8091 (95.7)	225 (2.7)	135 (1.6)
							SB	7449	7029 (94.4)	246 (3.3)	174 (2.3)
ST13.3	La Costa Avenue to Poinsettia Lane	3/23/04	14:40	66.7	68.3	1.6	NB	6045	5544 (91.7)	216 (3.6)	285 (4.7)
ST13.5				56.2	57.1	0.9	SB	6429	5931 (92.3)	243 (3.8)	255 (4.0)
ST14.1	Poinsettia Lane to Palomar Airport Road	3/23/04	13:52	70.7	71.8	1.1	NB	5394	4857 (90.0)	285 (5.3)	252 (4.7)
ST14.4				72.5	74.0	1.5	SB	6270	5760 (91.9)	213 (3.4)	297 (4.7)

TABLE 6-3 – NOISE MODEL CALIBRATION (CONT'D.)

Site No.	Roadway Segment	Date	Time	Noise Levels, $L_{eq(h)}$, dBA		Deviation, dB	Direction	Total Hourly Volume	Cars Vol (%)	Medium Trucks Vol (%)	Heavy Trucks Vol (%)
				Measured	Modeled						
ST16.1	Cannon Road to Tamarack Avenue	3/23/04	16:04	70.5	71.3	0.8	NB	7491	7176 (95.8)	165 (2.2)	150 (2.0)
ST16.2				71.8	70.0	-1.8	SB	5619	5334 (94.9)	108 (1.9)	177 (3.2)
ST17.2	Tamarack Avenue to Carlsbad Village Road	3/24/04	11:44	70.3	71.4	1.1	NB	5799	5310 (91.6)	192 (3.3)	297 (5.1)
ST17.3				75.4	74.4	-1.0	SB	5931	5418 (91.4)	183 (3.1)	330 (5.6)
ST18.2	Carlsbad Village Road to Vista Way	3/24/04	10:55	69.5	70.3	0.8	NB	5331	4821 (90.4)	240 (4.5)	270 (5.1)
ST18.5				67.8	68.7	0.9	SB	5904	5355 (90.7)	273 (4.6)	276 (4.7)
ST19.2	Vista Way to Oceanside Boulevard	3/23/04	9:27	70.0	71.5	1.5	NB	5280	4665 (88.4)	252 (4.8)	363 (6.9)
ST19.3				68.8	67.8	-1.0	SB	5421	4977 (91.8)	198 (3.7)	246 (4.5)
ST19.4	Vista Way to Oceanside Boulevard	3/23/04	8:20	67.8	69.2	1.4	NB	5508	5016 (91.1)	225 (4.1)	267 (4.8)
ST19.5				68.0	69.2	1.2	SB	5178	4785 (92.4)	180 (3.5)	213 (4.1)
ST20.1	Oceanside Boulevard to Mission Avenue	3/24/04	14:23	66.9	66.6	-0.3	NB	5949	5505 (92.5)	216 (3.6)	228 (3.8)
							SB	5583	5157 (92.4)	210 (3.8)	216 (3.9)
ST21.1	Mission Avenue to SR 76	3/22/04	14:40	73.0	74.2	1.2	NB	4902	4491 (91.6)	195 (4.0)	216 (4.4)
							SB	4659	4290 (92.1)	168 (3.6)	201 (4.3)
ST22.1	SR 76 to Wire Mountain Road	3/23/04	11:02	80.0	78.5	-1.5	NB	3315	2823 (85.2)	183 (5.5)	309 (9.3)
							SB	4302	3804 (88.4)	210 (4.9)	288 (6.7)

Classroom Measurements

Short-term, indoor/outdoor simultaneous measurements were conducted in classrooms at five different schools located adjacent to the project alignment. The purpose of these measurements was to determine the sound reduction provided by each of the buildings and the existing worst-hour in-classroom noise levels during typical school hours. A classroom at each school that was closest to the freeway was generally chosen as the measurement location. These schools included the following: Del Mar Hills Elementary School (ST5.3A), Santa Fe Montessori School (ST6.5A), Santa Fe Christian School (ST6.7A), Sea Coast Community School (ST10.2A), and St. Patrick's School (ST17.1A).

All classroom measurements were conducted according to the procedures presented in the Department's TeNS manual (Caltrans, 1998). The distances of the microphones from each side of the facades of the classroom buildings are shown in the field data sheets in Appendix A.

Table 6-4 presents the results of the classroom noise measurements, including the measured building attenuation. According to the results, the existing peak hour noise levels inside of the classrooms range from 41 to 65 dBA. This wide range of results is due to varying classroom conditions such as open or closed doors and windows and the presence of HVAC systems. As shown in Table 6-4, at Site ST5.3A, Del Mar Hills Elementary School, the interior noise levels were 55 dBA due to an HVAC system with a noisy fan. This resulted in only a 2 dB difference between the measured indoor and outdoor levels. According to the teacher and school staff, the classrooms are climate controlled throughout the year, with the windows kept shut. Because an accurate indoor/outdoor noise measurement couldn't be taken at Del Mar Hills Elementary School, an average of the measured building attenuation at ST6.5A and ST17.1A was utilized for the future noise analysis for classroom noise instead.

TABLE 6-4 – CLASSROOM NOISE MEASUREMENTS

Site No.	School Name/ Street Address, City	Date	Start Time	Classroom Condition[1]	Measured Exterior Leq(h), dBA[2]	Measured Interior Leq(h), dBA[2]	Building Attenuation, dB
ST5.3A	Del Mar Hills Elementary School, 14085 Mango Drive, Del Mar.	9/23/04	13:50	Door closed, air conditioning on, no operable windows	57.1	55.0	-20.5*
ST6.5A	Santa Fe Montessori School, 1010 Solana Drive, Solana Beach	9/22/04	16:46	Door and windows closed, central air conditioning	60.3	40.5	-19.8
ST6.7A	Santa Fe Christian School, 838 Academy, Solana Beach	9/23/04	15:16	Windows closed, rear doors open, no air conditioning	60.0	47.4	-12.6
ST10.2A	Sea Coast Community Church/ School, 1050 Regal Road, Encinitas	9/22/04	14:33	Windows and doors open, no air conditioning	68.9	64.7	-4.2
ST17.1A	Saint Patrick's School, 3820 Pio Pico Drive, Carlsbad	9/22/04	10:55	Door and windows closed, central air conditioning	72.2	51.0	-21.2

Notes:

1- Classroom measurements were conducted under interior environmental conditions that are typical of each of the classrooms.

2- Measured for 20-minute periods.

* The actual building attenuation at Site 5.3A could not be determined due to a noisy central HVAC system, and an average of ST6.5A and ST17.1A building attenuation was utilized instead.

Traffic Frontyard to Backyard Measurements

Measurements were taken simultaneously in the front and backyards of certain first-row residences where the front-yard of the residence faces the I-5 freeway and the results are presented in Table 6-5. The purpose of these measurements was to capture the drop-off in noise level from the front-yard to the backyard locations. These measurements were necessary because there was no evidence of frequent human use such as a porch or seating area in the frontyard. At some areas it was not possible to access the backyards of the houses; therefore, noise measurements were conducted in the frontyard and then the backyard noise levels were estimated by applying building reduction factors.

The results of the simultaneous front/backyard noise measurements indicate that the drop-off rate ranges from approximately 5 to 8 dB. It should be noted that these drop-off rates also include some attenuation due to the distance between the front and backyard positions. The results of these measurements were used in the future noise model as shielding factors at similar sites. However, at Receivers R19.32 to R19.34, the shielding factor of 11 dB was used this was based on a previous noise study done in the same area (Parsons, 2002). The receptor site number and shielding factor used for the future model are presented in Table 6-6.

TABLE 6-5 – FRONT/BACKYARD SIMULTANEOUS NOISE MEASUREMENTS

Site No.	Street Address, City	Date	Start Time	Frontyard $L_{eq(h)}$, dBA[1]	Backyard $L_{eq(h)}$, dBA[1]	Difference, dB
ST6.1A	15863 Highland Court, Solana Beach	9/23/04	12:39	60.1	52.5	7.6
ST9.2A	1527 Via Cardiff Drive, Encinitas	9/23/04	11:44	61.9	54.0	7.9
ST12.2A	1036 Orpheus Avenue, Encinitas	9/22/04	13:33	74.2	67.3	6.9
ST13.4A	7435 Neptune Drive, Carlsbad	9/22/04	12:02	58.0	53.2	4.8
ST19.2A	1625 Griffin Street, Oceanside	9/22/04	10:01	70.1	65.3	4.8
ST19.1A	1738 Soto Street, Oceanside	9/22/04	9:10	64.8	58.3	6.5

Note:
1- Measured for 20-minute periods.

TABLE 6-6 – Shielding Factor for the Future Build Model

Site No.	Shielding Factor (dB)	Site No.	Shielding Factor (dB)	Site No.	Shielding Factor (dB)	Site No.	Shielding Factor (dB)
R5.16A	-5	R18.14	-5	R19.47	-5	R21.3	-5
R9.14	-5	R18.15	-5	R20.9	-5	R21.4	-5
R9.15A	-5	R18.18	-5	R20.10	-5	R21.7	-5
R9.16	-5	R18.20	-5	R20.12	-5	R21.10	-5
R10.3B	-5	R19.11	-5	R20.15	-5	R21.12	-5
R10.12	-5	R19.13	-5	R20.17	-5	R21.13	-5
R17.14	-5	R19.32	-11	R20.18	-5	R21.15	-5
R17.16	-5	R19.33	-11	R20.19	-5	R21.22	-5
R18.4	-5	R19.34	-11	R20.20	-5	R22.3	-5
R18.13	-5	R19.46	-5	R21.2	-5		

7.0 FUTURE NOISE ENVIRONMENT, IMPACTS, AND ABATEMENT MEASURES

This noise study was conducted to determine future noise impacts at sensitive receptors within the boundaries of this project. The future/worst case scenario traffic noise levels were modeled to determine the appropriate abatement measures. This section discusses the future noise environment and considers possible abatement measures for impacted locations.

7.1 TRAFFIC DATA

The highest traffic noise levels occur when traffic is heavy but remains free-flowing. Level-of-Service (LOS) C volumes were modeled to ensure the absolute worst-case scenario traffic noise for the future year. The LOS C volumes used for "No-Build" and "Build" scenarios of this project are 1,800 vehicles per hour per lane for I-5 mainline lanes.

Table 7-1 presents the future traffic volumes and traffic distributions used for the noise analysis per direction of travel. The traffic distribution for the projected year 2030 has been applied to the LOS C volume limit of 1,800 vehicles per hour (vph) per lane to obtain these volumes. Speeds of 105 kilometers per hour (km/h) (65 miles per hour [mph]) are assumed for all vehicle types for I-5 mainline traffic. Since the freeway traffic would be the dominant noise source at a majority of the receptors located adjacent to the project corridor, no local surface street traffic was modeled.

TABLE 7-1 – TRAFFIC VOLUMES

Roadway/ Roadway Segment	Peak-Hour Traffic Volume (LOS C)[1] per Lane	Cars Vol (%)	Medium Trucks Vol (%)	Heavy Trucks Vol (%)	Vehicle Speed, km/h / mph
I-5 Mainline Traffic					
La Jolla Village Drive to I-805 Junction	1800	1707 (94.8)	53 (2.9)	40 (2.2)	105 / 65
I-805 Junction to SR-78 (Vista Way)	1800	1696 (94.2)	44 (2.4)	61 (3.4)	105 / 65
SR-78 (Vista Way) to SR-76	1800	1682 (93.5)	49 (2.7)	69 (3.8)	105 / 65
North of SR 76	1800	1663 (92.4)	57 (3.2)	80 (4.4)	105 / 65
I-5 HOV Lanes					
All Road Segments	1500	1500 (100)	0 (0)	0 (0)	105 / 65

Note:
1- Level-of-Service (LOS) C volumes are used to predict worst-case traffic noise levels. These volumes are used for both existing and future year 2030 traffic conditions.

Tables 7-2 and 7-3 present the ramp traffic volumes used in the analysis for the future "No-Build" and "Build" scenarios, respectively. The ramp traffic data provided by the Department was examined and has been capped at a maximum of 1,000 vph/lane for LOS C conditions for the "No-Build" scenario and assumed to be 1,000 vph/lane for the "Build" scenario. The number of lanes in the traffic noise model for a ramp is governed by the lowest number of lanes in the ramp. If an off ramp begins at one lane on the freeway and then at its end point becomes three lanes, only one lane's worth of traffic, capped at 1,000 vph/lane or equal to 1,000 vph/lane, is modeled. The higher of either the AM or PM ramp traffic volumes has been used in the model to ensure the worst-case

TABLE 7-2 –RAMP TRAFFIC VOLUMES - FUTURE NO-BUILD

Intersection/ Ramp	Total Peak-Hour Traffic Volume (LOS C)[1]	# of lanes[2]	Cars Vol (%)	Medium Trucks Vol (%)[3]	Heavy Trucks Vol (%)[3]	Vehicle Speed, km/h / mph
La Jolla Village Drive						
SB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
SB On-ramp (Loop)	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	40 / 25
SB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB On-ramp	600	1	574 (95.7)	17 (2.9)	8 (1.4)	72 / 45
NB On-ramp (Loop)	900	1	861 (95.7)	26 (2.9)	13 (1.4)	40 / 25
NB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
Genesse Avenue						
SB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
SB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
Carmel Mountain Road						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB By Pass [4]	7100	4	6688 (94.2)	170 (2.4)	241 (3.4)	105 / 65
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB By Pass [4]	6780	4	6387 (94.2)	163 (2.4)	231 (3.4)	105 / 65
Carmel Valley Road / SR-56						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	120	1	114 (95.0)	3 (2.4)	3 (2.6)	72 / 45
SB By Pass Ramp [4]	2700	2	2543 (94.2)	65 (2.4)	92 (3.4)	105 / 65
SB Connector from SR-56	2000	2	1884 (94.2)	48 (2.4)	68 (3.4)	105 / 65
NB On-ramp	150	1	143 (95.0)	4 (2.4)	4 (2.6)	72 / 45
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB By Pass Ramp [4]	2390	2	2251 (94.2)	57 (2.4)	81 (3.4)	105 / 65
NB Connector to SR-56	2000	2	1884 (94.2)	48 (2.4)	68 (3.4)	105 / 65
Del Mar Heights Road						
SB On-ramp	700	1	665 (95.0)	17 (2.4)	18 (2.6)	72 / 45
SB On-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1340	2	1273 (95.0)	32 (2.4)	35 (2.6)	72 / 45
Via De La Valle						
SB On-ramp	900	1	855 (95.0)	22 (2.4)	23 (2.6)	72 / 45
SB On-ramp (Loop)	700	1	665 (95.0)	17 (2.4)	18 (2.6)	40 / 25
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	550	1	523 (95.0)	13 (2.4)	14 (2.6)	72 / 45
NB On-ramp (Loop)	650	1	618 (95.0)	16 (2.4)	17 (2.6)	40 / 25
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Lomas Santa Fe Drive						
SB On-ramp	690	1	656 (95.0)	17 (2.4)	18 (2.6)	72 / 45
SB Off-ramp	840	1	798 (95.0)	20 (2.4)	22 (2.6)	72 / 45
NB On-ramp	840	1	798 (95.0)	20 (2.4)	22 (2.6)	72 / 45
NB Off-ramp	650	1	618 (95.0)	16 (2.4)	17 (2.6)	72 / 45

Notes:

1- The existing and predicted design-year 2030 conditions for ramp traffic were compared to the LOS C volumes of 1,000 vph/ lane, and the lesser of the two have been used to model ramp traffic for the No-Build alternative.

2- The number of lanes modeled for each ramp are governed by the lowest number of lanes in the ramp.

3- Truck percentages for I-5 ramp traffic are based on mainline I-5 traffic.

4- Predicted design-year 2030 volumes.

TABLE 7-2 – RAMP TRAFFIC VOLUMES - FUTURE NO-BUILD (CONT'D.)

Intersection/ Ramp	Total Peak-Hour Traffic Volume (LOS C)[1]	# of lanes[2]	Cars Vol (%)	Medium Trucks Vol (%)[3]	Heavy Trucks Vol (%)[3]	Vehicle Speed, km/h / mph
Manchester Avenue						
SB On-ramp (Loop)	950	1	903 (95.0)	23 (2.4)	25 (2.6)	40 / 25
SB Off-ramp	200	1	190 (95.0)	5 (2.4)	5 (2.6)	72 / 45
NB On-ramp	140	1	133 (95.0)	3 (2.4)	4 (2.6)	72 / 45
NB Off-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
Birmingham Drive						
SB On-ramp	930	1	908 (97.6)	13 (1.4)	9 (1.0)	72 / 45
SB Off-ramp	420	1	410 (97.6)	6 (1.4)	4 (1.0)	72 / 45
NB On-ramp	430	1	420 (97.6)	6 (1.4)	4 (1.0)	72 / 45
NB Off-ramp	480	1	468 (97.6)	7 (1.4)	5 (1.0)	72 / 45
Santa Fe Drive						
SB On-ramp	480	1	456 (95.0)	12 (2.4)	12 (2.6)	72 / 45
SB Off-ramp	480	1	456 (95.0)	12 (2.4)	12 (2.6)	72 / 45
NB On-ramp	670	1	637 (95.0)	16 (2.4)	17 (2.6)	72 / 45
NB Off-ramp	520	1	494 (95.0)	12 (2.4)	14 (2.6)	72 / 45
Encinitas Boulevard						
SB On-ramp	720	1	684 (95.0)	17 (2.4)	19 (2.6)	72 / 45
SB Off-ramp	700	1	665 (95.0)	17 (2.4)	18 (2.6)	72 / 45
NB On-ramp	880	1	836 (95.0)	21 (2.4)	23 (2.6)	72 / 45
NB Off-ramp	730	1	694 (95.0)	18 (2.4)	19 (2.6)	72 / 45
Leucadia Boulevard						
SB On-ramp	750	1	713 (95.0)	18 (2.4)	20 (2.6)	72 / 45
SB Off-ramp	810	1	770 (95.0)	19 (2.4)	21 (2.6)	72 / 45
NB On-ramp	580	1	551 (95.0)	14 (2.4)	15 (2.6)	72 / 45
NB Off-ramp	930	1	884 (95.0)	22 (2.4)	24 (2.6)	72 / 45
La Costa Avenue						
SB On-ramp	800	1	760 (95.0)	19 (2.4)	21 (2.6)	72 / 45
SB Off-ramp	800	1	760 (95.0)	19 (2.4)	21 (2.6)	72 / 45
NB On-ramp	660	1	627 (95.0)	16 (2.4)	17 (2.6)	72 / 45
NB Off-ramp	830	1	789 (95.0)	20 (2.4)	22 (2.6)	72 / 45
Poinsettia Lane						
SB On-ramp	690	1	656 (95.0)	17 (2.4)	18 (2.6)	72 / 45
SB Off-ramp	540	1	513 (95.0)	13 (2.4)	14 (2.6)	72 / 45
NB On-ramp	520	1	494 (95.0)	12 (2.4)	14 (2.6)	72 / 45
NB Off-ramp	740	2	703 (95.0)	18 (2.4)	19 (2.6)	72 / 45
Palomar Airport Road						
SB On-ramp	360	1	342 (95.0)	9 (2.4)	9 (2.6)	72 / 45
SB On-ramp (Loop)	1140	2	1083 (95.0)	27 (2.4)	30 (2.6)	40 / 25
SB Off-ramp	1330	2	1264 (95.0)	32 (2.4)	35 (2.6)	72 / 45
NB On-ramp	1360	2	1292 (95.0)	33 (2.4)	35 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Cannon Road						
SB On-ramp	470	1	447 (95.0)	11 (2.4)	12 (2.6)	72 / 45
SB Off-ramp	1300	2	1235 (95.0)	31 (2.4)	34 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	520	1	494 (95.0)	12 (2.4)	14 (2.6)	72 / 45

Notes:

1- The existing and predicted design-year 2030 conditions for ramp traffic were compared to the LOS C volumes of 1,000 vph/ lane, and the lesser of the two have been used to model ramp traffic for the No-Build alternative.

2- The number of lanes modeled for each ramp are governed by the lowest number of lanes in the ramp.

3- Truck percentages for I-5 ramp traffic are based on mainline I-5 traffic.

4- Predicted design-year 2030 volumes.

TABLE 7-2 – RAMP TRAFFIC VOLUMES - FUTURE NO-BUILD (CONT'D.)

Intersection/ Ramp	Total Peak-Hour Traffic Volume (LOS C)[1]	# of lanes[2]	Cars Vol (%)	Medium Trucks Vol (%)[3]	Heavy Trucks Vol (%)[3]	Vehicle Speed, km/h / mph
Tamarack Avenue						
SB On-ramp	820	1	779 (95.0)	20 (2.4)	21 (2.6)	72 / 45
SB Off-ramp	440	1	418 (95.0)	11 (2.4)	11 (2.6)	72 / 45
NB On-ramp	520	1	494 (95.0)	12 (2.4)	14 (2.6)	72 / 45
NB Off-ramp	710	1	675 (95.0)	17 (2.4)	18 (2.6)	72 / 45
Carlsbad Village Drive						
SB On-ramp	650	1	618 (95.0)	16 (2.4)	17 (2.6)	72 / 45
SB Off-ramp	570	1	542 (95.0)	14 (2.4)	15 (2.6)	72 / 45
NB On-ramp	510	1	485 (95.0)	12 (2.4)	13 (2.6)	72 / 45
NB Off-ramp	660	1	627 (95.0)	16 (2.4)	17 (2.6)	72 / 45
Las Flores Drive						
SB On-ramp	240	1	234 (97.6)	3 (1.4)	2 (1.0)	72 / 45
SB Off-ramp	280	1	273 (97.6)	4 (1.4)	3 (1.0)	72 / 45
NB On-ramp	530	1	517 (97.6)	7 (1.4)	5 (1.0)	72 / 45
NB Off-ramp	380	1	371 (97.6)	5 (1.4)	4 (1.0)	72 / 45
SR-78 (Vista Way)						
SB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
SB On-ramp (Loop)	2000	2	1890 (94.5)	54 (2.7)	56 (2.8)	40 / 25
NB On-ramp	2000	2	1890 (94.5)	54 (2.7)	56 (2.8)	72 / 45
NB Off-ramp (Loop)	300	1	284 (94.5)	8 (2.7)	8 (2.8)	40 / 25
NB On-ramp (Loop)	30	1	28 (94.5)	1 (2.7)	1 (2.8)	40 / 25
NB Off-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
Cassidy Street						
SB On-ramp	360	1	340 (94.5)	10 (2.7)	10 (2.8)	72 / 45
SB Off-ramp	200	1	189 (94.5)	5 (2.7)	6 (2.8)	72 / 45
California Street						
NB On-ramp	240	1	234 (97.3)	4 (1.7)	2 (1.0)	72 / 45
Oceanside Boulevard						
SB On-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
SB Off-ramp	590	1	558 (94.5)	16 (2.7)	17 (2.8)	72 / 45
NB On-ramp	500	1	473 (94.5)	14 (2.7)	14 (2.8)	72 / 45
NB Off-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
Mission Avenue						
SB On-ramp	600	1	567 (94.5)	16 (2.7)	17 (2.8)	72 / 45
SB On-ramp (Loop)	750	1	709 (94.5)	20 (2.7)	21 (2.8)	40 / 25
SB Off-ramp	380	1	359 (94.5)	10 (2.7)	11 (2.8)	72 / 45
NB On-ramp	390	1	369 (94.5)	11 (2.7)	11 (2.8)	72 / 45
NB Off-ramp (Loop)	935	1	884 (94.5)	25 (2.7)	26 (2.8)	40 / 25
NB Off-ramp	935	1	884 (94.5)	25 (2.7)	26 (2.8)	72 / 45
SR-76						
SB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
SB Off-ramp (Loop)	870	1	822 (94.5)	23 (2.7)	24 (2.8)	40 / 25
SB Off-ramp	190	1	180 (94.5)	5 (2.7)	5 (2.8)	72 / 45
NB On-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
NB Off-ramp	1570	2	1484 (94.5)	42 (2.7)	44 (2.8)	72 / 45
Harbor Drive/ Vandergrift Boulevard						
SB On-ramp (Loop)	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	40 / 25
SB Off-ramp	220	1	205 (93.4)	7 (3.2)	7 (3.4)	72 / 45
NB On-ramp	190	1	177 (93.4)	6 (3.2)	6 (3.4)	72 / 45
NB Off-ramp (Loop)	240	1	224 (93.4)	8 (3.2)	8 (3.4)	40 / 25
NB Off-ramp	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	72 / 45

Notes:
1- The existing and predicted design-year 2030 conditions for ramp traffic were compared to the LOS C volumes of 1,000 vph/ lane, and the lesser of the two have been used to model ramp traffic for the No-Build alternative.
2- The number of lanes modeled for each ramp are governed by the lowest number of lanes in the ramp.
3- Truck percentages for I-5 ramp traffic are based on mainline I-5 traffic.
4- Predicted design-year 2030 volumes.

TABLE 7-3 – RAMP TRAFFIC VOLUMES - FUTURE BUILD

Intersection/ Ramp	Total Peak-Hour Traffic Volume (LOS C)[1]	# of lanes[2]	Cars Vol (%)	Medium Trucks Vol (%)[3]	Heavy Trucks Vol (%)[3]	Vehicle Speed, km/h / mph
La Jolla Village Drive						
SB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
SB On-ramp (Loop)	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	40 / 25
SB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB On-ramp (Loop)	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	40 / 25
NB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
Genesse Avenue						
SB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
SB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB On-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
NB Off-ramp	1000	1	957 (95.7)	29 (2.9)	14 (1.4)	72 / 45
Carmel Mountain Road						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB By Pass [4]	7200	4	6782 (94.2)	173 (2.4)	245 (3.4)	105 / 65
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB By Pass [4]	7200	4	6782 (94.2)	173 (2.4)	245 (3.4)	105 / 65
Carmel Valley Road / SR-56						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB By Pass Ramp [4]	3300	2	3109 (94.2)	79 (2.4)	112 (3.4)	105 / 65
SB Connector from SR-56	2000	2	1884 (94.2)	48 (2.4)	68 (3.4)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB By Pass Ramp [4]	3040	2	2864 (94.2)	73 (2.4)	103 (3.4)	105 / 65
NB Connector to SR-56	2000	2	1884 (94.2)	48 (2.4)	68 (3.4)	72 / 45
Del Mar Heights Road						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB On-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
SB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
Via De La Valle						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB On-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
SB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
Lomas Santa Fe Drive						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB On-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp (Loop)	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	40 / 25
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45

Notes:

1- LOS C volumes of 1,000 vph/ lane have been used to model ramp traffic for the Build alternative.

2- The number of lanes modeled for each ramp are governed by the lowest number of lanes in the ramp.

3- Truck percentages for I-5 ramp traffic are based on mainline I-5 traffic.

4- Predicted design-year 2030 volumes.

TABLE 7-3 – RAMP TRAFFIC VOLUMES - FUTURE BUILD (CONT'D.)

Intersection/ Ramp	Total Peak-Hour Traffic Volume (LOS C)[1]	# of lanes[2]	Cars Vol (%)	Medium Trucks Vol (%)[3]	Heavy Trucks Vol (%)[3]	Vehicle Speed, km/h / mph
Manchester Avenue						
SB On-ramp (Loop)	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	40 / 25
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp (Loop)	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	40 / 25
Birmingham Drive						
SB On-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
SB Off-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
NB On-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
NB Off-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
Santa Fe Drive						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Encinitas Boulevard						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Leucadia Boulevard						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
La Costa Avenue						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Poinsettia Lane						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
Palomar Airport Road						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB On-ramp (Loop)	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	40 / 25
SB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB On-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
Cannon Road						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	2000	2	1900 (95.0)	48 (2.4)	52 (2.6)	72 / 45

Notes:

1- LOS C volumes of 1,000 vph/ lane have been used to model ramp traffic for the Build alternative.

2- The number of lanes modeled for each ramp are governed by the lowest number of lanes in the ramp.

3- Truck percentages for I-5 ramp traffic are based on mainline I-5 traffic.

4- Predicted design-year 2030 volumes.

TABLE 7-3 – RAMP TRAFFIC VOLUMES - FUTURE BUILD (CONT'D.)

Intersection/ Ramp	Total Peak-Hour Traffic Volume (LOS C)[1]	# of lanes[2]	Cars Vol (%)	Medium Trucks Vol (%)[3]	Heavy Trucks Vol (%)[3]	Vehicle Speed, km/h / mph
Tamarack Avenue						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Carlsbad Village Drive						
SB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
SB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB On-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
NB Off-ramp	1000	1	950 (95.0)	24 (2.4)	26 (2.6)	72 / 45
Las Flores Drive						
SB On-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
SB Off-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
NB On-ramp	1000	1	976 (97.6)	14 (1.4)	10 (1.0)	72 / 45
NB Off-ramp	2000	2	1952 (97.6)	28 (1.4)	20 (1.0)	72 / 45
SR-78 (Vista Way)						
SB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
SB On-ramp (Loop)	2000	2	1890 (94.5)	54 (2.7)	56 (2.8)	40 / 25
NB On-ramp	2000	2	1890 (94.5)	54 (2.7)	56 (2.8)	72 / 45
NB Off-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
NB On-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
NB Off-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
Cassidy Street						
SB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
SB Off-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
California Street						
NB On-ramp	1000	1	973 (97.3)	17 (1.7)	10 (1.0)	72 / 45
Oceanside Boulevard						
SB On-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
SB Off-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
NB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
NB Off-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
Mission Avenue						
SB On-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
SB Off-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
NB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
NB Off-ramp (Loop)	2000	2	1890 (94.5)	54 (2.7)	56 (2.8)	40 / 25
SR-76						
SB On-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
SB Off-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
SB Off-ramp	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	72 / 45
NB On-ramp (Loop)	1000	1	945 (94.5)	27 (2.7)	28 (2.8)	40 / 25
NB Off-ramp	2000	2	1890 (94.5)	54 (2.7)	56 (2.8)	72 / 45
Harbor Drive/ Vandergrift Boulevard						
SB On-ramp (Loop)	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	40 / 25
SB Off-ramp	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	72 / 45
NB On-ramp	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	72 / 45
NB Off-ramp (Loop)	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	40 / 25
NB Off-ramp	1000	1	934 (93.4)	32 (3.2)	34 (3.4)	72 / 45

Notes:

1- LOS C volumes of 1,000 vph/ lane have been used to model ramp traffic for the Build alternative.

2- The number of lanes modeled for each ramp are governed by the lowest number of lanes in the ramp.

3- Truck percentages for I-5 ramp traffic are based on mainline I-5 traffic.

4- Predicted design-year 2030 volumes.

scenario for the "No-Build" case. Speeds of 105 km/h (65 mph) were modeled for the connector ramps, while average speeds of 72 km/h (45 mph) were used for all "on" and "off" ramps. Slower speeds of 40 km/h (25 mph) were used to model traffic on loop ramps. Heavy truck traffic percentages on ramps are typically less than the percentages for I-5 mainline traffic.

The published I-5 mainline traffic percentages have been used to develop the following assumptions for ramp truck traffic distributions for this project:

- Medium truck percentages on ramps are assumed to be equal to the percentage of trucks on the mainline in a given area.
- Heavy truck percentages on ramps between SR-78 and La Jolla Village Drive are assumed to be 0.8% less than mainline percentages.
- Heavy truck percentages on ramps between SR-76 and SR-78 are assumed to be 1% less than I-5 mainline percentages.
- Heavy truck percentages for connectors at SR-56, SR-76, and SR-78 are assumed to be the same as I-5 mainline percentages.

The above assumptions apply to all ramps within the project area with the exception of those at the intersections of Birmingham Drive, Las Flores Drive, and California Street. These three intersections serve smaller streets in residential areas, and are therefore less likely to be used by trucks. It has been assumed that medium truck traffic is 1% less than I-5 mainline percentages, which results in medium truck percentages of 1.4% for Birmingham Drive and Las Flores Drive, and 1.7% for California Street ramps. Heavy truck traffic has been limited to a total of 1% overall for these three intersections.

The following paragraphs describe the considerations used in modeling the different lane configurations that exist in both the future "No-Build" and "Build" project scenarios:

Future No-Build Project Configurations:

- 4 total lanes: 4 general lanes – The inside two general lanes are modeled along the striping between two lanes with 1,800 cars and medium trucks per lane and no heavy trucks. The outside two general lanes are modeled as one line along the striping between two lanes with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. The number of the medium and heavy trucks is determined based on the total volume of the vehicles on 4 lanes. Medium trucks are spread equally between two modeled lines.
- 5 total lanes: 5 general lanes or 4 general lanes and 1 auxiliary lane - Inside two general lanes are modeled along the striping between two lanes with 1,800 cars and medium trucks per lane and no heavy trucks. The outside three general lanes (or two general and one auxiliary) are modeled as one line along the center of the middle lane with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. The number of the medium and heavy trucks is determined based on the total volume of the vehicles on 5 lanes. Medium trucks are spread proportionally between two modeled lines using 2/5 and 3/5 ratios.

Future Build Project Configurations

- 5 total lanes: 1 HOV, 4 general lanes - HOV lane is modeled as one line along the center of the HOV lane with 1,500 cars per lane and no trucks. Inside two general lanes are modeled along the striping between two lanes with 1,800 cars and medium trucks per lane and no heavy trucks. The outside two general lanes are modeled as one line along the striping between two lanes with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. Number of the medium and heavy trucks is determined based on the total volume of the vehicles on 5 lanes. Medium trucks are spread equally between two modeled lines.
- 6 total lanes: 2 HOV, 4 general lanes - HOV lanes are modeled as one line along the divider line of two HOV lanes with 1,500 cars per lane and no trucks. Inside two general lanes are modeled along the striping between two lanes with 1,800 cars and medium trucks per lane and no heavy trucks. The outside two general lanes are modeled as one line along the striping between two lanes with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. Number of the medium and heavy trucks is determined based on the total volume of the vehicles on 6 lanes. Medium trucks are spread equally between two modeled lines.
- 7 total lanes: 2 HOV, 4 general lanes, 1 auxiliary lane - HOV lanes are modeled as one line along the divider line of two HOV lanes with 1,500 cars per lane and no trucks. Inside two general lanes are modeled along the striping between two lanes with 1,800 cars and medium trucks per lane and no heavy trucks. Two outside general lanes and the auxiliary lane are modeled as one line along the centerline of the middle lane with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. Number of the medium and heavy trucks is determined based on the total volume of the vehicles on 7 lanes. Medium trucks are spread proportionally between two modeled lines using 2/5 and 3/5 ratios.
- 8 total lanes: 2 HOV, 5 general lanes, 1 auxiliary lane (or 2 HOV, 4 general lanes, 2 auxiliary lane) - HOV lanes are modeled as one line along the divider line of two HOV lanes with 1,500 cars per lane and no trucks. Inside three general lanes are modeled along the centerline of the middle lane with 1,800 cars and medium trucks per lane and no heavy trucks. The outside two general lanes and the auxiliary lane (or one general lane and two auxiliary lanes) are modeled as one line along the centerline of the middle lane with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. Number of the medium and heavy trucks is determined based on the total volume of the vehicles on 8 lanes. Medium trucks are spread equally between two modeled lines.
- 9 total lanes: 2 HOV, 5 general lanes, 2 auxiliary lanes - HOV lanes are modeled as one line along the divider line of two HOV lanes with 1,500 cars per lane and no trucks. Inside three general lanes are modeled along the centerline of the middle lane with 1,800 cars and medium trucks per lane and no heavy trucks. The outside two general lanes and two auxiliary lanes are modeled as one line

along the center of the four lanes with 1,800 cars, medium trucks, and heavy trucks per lane. All the heavy trucks are included in this line. Number of the medium and heavy trucks is determined based on the total volume of the vehicles on 9 lanes. Medium trucks are spread proportionally between two modeled lines using 3/7 and 4/7 ratios.

The predicted peak-hour noise levels for the future year 2030 are shown in the following sections, which have been divided by roadway segment. The predicted future noise levels exceed 67 dBA at a majority of the receptor locations, and an increase of up to 3 to 5 dB over existing peak hour noise levels is seen at many receptors. An analysis with barrier heights ranging from 2.4 meters (8 feet) to 4.9 meters (16 feet) was conducted for impacted noise sensitive areas. All recommended barrier heights and locations are designed to provide a minimum 5 dB noise reduction. The heights and locations of the soundwalls are also shown graphically on the figures in Appendix C.

The minimum barrier heights to cut the line-of-sight from each receptor to the exhaust stacks of heavy trucks have been calculated for all recommended barriers. These heights were determined through calculations performed by line-of-sight PC Version 1.353, which accompanies the SOUND2000 software package. All recommended barriers meet or exceed these minimum barrier heights for receivers with recommended noise abatement.

7.2 NOISE IMPACT AND BARRIER ANALYSIS FOR EACH HIGHWAY SEGMENT

The following sections and paragraphs describe the recommended soundwalls and non abated area for each segment designated in Table 2-1. Noise impacts are identified for outdoor use areas, as well as the number of impacted residences. For outdoor land use areas such as schools and parks, 30-meter (100-foot) "frontage units" were totaled for use in consideration of cost effectiveness. The Computer Noise Modeling Input/Output files for Calibration, No Build, Build, and Design are in Appendix D. Street addresses for all of the noise sensitive receptors in this study are provided in Appendix E.

SEGMENT 1 – LA JOLLA VILLAGE DRIVE TO GENESEE AVENUE

Areas with noise abatement

Table 7-4 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-5 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-6 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraph describes the recommended soundwall:

Soundwall S475: Soundwall S475 would be located along the southbound side of I-5 just north of La Jolla Village Drive. The soundwall would provide feasible reduction from highway traffic noise for the outdoor use area of university housing, represented by Receptor R1.4. The common outdoor use area for this complex is behind the laundromat building. The existing 1.7 m (5.5 ft) property wall already provides the required abatement from highway traffic noise, except for Receptors R1.2 to R1.4. However, 2.4 m (8 ft), 3.0 m (10 ft), 3.7 m (12 ft), 4.3 m (14 ft), and 4.9 m (16 ft) soundwalls that were modeled along the frontage road did not meet the feasible reduction criteria, except for Receptor R1.4. Sheet 2 shows the location of the soundwall.

Areas without noise abatement

There is a baseball field in Segment 1 that is impacted by the widening and improvement project where it was not feasible to apply standard noise abatement techniques.

Receptor R1.6

Receptors R1.6 and R1.7 represent a baseball field at the east side of I-5 and south of Voigt Street. There is a park and ride facility between this baseball field and I-5. A soundwall at the R/W line from station 476+15 to 478+25 was considered for this area, but it was not considered feasible.

TABLE 7-4 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 1

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] $L_{eq(h)}$, dBA	FUTURE PEAK HOUR NOISE LEVELS, $L_{eq(h)}$, dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	
La Jolla Village Drive to Genesse Avenue - Southbound																	
R 1.1	MFR	61 E	62	64	B (67)	NONE	63	1	63	1	62	2	62	2	62	2	S475/Frontage Road/ Southbound
R 1.2	MFR	66 E	67	69	B (67)	A/E	68	1	68	1	67	2	66	3	65	4	
R 1.3	MFR	71 E	72	74	B (67)	A/E	74	0	73	1	72	2	72	2	70	4	
R 1.4 C	MFR	70 M, ST1.1	71	73	B (67)	A/E	73 T	0	72	1	71	2	69	4	**68 R**	**5**	
R 1.5	MFR	64 E	65	68	B (67)	A/E	66	2	66	2	65	3	65	3	64	4	
La Jolla Village Drive to Genesse Avenue - Northbound																	
R 1.6	REC	62 E	63	66	B (67)	A/E	65	1	64	2	64	2	64	2	64	2	R/W
R 1.7	REC	61 E	62	64	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	

Notes:

1 - $L_{eq(h)}$ are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - Fire Station; HM - Hotel/Motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - Includes the benefits of an existing soundwall/property wall.

TABLE 7-5 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 1

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S475	R1.4	2 University Housing Units	Frontage Road/ Southbound	4.9 m (16 ft)/ 359 m (1,178 ft)	$48,000	$96,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-6 – BARRIER LOCATIONS AND ELEVATIONS- SEGMENT 1

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S475	R1.4	Frontage Road/ Southbound	472+60	4.9 (16)	102.9 (338)
			472+70	4.9 (16)	103.9 (341)
			472+95	4.9 (16)	102.9 (338)
			473+40	4.9 (16)	101.4 (333)
			474+00	4.9 (16)	100.4 (329)
			474+65	4.9 (16)	100.9 (331)
			475+20	4.9 (16)	102.9 (338)
			475+70	4.9 (16)	104.9 (344)
			476+25	4.9 (16)	106.9 (351)
		Approximate Length: 359 m (1,178 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 2 – GENESEE AVENUE TO CARMEL MOUNTAIN ROAD

Areas with noise abatement

Table 7-7 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. Table 7-8 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-9 provides a summary of barrier location, elevation, and length. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraph describes the recommended soundwall for Segment 2:

Soundwall S518: Soundwall S518 would be located along the northbound R/W and private property between stations 517+00 and 520+60. The soundwall would provide a 5 dB noise reduction to grassy outdoor use areas for multi-family residences represented by Receptors R2.1 through R2.5 at the Torry Villas Apartment complex. It would replace an existing 1.8 meter (6 foot) high glass/block property wall located on the R/W. Soundwall S518 has been raised higher than otherwise required in front of Receptor R2.4 to provide a 5 dB noise reduction to Receptor R2.5. Sheets 8 and 9 show the location of Soundwall S518.

Areas without noise abatement

There are no noise sensitive areas in Segment 2 that are impacted by the widening and improvement project where it was not feasible to apply standard noise abatement techniques.

TABLE 7-7 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 2

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Genesse Avenue to Carmel Mountain Road - Northbound																	
R 2.1[W]	MFR	68 [E]	69	70	B (67)	A/E	67	3	**65** [R]	**5**	63	7	62	8	61	9	S518/R/W and Private Property
R 2.2[W]	MFR	68 [M, ST2.1]	69	70	B (67)	A/E	68	2	66	4	**65** [R]	**5**	63	7	62	8	
R 2.3[W]	MFR	69 [E]	70	70	B (67)	A/E	68	2	66	4	**64** [R]	**6**	62	8	61	9	
R 2.4[W, C]	MFR	69 [E]	70	70	B (67)	A/E	68	2	65	5	**63** [R,5]	**7**	62	8	61	9	
R 2.5[W]	MFR	65 [E]	66	66	B (67)	A/E	64	2	62	4	**61** [R]	**5**	60	6	59	7	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM- hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - Include the benefits of an existing property wall.

TABLE 7-8 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 2

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S518	R2.1 - R2.5	30 MFR	R/W and Private Property/ Northbound	3.0 m (10 ft) to 3.7 m (12 ft)/ 427 m (1,401 ft)	$38,000	$1,140,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-9 – BARRIER LOCATIONS AND ELEVATIONS

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S518	R2.1 - R2.5	R/W and Private Property/ Northbound	517+00	3.0 (10)	59.0 (194)
			517+30	3.0 (10)	59.3 (195)
			517+55	3.0 (10)	59.5 (195)
			517+55	3.7 (12)	60.2 (198)
			518+00	3.7 (12)	60.2 (198)
			518+10	3.7 (12)	60.2 (198)
			581+35	3.7 (12)	59.8 (196)
			518+65	3.7 (12)	58.5 (192)
			519+05	3.7 (12)	58.3 (191)
			519+65	3.7 (12)	58.2 (191)
			520+10	3.7 (12)	57.6 (189)
			520+30	3.7 (12)	57.2 (188)
			520+55	3.7 (12)	57.2 (188)
			520+62	3.7 (12)	57.2 (188)
			520+60	3.7 (12)	57.2 (188)
			520+58	3.7 (12)	57.2 (188)
		Approximate Length: 427 m (1,401 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 3 – CARMEL MOUNTAIN ROAD TO CARMEL VALLEY ROAD

Areas with noise abatement

Table 7-10 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. Table 7-11 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-12 provides a summary of barrier location, elevation, and length. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls for Segment 3:

Soundwall S526: Soundwall S526 would be located along the northbound R/W and property line between stations 522+80 and 527+15. The R/W and property line meet in the areas between stations 523+80 and 524+80 and between stations 526+00 and 526+50. The R/W drops downhill considerably for the remainder of the area; therefore, Soundwall S526 follows the property line of the residences in the area. A soundwall has not been considered at the shoulder for I-5 because the freeway is depressed by approximately 30 meters (100 feet). The soundwall would provide a 5 dB noise reduction for single-family residences represented by Receptors R3.2 through R3.4, R3.6, R3.8 through R3.10, and R3.10A. It would replace an existing 1.8 meter (6 foot) high glass/block property wall located on the property line. Soundwall S526 has been raised higher than otherwise required in front of Receptors R3.9 and R3.10 to provide a 5 dB noise reduction to Receptor R3.10A. Sheet 9 shows the location of Soundwall S526.

Soundwall S528: Soundwall S528 would be located along the northbound property line between stations 528+40 and 529+30. A soundwall has not been considered for the shoulder because the freeway is depressed by approximately 30 meters (100 feet). The soundwall would provide a 5 dB noise reduction for single-family residences represented by Receptor R3.13. It would replace an existing 1.8 meter (6 foot) high glass/block property wall located on the property line. Soundwall S528 has been raised in front of Receptor R3.14 to provide a 5 dB noise reduction to Receptor R3.13. Sheets 9 and 10 show the location of Soundwall S528.

Areas without noise abatement

There are no noise sensitive areas in Segment 3 that are impacted by the widening and improvement project where it was not feasible to apply standard noise abatement techniques.

TABLE 7-10 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 3

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] $L_{eq(h)}$, dBA	FUTURE PEAK HOUR NOISE LEVELS, $L_{eq(h)}$, dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	
Carmel Mountain Road to Carmel Valley Road - Northbound																	
R 3.1[W]	SFR	59 [E]	62	62	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	--
R 3.1A[W]	SFR	62 [E]	65	65	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	
R 3.2[W]	SFR	63 [E]	66	66	B (67)	A/E	64 [T]	2	**61** [R]	**5**	59	7	58	8	57	9	
R 3.3[W]	SFR	64 [E]	67	68	B (67)	A/E	65 [T]	3	**63** [R]	**5**	61	7	60	8	59	9	
R 3.4[W]	SFR	65 [M, LT3.1]	68	69	B (67)	A/E	66 [T]	3	**64** [R]	**5**	63	6	61	8	60	9	
R 3.5* [W]	SFR	55 [E]	58	58	B (67)	NONE	58	0	57	1	56	2	55	3	55	3	S526/
R 3.6[W]	SFR	67 [E]	70	71	B (67)	A/E	67 [T]	4	**65** [R]	**6**	63	8	61	10	61	10	Private Property
R 3.7[W]	SFR	60 [E]	63	64	B (67)	NONE	62	2	61	3	60	4	60	4	59	5	and R/W
R 3.8[W]	SFR	64 [E]	65	66	B (67)	A/E	64 [T]	2	62	4	**61** [R]	**5**	59	7	58	8	
R 3.9[W]	SFR	67 [M, ST3.1/ CAL]	68	69	B (67)	A/E	65 [T]	4	63	6	61	8	**60** [R,5]	**9**	59	10	
R 3.10[W, C]	SFR	70 [E]	71	72	B (67)	A/E	69 [T]	3	67	5	64	8	**63** [R,5]	**9**	62	10	
R 3.10A[W]	SFR	68 [E]	66	66	B (67)	A/E	65 [T]	1	63	3	62	4	**61** [R]	**5**	60	6	
R 3.11[W]	SFR	64 [E]	65	65	B (67)	NONE	63	2	62	3	61	4	60	5	59	6	--
R 3.12[W]	SFR	63 [E]	64	65	B (67)	NONE	63	2	61	4	60	5	59	6	58	7	
R 3.13[W, C]	SFR	66 [E]	67	67	B (67)	A/E	64 [T]	3	**62** [R]	**5**	60	7	59	8	58	9	S528/
R 3.14[W]	SFR	64 [E]	65	65	B (67)	NONE	63	2	62	3	60	5	59	6	58	7	Private Property

Notes:

1 - $L_{eq(h)}$ are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire Station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - Include the benefits of an existing 1.8 meter (6 foot) high property wall.

* Non first-row receiver.

TABLE 7-11 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 3

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S526	R3.2 - R3.10A	28 SFR	R/W and Private Property/ Northbound	3.0 m (10 ft) to 4.3 m (14 ft)/ 577 m (1,893 ft)	$40,000	$1,120,000
S528	R3.13 - R3.14	2 SFR	Private Property/ Northbound	3.0 m (10 ft)/ 116 m (381 ft)	$34,000	$68,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-12 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 3

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S526	R3.2 - R3.10A	R/W and Private Property/ Northbound	522+80	3.0 (10)	63.0 (207)
			523+00	3.0 (10)	63.3 (208)
			523+30	3.0 (10)	63.7 (209)
			523+60	3.0 (10)	63.8 (209)
			523+85	3.0 (10)	63.7 (209)
			524+15	3.0 (10)	63.5 (208)
			524+35	3.0 (10)	63.2 (207)
			524+80	3.0 (10)	63.0 (207)
			524+90	3.0 (10)	63.0 (207)
			524+95	3.0 (10)	63.7 (209)
			524+95	3.7 (12)	64.4 (211)
			525+25	3.7 (12)	64.2 (211)
			525+40	3.7 (12)	64.3 (211)
			525+75	3.7 (12)	64.7 (212)
			525+90	3.7 (12)	65.0 (213)
			525+90	4.3 (14)	65.6 (215)
			526+05	4.3 (14)	65.8 (216)
			526+50	4.3 (14)	64.8 (213)
			526+60	4.3 (14)	65.8 (216)
			526+75	4.3 (14)	67.8 (222)
			527+15	4.3 (14)	68.6 (225)
		Approximate Length: 577 m (1,893 ft)			
S528	R3.13 - R3.14	Private Property/ Northbound	528+45	3.0 (10)	67.0 (220)
			528+40	3.0 (10)	67.7 (222)
			528+55	3.0 (10)	67.7 (222)
			528+85	3.0 (10)	67.8 (222)
			529+10	3.0 (10)	67.9 (223)
			529+30	3.0 (10)	68.2 (224)
		Approximate Length: 116 m (381 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 4 – CARMEL VALLEY ROAD TO DEL MAR HEIGHTS ROAD

Areas with noise abatement

Table 7-13 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. Table 7-14 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-15 provides a summary of barrier location, elevation, and length. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls for Segment 4:

Soundwall S541: Soundwall S541 would be located on the southbound side of I-5 on private property between stations 540+30 and 541+65. The soundwall would provide a 5 dB noise reduction for the recreational area of a gated housing community, comprised of a pool and tennis courts, represented by Receptors R4.2 and R4.4. It would replace an existing 1.8 to 2.1 meter (6 to 7 foot) high property wall located on the property line. Soundwall S541 would not provide a 5 dB noise reduction to the residence represented by Receptor R4.3 because the residence is elevated above both the wall and the recreational area by approximately 4 meters (13 feet). Sheet 11 shows the location of Soundwall S541.

Soundwall S543: Soundwall S543 would be located on the southbound side of I-5 on private property between stations 541+75 and 542+55. The soundwall would provide a 5 dB noise reduction to a grassy backyard outdoor use area for multi-family residences represented by Receptor R4.5. It would replace the eastern side of an existing 2.3 meter (7.5 foot) high glass/block property wall located on the property line. Sheet 11 shows the location of Soundwall S543.

Soundwall S551: Soundwall S551 would be located on the southbound side of I-5 on private property between stations 545+45 and 556+40. The soundwall would provide a 5 dB noise reduction to single-family residences represented by Receptors R4.11 through R4.21. It would replace an existing 2.1 meter (7 foot) high glass/block property wall located on the property line. Soundwall S551 has been raised higher than otherwise required at Receptors R4.16 and R4.19 to provide a 5 dB noise reduction at Receptors R4.17 and R4.18. Sheets 12 and 13 show the location of Soundwall S551.

Soundwall S557: Soundwall S557 would be located on the southbound side of I-5 on private property between stations 556+05 and 558+05. The soundwall would provide a 5 dB noise reduction to grassy backyard outdoor use areas for multi-family residences represented by Receptors R4.22A, R4.23, and R4.24. However, there is only 5 feet of flat surface area behind these residences and many large trees in the area that would have to be removed for Soundwall S557 to be built. Soundwall S557 has been raised higher than otherwise required in front of Receptor R4.23 to provide a 5 dB noise reduction to Receptor R4.22A. Sheets 13 and 14 show the location of Soundwall S557.

Areas without noise abatement

Several areas in Segment 4 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptor R4.1 Receptor R4.1 represents a single-family residence in a gated community on the southbound side of I-5, just north of Carmel Valley Road. This receiver is elevated by approximately 7 meters (23 feet) above the freeway and 10 meters (33 feet) above the R/W. A soundwall located on the shoulder or the R/W would not be effective due to the elevation of the residence. A soundwall was not considered on private property for Receptor R21.1, because constructing a soundwall on private property is not considered practical for only one receptor. Sheet 11 shows the location of Receptor R4.1.

Receptors R4.6 through R4.10 Receptors R4.6 through R4.10 represent a group of multi-family residences on the southbound side of I-5, north of Carmel Valley Road. Receptors R4.6 through R4.8 are protected by an existing 4.6 meter (15 foot) high soundwall. The existing soundwall decreases in height from 4.6 to 2.7 meters (15 to 9 feet) in front of Receptors R4.9 and R4.10. The results in Table 4-1 show that raising the height of the existing soundwall to 4.9 meters (16 feet) would not provide a 5 dB benefit to any of the residences; therefore, it would not be feasible. Sheets 11 and 12 show the location of the receptors.

TABLE 7-13 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 4

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Carmel Valley Road to Del Mar Heights Road - Southbound																	
R 4.1	SFR	68 E	71	72	B (67)	A/E	72	0	71	1	71	1	71	1	71	1	
R 4.2 W, C	REC	69 E	72	72	B (67)	A/E	70 T	2	**67** R	**5**	65	7	63	9	62	10	S541/
R 4.3 W	SFR	70 E	73	73	B (67)	A/E	73	0	72	1	71	2	71	2	70	3	Private Property
R 4.4 W	REC	67 E	70	71	B (67)	A/E	69 T	2	**66** R	**5**	64	7	62	9	61	10	
R 4.5 W, C	MFR	69 M, ST4.1	72	73	B (67)	A/E	72 T	1	71	2	69	4	**67** R	**6**	66	7	S543/ Private Property
R 4.6 W, Z	MFR	65 E	68	69	B (67)	A/E	--	--	--	--	--	--	--	--	67	2	
R 4.7 W, Z	REC	63 E	66	67	B (67)	A/E	--	--	--	--	--	--	--	--	67	0	Private Property
R 4.8 W, Z	MFR	62 E	65	66	B (67)	A/E	--	--	--	--	--	--	--	--	65	1	
R 4.9 W, Z	MFR	68 M, ST4.2	67	67	B (67)	A/E	--	--	--	--	--	--	66	1	67	0	
R 4.10 W, Z	SFR	66 E	65	66	B (67)	A/E	66	0	65	1	65	1	65	1	65	1	
R 4.11 W, C	SFR	74 E	74	75	B (67)	A/E	74 T	1	71	4	**68** R	**7**	66	9	65	10	
R 4.12 W	SFR	72 E	72	73	B (67)	A/E	72 T	1	70	3	**68** R	**5**	67	6	65	8	S551/
R 4.13 W	SFR	69 M, ST4.3/CAL	69	69	B (67)	A/E	68 T	1	67	2	65	4	**64** R	**5**	64	5	Private Property
R 4.14 W	SFR	69 E	69	70	B (67)	A/E	69 T	1	67	3	66	4	**65** R	**5**	64	6	
R 4.15 W	SFR	68 E	69	69	B (67)	A/E	69 T	0	67	2	65	4	**64** R	**5**	64	5	
R 4.16 W	SFR	68 E	69	70	B (67)	A/E	69 T	1	67	3	65	5	**64** R, 5	**6**	63	7	
R 4.17 W	SFR	67 E	68	69	B (67)	A/E	68 T	1	67	2	65	4	**64** R	**5**	63	6	
R 4.18 W	SFR	67 E	68	69	B (67)	A/E	68 T	1	67	2	65	4	**64** R	**5**	63	6	
R 4.19 W	SFR	68 M, LT4.1	69	70	B (67)	A/E	69 T	1	67	3	65	5	**64** R, 5	**6**	63	7	
R 4.20 W	SFR	68 E	69	69	B (67)	A/E	68 T	1	67	2	65	4	**64** R	**5**	63	6	
R 4.21 W	SFR	68 E	69	69	B (67)	A/E	68 T	1	67	2	65	4	**64** R	**5**	63	6	
R 4.22 W	SFR	67 E	68	69	B (67)	A/E	68 T	1	67	2	66	3	65	4	65	4	
R 4.22A	MFR	71 E	71	71	B (67)	A/E	68 T	3	**66** R	**5**	64	7	62	9	61	10	S557/
R 4.23 C	MFR	77 M, ST4.4/CAL	77	78	B (67)	A/E	73 T	5	**71** R,5	**7**	69	9	66	12	65	13	Private Property
R 4.24	MFR	72 E	72	73	B (67)	A/E	69 T	4	**66** R	**7**	63	10	62	11	61	12	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - Includes the benefits of an existing soundwall/property wall.

Z - Receivers R4.6 through R4.9 are behind an existing 3.3 to 4.6 meter (11 to 15 foot) high soundwall; therefore, a soundwall of lesser height has not been considered for these receivers.

TABLE 7-14 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 4

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S541	R4.2 and R4.4	1 Recreational Area (4 frontage units)	Private Property/ Southbound	3.0 m (10 ft)/ 174 m (571 ft)	$38,000	$152,000
S543	R4.5	6 MFR	Private Property/ Southbound	4.3 m (14 ft)/ 80 m (262 ft)	$50,000	$300,000
S551	R4.11 - R4.22	51 SFR	Private Property/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)/ 1,102 m (3,615 ft)	$50,000	$2,550,000
S557	R4.22A, R4.23, and R4.24	10 MFR	Private Property/ Southbound	3.0 m (10 ft)/ 271 m (889 ft)	$40,000	$400,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-15 – BARRIER LOCATIONS AND ELEVATIONS– SEGMENT 4

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S541	R4.2 and R4.4	Private Property/ Southbound	540+30	3.0 (10)	25.5 (84)
			540+30	3.0 (10)	25.5 (84)
			540+70	3.0 (10)	26.0 (85)
			541+20	3.0 (10)	27.5 (90)
			541+60	3.0 (10)	29.0 (95)
			541+65	3.0 (10)	29.0 (95)
		Approximate Length: 174 m (571 ft)			
S543	R4.5	Private Property/ Southbound	541+75	4.3 (14)	38.3 (126)
			542+10	4.3 (14)	38.3 (126)
			542+55	4.3 (14)	35.6 (117)
		Approximate Length: 80 m (262 ft)			
S551	R4.11 - R4.22	Private Property/ Southbound	545+45	3.7 (12)	46.0 (151)
			545+70	3.7 (12)	47.4 (156)
			546+00	3.7 (12)	48.5 (159)
			546+50	3.7 (12)	48.7 (160)
			546+85	3.7 (12)	53.7 (176)
			546+85	4.3 (14)	54.3 (178)
			547+25	4.3 (14)	56.3 (185)
			547+65	4.3 (14)	58.3 (191)
			548+25	4.3 (14)	61.3 (201)
			548+90	4.3 (14)	64.3 (211)
			549+45	4.3 (14)	66.8 (219)
			550+10	4.3 (14)	69.8 (229)
			550+70	4.3 (14)	71.8 (236)
			551+40	4.3 (14)	72.8 (239)
			551+80	4.3 (14)	73.6 (241)
			552+40	4.3 (14)	74.8 (245)
			553+10	4.3 (14)	76.3 (250)
			553+70	4.3 (14)	76.8 (252)
			554+55	4.3 (14)	78.3 (257)
			555+00	4.3 (14)	79.3 (260)
			555+70	4.3 (14)	81.3 (267)
			556+05	4.3 (14)	82.3 (270)
			556+40	4.3 (14)	83.3 (273)
		Approximate Length: 1,102 m (3,615 ft)			
S557	R4.22A, R4.23, and R4.24	Private Property/ Southbound	556+05	3.0 (10)	87.0 (285)
			556+50	3.0 (10)	87.0 (285)
			556+90	3.0 (10)	87.0 (285)
			557+35	3.0 (10)	89.0 (292)
			557+70	3.0 (10)	89.0 (292)
			557+95	3.0 (10)	89.0 (292)
			558+00	3.0 (10)	90.5 (297)
			558+05	3.0 (10)	92.0 (302)
		Approximate Length: 271 m (889 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 5 – DEL MAR HEIGHTS ROAD TO VIA DE LA VALLE UC

Areas with noise abatement

Table 7-16 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-17 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-18 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S561: Soundwall S561 would be located along the southbound side of I-5 between stations 560+75 and 562+20. It is not feasible to abate for highway traffic noise from within the R/W in this area due to the R/W elevation compared to the residence elevation; however, a soundwall on private property would provide feasible abatement for the outdoor use areas for the multi family residences, represented by Receptors R5.1 and R5.2, in this area. The outdoor use areas for the multi family residences are patios. Permission is needed from the property owners of the multifamily residences to place Soundwall S561 at this location. Sheet 14 shows location of the soundwall.

Soundwall S563: Soundwall S563 would be located along the southbound side of I-5 between stations 562+35 and 563+30. It is not feasible to abate for highway traffic noise from within the R/W in this area due to the R/W elevation compared to the school elevation. The existing property wall for this outdoor use area does not span far enough south of the school and is not sufficiently tall to provide traffic noise protection; however, replacing the property wall with Soundwall S563 would provide feasible abatement for this outdoor use area at Del Mar Hills Elementary School, represented by Receptor R5.3. Permission is needed from the school district to place Soundwall S563 at this location. Receptor R5.4 represents a measurement site used to determine if Del Mar Hills Elementary School qualifies for building acoustical treatment due to high outdoor noise levels; which is discussed in section 7.3. Sheet 14 shows location of the soundwall.

Soundwall S565: Soundwall S565 would be located along the southbound side of I-5 between stations 563+30 and 564+40. It is not feasible to abate for highway traffic noise from within the R/W in this area due to the R/W elevation compared to the school elevation; however, a soundwall along the property line would provide feasible abatement for the outdoor use areas at Del Mar Hills Elementary School, represented by Receptors R5.5 and R5.6. This soundwall would not provide noise abatement to any classroom. Permission is needed from the school district to place Soundwall S563 at this location. Recommended soundwall height for Receptor R5.5 is higher than required, this was done to meet the abatement requirement for Receptor R5.6. Soundwall S565 starts at the same highway station number where Soundwall S563 ends. The reason Soundwall S565 is being assessed as a separate soundwall is because it would be built at a much lower elevation than Soundwall S563. Sheet 14 shows location of the soundwall.

Soundwall S567: Soundwall S567 would be located along the southbound side of I-5 between stations 565+75 and 567+20. The wall would provide feasible abatement for single family residences, represented by Receptors R5.7A, R5.8, and R5.8A, from highway traffic noise. While both soundwall S567 and S569 run along the R/W and are near each other, they are considered different walls because of an elevation drop

between them that prevents the gap from being closed. Sheet 15 shows the location of the soundwall.

Soundwall S569: Soundwall S569 would be located along the southbound side of I-5 between stations 567+30 and 568+10. The wall would provide feasible abatement for single family residences, represented by Receptor R5.9, from highway traffic noise. While both soundwall S567 and S569 run along the R/W and are near each other, they are considered different walls because of an elevation drop between them that prevents the gap from being closed. Sheet 15 shows the location of the soundwall.

Soundwall S568: Soundwall S568 would be located on the R/W and in private property along the northbound side of I-5 between stations 566+25 and 567+90. The wall would provide feasible abatement for single family residences, represented by Receptors R5.21 to R5.23, from highway traffic noise. It may not be practical to construct a soundwall at this location due to the topographical characteristics at this location and backyard decks. Sheet 15 shows the location of the soundwall.

Soundwall S573: Soundwall S573 would be located along the southbound side of I-5 between stations 570+45 and 577+00. The wall would provide feasible abatement for single family residences, represented by Receptors R5.10 to R5.14, from highway traffic noise. Sheets 15 and 16 show the location of the soundwall.

Soundwall S589: Soundwall S589 would be located along the southbound side of I-5 between stations 587+60 and 593+00. The wall would provide feasible abatement for recreational areas, represented by Receptors R5.24 to R5.26, from highway traffic noise. R5.24 represents Surf -N- Turf's mini golf course. R5.25 represents tennis courts near the highway, and R5.26 represents tennis courts set back from the highway near the Hilton Hotel. Recommend wall height for Receptor R5.25 is higher than required to meet the noise abatement requirements for Receptor R5.26. The swimming pool is the only outdoor use area at the Hilton Hotel and is located in the courtyard; therefore, it is not impacted. Sheet 18 shows location of the soundwall.

Areas without noise abatement

Several areas in Segment 5 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non abatement are described in the following paragraphs:

Receptor R5.7: A single family residence is represented by Receptor R5.7. It is not feasible to abate highway traffic noise for Receptor R5.7 due to the R/W elevation compared to the residence elevation. The R/W elevation is significantly lower than residence elevation; therefore, a soundwall within the state R/W would not be feasible. Also, a soundwall on the property line would not be feasible to abate highway traffic noise due to the property line elevation compared to the residence's outdoor use area elevation. The elevation at the property line is significantly lower than the residence's outdoor use area elevation, and again a soundwall at the property line would not be feasible. A soundwall that would abate traffic noise for R5.7 would have to be built well within the property of the residence, which was considered not a practical solution. Sheet 15 shows the location of the receptor.

Receptors R5.17 to R5.20: Single family residences are represented by Receptors R5.17 to R5.20 are located on the northbound side of I-5. The existing 3.0 m (10 ft) property wall already provides the required abatement from highway traffic noise, except for R5.17. However, 3.7 m (12 ft), 4.3 m (14 ft), and 4.9 m (16 ft) soundwalls that were

modeled in place of the existing property wall and did not meet the 5 dB reduction requirement to be considered feasible. Sheets 14 and 15 show location of the receptors.

TABLE 7-16 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 5

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1,8]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S,A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R5.1	MFR	70 E	71	73	B (67)	A/E	**67** R,T	**6**	65	8	64	9	63	10	62	11	S561/ Private Property
R5.2 C	MFR	71 M, ST5.2	72	74	B (67)	A/E	**68** R,T	**6**	66	8	64	10	63	11	62	12	
R5.3 W, C	SCH	68 E	69	71	B (67)	A/E	68 T	3	67	4	**66** R	**5**	65	6	65	6	S563/ School Property
R5.4 W	SCH	64 E	65	67	B (67)	A/E	66	1	65	2	65	2	65	2	64	3	
R5.5 C	SCH	68 E	69	71	B (67)	A/E	65 T	6	**64** R,5	**7**	63	8	62	9	62	9	S565/ School Property
R5.6	SCH	69 E	70	72	B (67)	A/E	68 T	4	**67** R	**5**	67	5	67	5	66	6	
R5.7	SFR	72 M, LT5.2	71	73	B (67)	A/E	-	-	-	-	-	-	-	-	-	-	S567/R/W
R5.7A C	SFR	72 E	71	73	B (67)	A/E	**67** R,T	**6**	66	7	65	8	64	9	64	9	
R5.8	SFR	72 E	71	72	B (67)	A/E	**66** R,T	**6**	64	8	62	10	61	11	60	12	
R5.8A	SFR	70 E	69	71	B (67)	A/E	**65** R,T	**6**	65	6	64	7	63	8	63	8	
R5.9 C	SFR	71 E	70	72	B (67)	A/E	72	0	72	0	71 T	1	69	3	**67** R	**5**	S569/R/W
R5.10 C	SFR	68 M, LT5.3	73	73	B (67)	A/E	70 T	3	69	4	**68** R	**5**	67	6	67	6	S573/Shoulder
R5.11	SFR	66 E	71	70	B (67)	A/E	67 T	3	66	4	**65** R	**5**	65	5	64	6	
R5.12	SFR	65 E	70	70	B (67)	A/E	67 T	3	66	4	**65** R	**5**	65	5	64	6	
R5.13	SFR	63 E	68	68	B (67)	A/E	65 T	3	64	4	64	4	**63** R	**5**	63	5	
R5.14	SFR	62 E	67	68	B (67)	A/E	65 T	3	64	4	64	4	**63** R	**5**	63	5	
R5.15	SFR	62 E	67	67	B (67)	A/E	65 T	2	64	3	64	3	63	4	63	4	
R5.16 W, 7, 9	MFR	67 M, ST5.1/CAL	68	70	B (67)	A/E	67	3	65	5	64	6	62	8	61	9	Private Property
R5.16A W, K	MFR	59 E	60	62	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R5.17 W	SFR	63 E	64	66	B (67)	A/E	-	-	-	-	64	2	62	4	62	4	R/W
R5.18 W	SFR	62 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R5.19 W	SFR	62 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R5.20 W	SFR	61 E	62	63	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R5.21	SFR	65 M, ST5.4/CAL	67	69	B (67)	A/E	66 T	3	65	4	65	4	**64** R	**5**	63	6	S568/R/W and Private Property
R5.22	SFR	68 E	70	72	B (67)	A/E	**67** R,T	**5**	66	6	64	8	63	9	62	10	
R5.23 C	SFR	70 E	72	74	B (67)	A/E	**68** R,T	**6**	66	8	64	10	62	12	61	13	
R5.24	REC	74 E	74	74	B (67)	A/E	71 T	3	70	4	**69** R	**5**	68	6	67	7	S589/Shoulder
R5.25 C	REC	74 E	74	74	B (67)	A/E	70 T	4	69	5	**68** R,5	**6**	67	7	66	8	
R5.26	REC	71 E	71	71	B (67)	A/E	69	2	68	3	67 T	4	**66** R	**5**	65	6	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Receptor does not represent an area of frequent human use. However, this is a measurement and calibration site.
R - Recommended height to meet feasibility requirements of Depatment's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
K - A shielding factor of 5 dB has been applied to Receptor R5.16A to account for attenuation provided by first-row buildings.
W - The existing and future no-build and build noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.

TABLE 7-17 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 5

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence	Reasonable Allowance Cost Per Barrier(s)
S561	R5.1 - R5.2	6 MFR	Private Property/ Southbound	2.4 m (8 ft)/ 150 m (492 ft)	$38,000	$228,000
S563	R5.3	1 SCH (3 Frontage Units)	School Property/ Southbound	3.7 m (12 ft)/ 97 m (318 ft)	$48,000	$144,000
S565	R5.5 - R5.6	1 SCH (4 Frontage Units)	School Property/ Southbound	3.0 m (10 ft)/ 111 m (364ft)	$50,000	$200,000
S567	R5.7A, R5.8, R5.8A	7 SFR	R/W/ Southbound	2.4 m (8 ft)/ 140 m (459 ft)	$48,000	$336,000
S568	R5.21 - R5.23	11 SFR	R/W and Private Property/ Northbound	2.4 m (8 ft) to 4.3 m (14 ft)/ 216 m (709 ft)	$40,000	$440,000
S569	R5.9	3 SFR	R/W/ Southbound	4.9 m (16 ft)/ 77 m (253 ft)	$46,000	$138,000
S573	R5.10 - R5.14	8 SFR	Shoulder/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)/ 650 m (2,133 ft)	$38,000	$304,000
S589	R5.24 - R5.26	3 REC (8 Frontage Units)	Shoulder/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)/ 562 m (1,844 ft)	$48,000	$384,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-18 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 5

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S561	R5.1 - R5.2	Private Property/ Southbound	560+75	2.4 (8)	98.4 (323)
			561+10	2.4 (8)	96.4 (316)
			561+75	2.4 (8)	96.4 (316)
			562+20	2.4 (8)	96.4 (316)
		Approximate Length: 150 m (492 ft)			
S563	R5.3	School Property/ Southbound	562+35	3.7 (12)	95.9 (315)
			562+60	3.7 (12)	95.7 (314)
			563+30	3.7 (12)	96.6 (317)
		Approximate Length: 97 m (318 ft)			
S565	R5.5 - R5.6	School Property/ Southbound	563+30	3.0 (10)	93.0 (305)
			564+40	3.0 (10)	91.7 (301)
		Approximate Length: 111 m (364 ft)			
S567	R5.7A, R5.8, and R5.8A	R/W/ Southbound	565+75	2.4 (8)	101.9 (334)
			566+15	2.4 (8)	102.3 (336)
			567+05	2.4 (8)	102.6 (337)
			567+20	2.4 (8)	102.4 (336)
		Approximate Length: 140 m (459 ft)			
S568	R5.21 - R5.23	R/W and Private Property/ Northbound	566+25	4.3 (14)	105.1 (345)
			566+25	4.3 (14)	104.0 (341)
			566+63	4.3 (14)	106.3 (349)
			566+77	4.3 (14)	106.3 (349)
			566+77	3.7 (12)	105.7 (347)
			566+97	3.7 (12)	103.7 (340)
			566+97	2.4 (8)	102.4 (336)
			567+27	2.4 (8)	102.4 (336)
			567+31	2.4 (8)	102.4 (336)
			567+43	2.4 (8)	102.4 (336)
			567+50	2.4 (8)	102.4 (336)
			567+90	2.4 (8)	102.4 (336)
		Approximate Length: 216 m (709 ft)			
S569	R5.9	R/W/ Southbound	567+30	4.9 (16)	100.9 (331)
			568+10	4.9 (16)	101.1 (332)
		Approximate Length: 77 m (253 ft)			
S573	R5.10 - R5.14	Shoulder/ Southbound	570+45	3.7 (12)	48.2 (158)
			571+05	3.7 (12)	47.3 (155)
			572+00	3.7 (12)	44.3 (145)
			573+00	3.7 (12)	41.2 (135)
			573+00	4.3 (14)	41.8 (137)
			574+00	4.3 (14)	38.8 (127)
			575+00	4.3 (14)	35.7 (117)
			576+00	4.3 (14)	32.8 (108)
			576+60	4.3 (14)	30.3 (99)
			577+00	4.3 (14)	29.8 (98)
		Approximate Length: 650 m (2,133 ft)			
S589	R5.24 - R5.26	Shoulder/ Southbound	587+60	3.7 (12)	11.3 (37)
			588+00	3.7 (12)	11.2 (37)
			589+00	3.7 (12)	10.7 (35)
			589+45	3.7 (12)	10.9 (36)
			590+00	3.7 (12)	11.5 (38)
			590+00	4.3 (14)	12.1 (40)
			590+35	4.3 (14)	13.4 (44)
			590+98	4.3 (14)	14.6 (48)
			591+25	4.3 (14)	15.4 (50)
			591+37	4.3 (14)	15.6 (51)
			591+58	4.3 (14)	16.1 (53)
			591+97	4.3 (14)	16.5 (54)
			592+30	4.3 (14)	16.6 (54)
			593+00	4.3 (14)	15.9 (52)
		Approximate Length: 562 m (1,844 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 6 – VIA DE LA VALLE UC TO LOMAS SANTA FE DRIVE

Areas with noise abatement

Table 7-19 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-20 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-21 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S602: Soundwall S602 would be located along the northbound side of I-5 between stations 595+50 and 604+40. The wall would provide feasible reduction for single and multi family residences, represented by Receptors R6.12A and R6.12 to R6.21, from highway traffic noise. The outdoor use areas for the multi family residences are patios, except for Receptor R6.12 which represents a communal swimming pool. Recommend wall heights for Receptors R6.14, R6.16A, R6.17, R6.17A, and R6.20 are higher than required, this was done to meet the abatement requirements for Receptors R6.13, R6.16, R6.18, R6.19 and R6.21. It is not feasible to abate highway traffic noise for the single family residence represented by R6.15 and the multi family residences represented by R6.13A and R6.14A due to the R/W elevation compared to the residence elevation. Also, Receptor R6.14A is not impacted by highway traffic noise. The R/W elevation is significantly lower than receptor elevation; therefore, a soundwall within the state R/W would not be feasible; however, Soundwall S602 would travel along the R/W in front of these receptors and would abate traffic noise in this area by 2 to 4 dB. The R/W elevation south of station 596+00 starts sloping down substantially. The height of the soundwall at station 596+00 is 4.3 m (14 ft) and it goes up gradually to 4.9 m (16 ft) at station 595+50 which is its southern endpoint. Sheets 19 and 20 show the location of the soundwall.

Soundwall S602 (Option 2): Soundwall S602 option 2 is a shorter wall that would be located along the northbound side of I-5 between stations 600+00 and 604+40. This wall would provide feasible reduction from highway traffic noise for several single family residences that are severely impacted because the future predicted traffic noise levels are equal to or higher than 75 dBA. This area is represented by Receptors R6.17A, R6.17 to R6.21 and is shown on Sheets 19 and 20.

Soundwall S603: Soundwall S603 would be located along the southbound side of I-5 between stations 597+80 and 608+15. The wall would provide feasible reduction for single and multi family residences, as well as St. Leo's Head Start Pre School and Santa Fe Christian School, represented by Receptors R6.4A and R6.4 to R6.11, from highway traffic noise. The outdoor use areas for the multi family residences are side yards, except for Receptor R6.4 which represents a swimming pool. Recommend wall height for Receptor R6.5 is higher than required to meet the abatement requirements for Receptor R6.6. At this section of the highway, the predicted noise levels for the build option is up to 9 dB higher than the existing noise levels, this is due to the highway expanding significantly toward the receptors. Classroom noise for these schools is discussed in Section 7.3. Sheets 19, 20, and 21 show the location of the soundwall.

Soundwall S603 (Option 2): Soundwall S603 option 2 would be located on private property along the southbound side of I-5 between stations 605+15 and 605+96. This wall would provide feasible reduction from highway traffic noise for multi family

residences that are impacted. Soundwall S603 option 2 would wrap around the property line of the four first row residences. This area is represented by Receptors R6.9 and R6.9A and is shown on Sheet 20.

Areas without noise abatement

Several areas in Segment 6 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non abatement are described in the following paragraphs:

Receptors R6.1 and R6.2: Single and multi family residences, which are represented by Receptor R6.1, are located on the southbound side of I-5. It is not feasible to abate for highway traffic noise for R6.1 due to the topography of the area. The highway elevation is significantly lower than the residence elevation. Receptor R6.2 is a front yard and is not an outdoor use area, and the backyard for this area is not impacted. It was modeled because it was meant to be a calibration site; however, the noise data collected from this site was contaminated and was not used for calibration. A potential soundwall was considered on the R/W. Sheet 19 shows location of the receptors.

Receptors R6.22 and R6.23: Santa Fe Montessori School is represented by Receptors R6.22 and R6.23 and is located on the northbound side of I-5. The R/W elevation is significantly lower than the school elevation; therefore, a soundwall within the state R/W would not be feasible. A soundwall on school property would not be feasible because the outdoor use area is located behind the school and a soundwall would not provide the required minimum 5 dB noise reduction. Receptor R6.22 is in the school's front parking lot and is not an outdoor use area, but it was modeled to aide in estimating existing noise levels in this area. Building acoustical treatment may need to be considered for this school due to the high exterior noise levels (74 dBA) at the facade of the building. Modeling for potential soundwalls was done on the R/W. Classroom noise for this school is discussed in section 7.3. Sheet 20 shows location of the receptors.

Receptors R6.24 and R6.25: Receptors R6.24 and R6.25 are located on the northbound side of I-5 and represent a single family residence and a home office separate from the residence, and are protected by a property wall. The property wall is a 3.9 meter high glass and block wall and is specifically designed to mitigate traffic noise at this property. A 4.3 m (14 ft) and 4.9 m (16 ft) soundwall running along the R/W, in front of R6.24 and R6.25, was modeled and did not meet the 5 dB reduction requirement to be considered feasible. Sheet 20 shows location of the receptors.

TABLE 7-19 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 6

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Via De La Valle to Lomas Santa Fe Drive - Southbound																	
R6.1	SFR	66 E	66	68	B (67)	A/E	67	1	67	1	66	2	66	2	65	3	
R6.1A	SFR	60 E	60	62	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	R/W
R6.2	MFR	65 M, ST6.1	65	67	B (67)	A/E	67	0	66	1	64	3	64	3	63	4	
R6.3	MFR	62 E	62	64	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	
R6.4A	MFR	67 E	67	72	B (67)	A/E	**67** R,T	**5**	66	6	65	7	65	7	64	8	
R6.4 C	MFR	71 E	76	80	B (67)	A/E	**73** R,T	**7**	71	9	70	10	69	11	68	12	
R6.5	SFR	64 E	69	74	B (67)	A/E	69 T	5	**68** R,5	**6**	67	7	67	7	66	8	
R6.6 *	SFR	61 E	66	69	B (67)	A/E	66	3	65 T	4	**64** R	**5**	63	6	63	6	
R6.7 *	SFR	64 M, ST6.3	69	71	B (67)	A/E	68 T	3	67	4	**66** R	**5**	65	6	64	7	S603/R/W and Shoulder
R6.7A	SFR	64 E	69	68	B (67)	A/E	65 T	3	64	4	**63** R	**5**	63	5	62	6	
R6.8	SCH	68 E, 8	73	70	B (67)	A/E	66 T	4	**65** R	**5**	65	5	64	6	64	6	
R6.9	MFR	69 M, LT6.2	74	74	B (67)	A/E	70 T	4	**68** R	**6**	67	7	66	8	65	9	
R6.9A	MFR	67 E	73	73	B (67)	A/E	69 T	4	**68** R	**5**	66	7	65	8	65	8	
R6.10	SCH	75 E	73	76	B (67)	A/E	71	5	**70** R,T	**6**	69	7	68	8	67	9	
R6.11	SCH	76 M, ST6.7/CAL	74	75	B (67)	A/E	73	2	**70** R,T	**5**	68	7	67	8	66	9	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Short term measurment taken by Caltrans August 7, 2006.
10 - Receptor does not represent an area of frequent human use. However, this is a measurement and calibration site.
R - Recommended height to meet feasibility requirements of Depatment's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
W - The existing and future noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.
# - The southend of Soundwall S602 is raised to 4.9m (16ft) and this meets the 4.3m (14 ft) requirement at Receptor R6.12.

TABLE 7-19 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 6 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Via De La Valle to Lomas Santa Fe Drive - Northbound																	
R6.12A	MFR	70 E	73	75	B (67)	A/E	75 T	0	73	2	71	4	**69** R	6	67	8	
R6.12 #	MFR	65 E	68	69	B (67)	A/E	67 T	2	66	3	65	4	**64** R	5	63	6	
R6.12B	SFR	65 E	68	69	B (67)	A/E	68	1	67	2	66	3	65	4	65	4	
R6.13	SFR	68 E	71	73	B (67)	A/E	70 T	3	69	4	**67** R	**6**	66	7	65	8	
R6.13A	SFR	64 E	67	68	B (67)	A/E	67	1	66	2	66	2	65	3	65	3	
R6.14	SFR	67 M, LT6.1	70	72	B (67)	A/E	68 T	4	67	5	**66** R,5	**6**	65	7	65	7	
R6.14A	SFR	61 E	64	65	B (67)	NONE	64	1	64	1	64	1	63	2	63	2	
R6.15	SFR	68 E	71	72	B (67)	A/E	70	2	69	3	69	3	68	4	68	4	S602/R/W and Shoulder
R6.16	SFR	69 E	71	72	B (67)	A/E	70	2	69	3	68 T	4	68	4	**67** R	**5**	
R6.16A [10]	SFR	79 M, ST6.2/CAL	75	76	B (67)	A/E	70	6	68	8	67 T	9	65	11	**64** R,5	**12**	
R6.17A	SFR	72 M, 9	71	72	B (67)	A/E	69	3	68	4	67 T	5	66	6	**65** R,5	**7**	
R6.17	SFR	71 E	73	75	B (67)	A/E	70	5	69 T	6	68	7	68	7	**67** R,5	**8**	
R6.18	SFR	69 E	71	73	B (67)	A/E	70	3	69	4	69	4	68	5	**68** R,T	**5**	
R6.19	SFR	70 E	72	75	B (67)	A/E	71	4	70	5	69	6	68	7	**67** R,T	**8**	
R6.20 C	SFR	73 M, ST6.4	75	75	B (67)	A/E	70 T	5	68	7	67	8	66	9	**66** R,5	**9**	
R6.21 *	SFR	66 M, ST6.6A	70	72	B (67)	A/E	70	2	69	3	68	4	67	5	**66** R,T	**6**	
R6.22 W	SCH	69 M, ST6.5	73	74	B (67)	A/E	73	1	72	2	72	2	71	3	70	4	R/W
R6.23 W	SCH	61 E	65	67	B (67)	A/E	65	2	65	2	64	3	64	3	64	3	
R6.24 W	Office	66 M, ST6.6	68	70	C (72)	NONE	-	-	-	-	-	-	-	-	-	-	
R6.25 W	SFR	63 E	65	66	B (67)	A/E	-	-	-	-	-	-	66	0	66	0	R/W

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Short term measurment taken by Caltrans August 7, 2006.
10 - Receptor does not represent an area of frequent human use. However, this is a measurement and calibration site.
R - Recommended height to meet feasibility requirements of Depatment's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
W - The existing and future noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.
# - The southend of Soundwall S602 is raised to 4.9m (16ft) and this meets the 4.3m (14 ft) requirement at Receptor R6.12.

TABLE 7-19 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 6 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Via De La Valle to Lomas Santa Fe Drive - Southbound																	
R6.9	MFR	69 M, LT6.2	74	74	B (67)	A/E	74	0	74	0	74	0	73 T	1	70	4	S603/Private Property Option 2
R6.9A C	MFR	67 E	73	73	B (67)	A/E	71	2	69	4	69	4	**68 R,T**	**5**	68	5	
Via De La Valle to Lomas Santa Fe Drive - Northbound																	
R6.16A 10	SFR	79 M, ST6.2/CAL	75	76	B (67)	A/E	70	6	68	8	**67 R,T**	**9**	65	11	64	12	S602/R/W and Shoulder Option 2
R6.17A	SFR	72 M, 9	71	72	B (67)	A/E	69	3	68	4	**67 R,T**	**5**	66	6	65	7	
R6.17 C	SFR	71 E	73	75	B (67)	A/E	70	5	69 T	6	**68 R,5**	**7**	67	8	67	8	
R6.18	SFR	69 E	71	73	B (67)	A/E	70	3	70	3	69	4	68	5	**68 R,T**	**5**	
R6.19	SCH	70 E	72	75	B (67)	A/E	73	2	73	2	72	3	71	4	**70 R,T**	**5**	
R6.20	SFR	73 M, ST6.4	75	75	B (67)	A/E	75 T	0	74	1	71	4	69	6	**68 R,5**	**7**	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Short term measurment taken by Caltrans August 7, 2006.
10 - Receptor does not represent an area of frequent human use. However, this is a measurement and calibration site.
R - Recommended height to meet feasibility requirements of Depatment's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
W - The existing and future noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.

TABLE 7-20 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 6

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence	Reasonable Allowance Cost Per Barrier(s)
S602	R6.12A, R6.12 - R6.21	20 MFR, 10 SFR	Shoulder and R/W/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)/ 887 m (2,877 ft)	$42,000	$1,260,000
S603	R6.4A, R6.4 - R6.11	20 MFR, 14 SFR, 2 SCH (10 Frontage Units)	Shoulder and R/W/ Southbound	2.4 m (8 ft) to 3.7 m (12 ft)/ 1,048 m (3,438 ft)	$46,000	$2,024,000
S602 Option 2	R6.17A, R6.17 - R6.20	6 SFR	Shoulder and R/W/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)/ 460 m (1,509 ft)	$42,000	$252,000
S603 Option 2	R6.9 and R6.9A	3 MFR	Private Property/ Southbound	4.3 m (14 ft) to 4.9 m (16 ft)/ 120 m (394 ft)	$38,000	$114,000

Notes:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - School; REC - recreational area.

2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-21 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 6

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S602	R6.12A, R6.12 - R6.21	Shoulder and R/W/ Northbound	595+50	4.9 (16)	34.9 (114)
			596+00	4.3 (14)	37.3 (122)
			596+75	4.3 (14)	40.3 (132)
			596+75	3.7 (12)	39.7 (130)
			597+00	3.7 (12)	41.5 (136)
			598+05	3.7 (12)	47.9 (157)
			598+45	3.7 (12)	50.7 (166)
			599+10	3.7 (12)	54.4 (178)
			599+45	3.7 (12)	58.2 (191)
			599+45	4.9 (16)	59.4 (195)
			599+60	4.9 (16)	59.4 (195)
			600+00	4.9 (16)	57.0 (187)
			600+25	4.9 (16)	54.4 (178)
			600+55	4.9 (16)	51.9 (170)
			601+00	4.9 (16)	56.0 (184)
			601+20	4.9 (16)	55.9 (183)
			601+35	4.9 (16)	53.2 (174)
			601+80	4.9 (16)	46.1 (151)
			602+27	4.9 (16)	44.9 (147)
			602+80	4.9 (16)	42.9 (141)
			603+20	4.9 (16)	43.0 (141)
			603+80	4.9 (16)	43.5 (143)
			604+40	4.9 (16)	42.9 (141)
		Approximate Length: 887 m (2,877 ft)			
S602 Option 2	R6.17A, R6.17 - R6.20	Shoulder and R/W/ Northbound	600+00	3.7 (12)	55.8 (183)
			600+25	3.7 (12)	53.2 (174)
			600+55	3.7 (12)	50.7 (166)
			601+00	3.7 (12)	54.8 (180)
			601+20	3.7 (12)	54.7 (179)
			601+40	3.7 (12)	52.0 (170)
			601+35	4.9 (16)	53.2 (174)
			601+80	4.9 (16)	46.1 (151)
			602+27	4.9 (16)	44.9 (147)
			602+80	4.9 (16)	42.9 (141)
			603+20	4.9 (16)	43.0 (141)
			603+80	4.9 (16)	43.5 (143)
			604+40	4.9 (16)	42.9 (141)
		Approximate Length: 460 m (1,509 ft)			
S603	R6.4A, R6.4 - R6.11	Shoulder and R/W/ Southbound	597+80	2.4 (8)	39.1 (128)
			598+27	2.4 (8)	37.4 (123)
			598+65	2.4 (8)	38.9 (128)
			599+00	2.4 (8)	38.4 (126)
			599+68	2.4 (8)	41.6 (137)
			599+68	3.0 (10)	42.2 (139)
			600+00	3.0 (10)	44.0 (145)
			600+25	3.0 (10)	41.0 (135)
			600+25	3.7 (12)	41.7 (137)
			600+80	3.7 (12)	43.2 (142)
			601+30	3.7 (12)	41.7 (137)
			601+80	3.7 (12)	41.4 (136)
			601+80	3.7 (12)	41.4 (136)
			602+80	3.7 (12)	41.8 (137)
			603+80	3.7 (12)	42.2 (138)
			603+80	3.0 (10)	41.5 (136)
			604+80	3.0 (10)	42.1 (138)
			605+80	3.0 (10)	42.6 (140)
			606+30	3.0 (10)	44.4 (146)
			606+70	3.0 (10)	47.0 (154)
			607+20	3.0 (10)	51.2 (168)
			607+55	3.0 (10)	55.7 (183)
			607+95	3.0 (10)	55.0 (181)
			608+00	3.0 (10)	53.0 (174)
			608+15	3.0 (10)	52.5 (172)
		Approximate Length: 1,048 m (3,438 ft)			
S603 Option 2	R6.9A	Private Property/ Southbound	605+15	4.3 (14)	38.3 (126)
			605+12	4.3 (14)	38.3 (126)
			605+15	4.3 (14)	38.3 (126)
			605+47	4.3 (14)	40.3 (132)
			605+73	4.3 (14)	42.3 (139)
			605+96	4.3 (14)	42.3 (139)
		Approximate Length: 120 m (394 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 7 – LOMAS SANTA FE DRIVE TO MANCHESTER AVENUE

Areas with noise abatement

Table 7-22 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-23 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-24 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S614: Soundwall S614 would be located along the northbound side of I-5 between stations 614+33 and 615+80. The wall would provide feasible reduction for single family residences, represented by Receptor R7.14, from highway traffic noise. Currently, there is an existing 3.7 m (12 ft) high soundwall in front of the residences represented by Receptors R7.12 and R7.13, but this soundwall will be demolished and rebuilt to make room for the new northbound access ramp alignment for Lomas Santa Fe Drive. Soundwall S614 will be coupled to the rebuilt project wall by a 3.0 m (10ft) connecting wall. Sheet 21 shows the location of the soundwall.

Soundwall S622: Soundwall S622 would be located along the northbound side of I-5 between stations 616+45 and 626+00. The wall would provide feasible reduction for single family residences, represented by Receptors R7.18 and R7.20 to R7.32, from highway traffic noise. The recommended wall heights for Receptors R7.21, R7.26, R7.28, R7.29, R7.31, and R7.32 are higher than required to meet the abatement requirements for Receptors R7.20, R7.25, R7.27 and R7.30. Four residences enclosed by this wall but not benefited are represented by Receptors R7.19 and R7.21A. It is not feasible to abate highway traffic noise for these single family residences due to the R/W elevation compared to the residence elevation; however, Soundwall S622 would travel along the R/W in front of these residences and would abate traffic noise by 3 dB. Sheets 22 and 23 show the location of the soundwall.

Soundwall S622 (Option 2): Soundwall S622 option 2 is a shorter wall that would be located along the northbound side of I-5 between stations 619+20 and 622+00. The wall would provide feasible reduction from highway traffic noise for nine single family residences that are severely impacted because the future predicted traffic noise levels are equal to or higher than 75 dBA. This area is represented by Receptors R7.23 to R7.26 and is shown on Sheet 22.

Areas without noise abatement

Several areas in Segment 7 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non abatement are described in the following paragraphs:

Receptors R7.1 to R7.6: The multi family residences represented by Receptors R7.1 and R7.2 and the single family residences that are represented by Receptors R7.3 to R7.6 are located on the southbound side of I-5. It is not practical to abate for highway traffic noise for these residences due to the topography of the area. The residences have tier lots in this area, which means the elevation at the residential outdoor use area are significantly higher than the highway and R/W elevation, making the construction of a soundwall within the R/W not feasible. Also, installing a soundwall on private property

is not feasible in this area, because the local street alignments prevent the construction of a continuous soundwall along private property that would be required to abate noise efficiently in this location. Table 7-22 shows the results of the traffic noise model for this area with a soundwall located on the R/W from stations 612+74 to 617+86. Sheet 21 shows location of the receptors.

Receptors R7.7 to R7.11: The single family residences that are represented by Receptors R7.7 to R7.11 are located on the southbound side of I-5. Only Receptor R7.7 is impacted, and it is not practical to abate for highway traffic noise for the two residences represented by Receptor R7.7 due to the topography of the area. The highway and R/W elevation is significantly lower than the residence elevation, and there is no practical area within the R/W to place a soundwall. A soundwall cannot be placed on private property for these residences because the lots have large backyard decks that would hinder the placement of a soundwall. Sheet 22 shows location of the receptors.

Receptors R7.15 and R7.16: The single family residences that are represented by Receptors R7.15 and R7.16 are located on the northbound side of I-5. The residence and highway elevations are significantly lower than the R/W elevation. The residence, represented by Receptor R7.16, is in an enclosed depressed area and is not impacted by highway noise. It is not feasible to abate for highway traffic noise for the residence represented by Receptor R7.15 by locating a soundwall at the top of the slope. Sheets 21 and 22 show location of the receptors.

Receptor R7.17: The single family residence that is represented by Receptor R7.17 is located on the northbound side of I-5. It is not feasible to abate for highway traffic noise for this residence due to the topography of the area. The residential outdoor use area elevation is higher than the highway and R/W elevation making the construction of a soundwall within the R/W not feasible. A soundwall on private property has not been considered because it will be a stand alone soundwall for only one house. Table 7-22 shows the results of the traffic noise model for this area with a soundwall located on the R/W from stations 615+51 to 616+67. Sheet 22 shows location of the receptor.

TABLE 7-22 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 7

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1,6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Lomas Santa Fe Drive to Manchester Avenue - Southbound																	
R7.1	MFR	68 E	69	71	B (67)	A/E	71	0	71	0	70	1	70	1	70	1	R/W
R7.2	MFR	71 E	71	74	B (67)	A/E	73	1	72	2	71	3	70	4	70	4	
R7.3	SFR	70 E	71	73	B (67)	A/E	73	0	73	0	72	1	71	2	71	2	R/W
R7.4 *	SFR	67 E	68	70	B (67)	A/E	70	0	69	1	68	2	68	2	67	3	
R7.5	SFR	69 M, LT7.2	70	72	B (67)	A/E	72	0	71	1	70	2	70	2	69	3	
R7.6	SFR	67 E	68	70	B (67)	A/E	70	0	70	0	70	0	69	1	68	2	
R7.7	SFR	63 E	64	66	B (67)	A/E	66	0	66	0	66	0	66	0	66	0	R/W
R7.8	SFR	60 E	61	64	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R7.9	SFR	61 M, ST7.2	62	64	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R7.10	SFR	61 E	62	64	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R7.11	SFR	62 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
Lomas Santa Fe Drive to Manchester Avenue - Northbound																	
R7.12 W	SFR	68 M, ST7.1	67	70	B (67)	A/E	-	-	-	-	-	-	69	1	67	3	S614/R/W
R7.13 W	SFR	65 M, LT7.1	66	68	B (67)	A/E	-	-	-	-	-	-	67	1	66	2	
R7.14 C	SFR	71 E	72	74	B (67)	A/E	**68**	**6**	67	7	66	8	65	9	65	9	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Barrier height recommended to match height of existing soundwall that will be removed to make room for new highway alignment.
R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
W - The existing and future no-build noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.

TABLE 7-22 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 7 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Lomas Santa Fe Drive to Manchester Avenue - Northbound																	
R7.15	SFR	63 E	64	66	B (67)	A/E	64	2	64	2	64	2	63	3	63	3	
R7.16	SFR	61 E	62	64	B (67)	NONE	63	1	63	1	62	2	62	2	62	2	R/W
R7.17	SFR	62 E	63	66	B (67)	A/E	64	2	64	2	63	3	63	3	62	4	
R7.18	SFR	65 E	66	68	B (67)	A/E	66	2	64	4	**62** R	**6**	61	7	60	8	
R7.19	SFR	64 E	64	66	B (67)	A/E	64	2	64	2	63	3	62	4	62	4	
R7.20	SFR	63 E	63	66	B (67)	A/E	62 T	4	62	4	**61** R	**5**	61	5	61	5	
R7.21	SFR	72 M, ST7.3/ CAL	70	72	B (67)	A/E	69 T	3	67	5	**65** R, 5	**7**	64	8	62	10	
R7.21A	SFR	63 E	63	66	B (67)	A/E	64	2	63	3	63	3	62	4	62	4	
R7.22	SFR	72 E	72	74	B (67)	A/E	72 T	2	70	4	**69** R	**5**	68	6	67	7	
R7.23	SFR	73 E	73	76	B (67)	A/E	74	2	73	3	72 T	4	**71** R	**5**	69	7	
R7.24	SFR	74 E	74	76	B (67)	A/E	74	2	73	3	**71** R, T	**5**	70	6	69	7	S622/R/W, Shoulder,
R7.25	SFR	75 E	75	77	B (67)	A/E	74	3	73	4	**72** R, T	**5**	71	6	70	7	and Private Property
R7.26 C	SFR	74 E	74	76	B (67)	A/E	72 T	4	70	6	**69** R,5	**7**	68	8	67	9	
R7.27	SFR	67 E	67	70	B (67)	A/E	66	4	66 T	4	**65** R	**5**	64	6	64	6	
R7.28	SFR	68 E	68	70	B (67)	A/E	66 T	4	65	5	**64** R,5	**6**	64	6	64	6	
R7.29	SFR	68 M, ST7.4	68	68	B (67)	A/E	64 T	4	64	4	63	5	**63** R,5	**5**	63	5	
R7.30	SFR	67 E	67	67	B (67)	A/E	64 T	3	63	4	63	4	**62** R	**5**	62	5	
R7.31	SFR	68 E	68	70	B (67)	A/E	65 T	5	64	6	63	7	**63** R,5	**7**	62	8	
R7.32	SFR	68 E	67	68	B (67)	A/E	64 T	4	63	5	62	6	**62** R,5	**6**	60	8	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Barrier height recommended to match height of existing soundwall that will be removed to make room for new highway alignment.
R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
W - The existing and future no-build noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.

TABLE 7-22 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 7 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			No Build WITHOUT BARRIER Leq(h), dBA	Build WITHOUT BARRIER Leq(h), dBA	ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Lomas Santa Fe Drive to Manchester Avenue - Northbound																	
R7.23	SFR	73 E	73	76	B (67)	A/E	74	2	73	3	72 T	4	**71** R	**5**	69	7	S622/R/W Option 2
R7.24	SFR	74 E	74	76	B (67)	A/E	74	2	73	3	**71** R,T	**5**	70	6	69	7	
R7.25	SFR	75 E	75	77	B (67)	A/E	74	3	73	4	**72** R,T	**5**	71	6	70	7	
R7.26 C	SFR	74 E	74	76	B (67)	A/E	72 T	4	70	6	**69** R,5	**7**	68	8	67	9	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - modeled calibration point.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
7 - Measurement site had a property wall.
8 - No Build condition is higher than the Build condition due to expansion of the highway shoulder for the Build condition.
9 - Barrier height recommended to match height of existing soundwall that will be removed to make room for new highway alignment.
R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
C - Critical design receiver.
W - The existing and future no-build noise levels at this receiver include the benefits of an existing property wall.
* - Non first-row receptor.

TABLE 7-23 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 7

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence	Reasonable Allowance Cost Per Barrier(s)
S614	R7.14	4 SFR	R/W/ Northbound	2.4 m (8 ft) to 3.0 m (10 ft)/ 152 m (499 ft)	$50,000	$200,000
S622	R7.18, R7.20 - R7.32	32 SFR	R/W, Shoulder, and Private Property/ Northbound	3.0 m (10 ft) to 4.3 m (14 ft)/ 1,112 m (3,648 ft)	$50,000	$1,600,000
S622 Option 2	R7.23 - R7.26	9 SFR	R/W/ Northbound	3.7 m (12 ft) to 4.3 m (14 ft)/ 279 m (915 ft)	$50,000	$450,000

Notes:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - School; REC - recreational area.

2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-24 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 7

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S614	R7.14	R/W/ Northbound	614+33	3.0 (10)	53.0 (174)
			614+43	3.0 (10)	55.0 (180)
			614+45	2.4 (8)	54.4 (179)
			614+80	2.4 (8)	55.9 (184)
			615+45	2.4 (8)	58.9 (193)
			615+50	2.4 (8)	59.4 (195)
			615+80	2.4 (8)	61.4 (202)
		Approximate Length: 152 m (499 ft)			
S622	R7.18, R7.20 - R7.32	R/W, Shoulder, and Private Property/ Northbound	616+40	3.7 (12)	68.7 (225)
			616+70	3.7 (12)	69.7 (229)
			616+85	3.7 (12)	70.9 (232)
			617+45	3.7 (12)	77.9 (255)
			617+95	3.7 (12)	80.3 (263)
			618+15	3.7 (12)	80.3 (263)
			618+55	3.7 (12)	73.2 (240)
			618+80	3.7 (12)	68.6 (225)
			619+00	3.7 (12)	66.0 (216)
			619+40	3.7 (12)	61.2 (201)
			619+40	4.3 (14)	61.8 (203)
			619+75	4.3 (14)	58.3 (191)
			620+10	4.3 (14)	54.3 (178)
			620+10	3.7 (12)	53.7 (176)
			620+60	3.7 (12)	47.7 (156)
			621+00	3.7 (12)	44.2 (145)
			621+15	3.7 (12)	44.2 (145)
			621+55	3.7 (12)	43.2 (142)
			622+00	3.7 (12)	40.7 (133)
			622+60	3.7 (12)	35.2 (115)
			622+60	4.3 (14)	35.8 (117)
			622+97	4.3 (14)	34.8 (114)
			623+45	4.3 (14)	33.3 (109)
			624+00	4.3 (14)	31.3 (103)
			624+50	4.3 (14)	29.3 (96)
			625+00	4.3 (14)	27.8 (91)
			625+00	3.0 (10)	26.5 (87)
			625+40	3.0 (10)	25.0 (82)
			626+00	3.0 (10)	23.5 (77)
		Approximate Length: 1,112 m (3,648 ft)			
S622 Option 2	R7.23 - R7.26	R/W/ Northbound	619+20	4.3 (14)	61.8 (203)
			619+75	4.3 (14)	58.3 (191)
			620+10	4.3 (14)	54.3 (178)
			620+10	3.7 (12)	53.7 (176)
			620+60	3.7 (12)	47.7 (156)
			621+00	3.7 (12)	44.2 (145)
			621+15	3.7 (12)	44.2 (145)
			621+55	3.7 (12)	43.2 (142)
			621+75	3.7 (12)	40.7 (133)
		Approximate Length: 279 m (915 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 8 – MANCHESTER DRIVE TO BIRMINGHAM DRIVE

Areas with noise abatement

Table 7-25 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-26 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-27 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S631: Soundwall S631 would be located along the southbound side of I-5 on private property between stations 630+90 and 632+25. The soundwall would provide feasible reduction for multi family residences represented by Receptors R8.1, R8.2, and R8.4A. The outdoor use areas for the multi family residences are grassy outdoor areas as well as a barbecue and swimming pool area. Sheet 24 shows the location of the soundwall.

Soundwall S633: Soundwall S633 would be located along the southbound side of I-5 between stations 631+66 and 634+10. The soundwall would provide feasible reduction for multi family residences represented by Receptors R8.4 and R8.5, as well as a single family residence represented by R8.3. The outdoor use areas for the multi family residences are grassy outdoor areas. Soundwall S633 has been raised higher than otherwise required in front of Receptor R8.5 to benefit adjacent residences represented by Receptor R8.6. Sheet 24 shows the location of the soundwall.

Soundwall S635: Soundwall S635 would be located along the southbound side of I-5 between stations 634+00 and 634+95. This soundwall has been extended to the side of a hill to close a gape to prevent noise leaks. The wall would provide feasible reduction for multi family residences represented by Receptor R8.6. The outdoor use areas for the multi family residences are grassy outdoor areas. Although Soundwall S635 provides less than 5 dB noise reduction to Receptor R8.7, the wall would bring the future noise level below the NAC. This soundwall should be considered as a system in conjunction with Soundwall S633. Sheet 24 shows the location of the soundwall.

Soundwall S640: Soundwall S640 would be located along the northbound side of I-5 between stations 639+55 and 640+90. The wall would provide feasible reduction for single family residences represented by Receptor R8.18. Sheet 25 shows the location of the soundwall.

Soundwall S647: Soundwall S647 would be located along the southbound side of I-5 between stations 647+00 and 649+20. The wall would provide feasible reduction for outdoor use areas at Cardiff by the Sea apartment complex represented by Receptors R8.10A and R8.11. The outdoor use areas for this apartment complex are the patios of the apartment units for the buildings located at the northern part of the complex and outdoor use area near the fountain. Soundwall S647 has been raised higher than otherwise required in front of Receptor R8.10A to provide a 5 dB noise reduction to Receptor R8.11. Sheet 26 show the location of the soundwall.

Soundwalls S644 and S646: Soundwalls S644 and S646 would be located along the northbound side of I-5 between stations 645+10 and 645+90 and stations 645+80 and 647+50, respectively. The soundwalls would provide feasible reduction for single family residences represented by Receptors R8.23 to R8.26. The southern end of Soundwall

S644 would wrap around near the property line of Receptor R8.23 because the elevation of the R/W drops considerably south of station 645+10. Receptor R8.22 would not receive a 5 dB noise reduction, even with S644 at a 4.9 meter (16 foot) height, due to its elevation above the R/W and the shoulder of the freeway. Soundwall S646 has been raised higher than otherwise required in front of Receptor R8.25 to provide a 5 dB noise reduction to Receptor R8.26. Sheets 25 and 26 show the location of the soundwalls.

Areas without noise abatement

Several areas in Segment 8 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non abatement are described in the following paragraphs:

Receptor R8.10: Receptor R8.10 represents a short term measurement site (ST05) taken at the Cardiff by the Sea apartment complex located on the southbound side of I-5, south of Birmingham Drive. Modeling for potential soundwalls was done on the shoulder. Sheet 26 shows the location of this receptor.

Receptor R8.12: Receptor R8.12 represents a group of single-family residences located on the southbound side of I-5, just south of Birmingham Drive. As the results in Table 7-25 show, a soundwall located on the shoulder of the southbound Birmingham Drive on-ramp would not provide a 5 dB noise reduction to these residences. This is due to the fact that they are located approximately 130 meters (425 feet) from the potential soundwall location. Sheet 26 shows the location of the receptors.

Receptor R8.13: A single-family residence represented by Receptor R8.13 is located on the northbound side of I-5, immediately east of the Manchester Avenue on-ramp. It is not feasible to abate for highway traffic noise impact in this area due to the R/W elevation compared to the receptors and area topography. In addition, a soundwall would only protect one single family residence. Sheet 24 shows the location of the receptors.

Receptors R8.14 to R8.17: Receptors R8.14 to R8.17 are located on the northbound side of I-5 on a hill elevated approximately 45 meters (148 feet) above the highway and represents a group of single-family residences. It is not feasible to abate for highway traffic noise in this area due to constraints related to the topography of the area. The R/W and shoulder elevations are significantly lower than the receptor elevation; therefore, a soundwall within the state R/W would not be feasible. A soundwall cannot be placed on private property for the residences represented by Receptors R8.14 to R8.17 because the lots are tiered and have large backyard decks that would hinder the placement of a soundwall. The view to the ocean from these residences would likely be obstructed as well.

Receptors R8.14 to R8.17 are also located more than 150 meters (500 feet) from the centerline of I-5. According to Technical Advisory on Noise TAN-02-02, SOUND2000 may not be accurate at such distances due to the effects of various atmospheric conditions (Hendricks, 2002). Sheet 24 shows the location of the receptors.

Receptors R8.19 to R8.21: Receptors R8.19 to R8.21 are located on the northbound side of I-5 on a hill elevated approximately 30 meters (98 feet) above the highway. It is not feasible to abate for highway traffic noise in this area due to constraints related to the topography of the area. The R/W elevation is significantly lower than the receptor elevation; therefore, a soundwall within the state R/W would not be feasible. A soundwall cannot be placed on private property for the residences represented by

Receptors R8.19 to R8.21 because the lots are tiered and have large backyard decks that would hinder the placement of a soundwall.

The residences represented by Receptor R8.20 are located more than 150 meters (500 feet) from the centerline of I-5. According to Technical Advisory on Noise TAN-02-02, SOUND2000 may not be accurate at such distances due to the effects of various atmospheric conditions (Hendricks, 2002). Sheet 25 shows the location of the receptors.

Receptors R8.27 to R8.30: Receptors R8.27 to R8.30 are located on the northbound side of I-5. These receptors are elevated by approximately 18 meters (60 feet) above the freeway. Both the R/W and the shoulder elevations are significantly lower than the receptor elevation; therefore, a soundwall within the state R/W would not be feasible. A commercial area is located between the receptors and the freeway, comprising of a storage facility and a gas station. The buildings of the storage facility partially obstruct the view of the freeway from residences represented by Receptors R8.28 and R8.29, and a berm partially shields the residence represented by Receptor R8.30. Due to the topography of this area, it would not be practical to consider a soundwall located at the property line of Receptors R8.28 and R8.29. Sheet 26 shows the location of the receptors and the commercial property.

TABLE 7-25 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 8

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Manchester Drive to Birmingham Drive - Southbound																	
R 8.1	MFR	62 E	65	68	B (67)	A/E	63	5	**62** R,T	**6**	61	7	60	8	59	9	S631/
R 8.2	MFR	65 E	68	70	B (67)	A/E	69	1	67 T	3	**65** R	**5**	63	7	62	8	Private Property
R 8.4A[C]	MFR	68 E	71	73	B (67)	A/E	71	2	70	3	**68** R,T	**5**	67	6	66	7	
R 8.3	SFR	69 E	72	74	B (67)	A/E	73	1	72 T	2	**69** R	**5**	67	7	66	8	
R 8.4	MFR	71 E	74	76	B (67)	A/E	73	3	71	5	**69** R,T	**7**	68	8	66	10	S633/ R/W
R 8.5[C]	MFR	72 M, ST8.1	75	78	B (67)	A/E	73	5	71 T	7	**70** R,5	**8**	69	9	68	10	
R 8.6[C]	MFR	71 E	74	77	B (67)	A/E	75	2	74	3	73 T	4	**72** R	**5**	70	7	S635/
R 8.7*	MFR	57 M, ST8.2	69	68	B (67)	A/E	67	1	67	1	66 T	2	65	3	64	4	Shoulder
R 8.8	MFR	57 E	60	62	B (67)	NONE	61	1	61	1	61	1	61	1	60	2	
R 8.9	MFR	58 E	61	63	B (67)	NONE	62	1	62	1	62	1	61	2	61	2	Shoulder
R 8.10[7]	MFR	70 M, ST8.5	72	73	B (67)	A/E	70	3	69	4	67	6	66	7	65	8	
R 8.10A[C]	MFR	69 E	72	74	B (67)	A/E	71 T	3	69	5	68	6	**68** R,5	**6**	66	8	S647/
R 8.11	MFR	66 E	69	70	B (67)	A/E	67 T	3	67	3	66	4	**65** R	**5**	64	6	Shoulder
R 8.12	SFR	63 E	66	68	B (67)	A/E	68	0	68	0	68	0	67	1	67	1	Shoulder
Manchester Drive to Birmingham Drive - Northbound																	
R 8.13	SFR	65 E	68	70	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	--
R 8.14	SFR	62 E	65	67	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 8.15	SFR	63 E	66	68	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	--
R 8.16	SFR	64 E	67	69	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 8.17	SFR	63 M, ST8.3	66	68	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 8.18[C]	SFR	71 E	71	73	B (67)	A/E	71 T	2	70	3	69	4	**68** R	**5**	66	7	S640/ R/W
R 8.19	SFR	75 M, LT8.1	71	73	B (67)	A/E	72	1	72	1	71	2	71	2	70	3	
R 8.20	SFR	71 E	71	74	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	--
R 8.21	SFR	71 M, ST8.4	69	71	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 8.22*	SFR	71 E	69	71	B (67)	A/E	71	0	71	0	71	0	71	0	71	0	S644/ R/W and
R 8.23[C]	SFR	79 E	76	79	B (67)	A/E	77	2	75 T	4	**72** R	**7**	70	9	68	11	Private Property
R 8.24	SFR	78 M, LT8.2	76	78	B (67)	A/E	78	0	78	0	76	2	75	3	**73** R,T	**5**	
R 8.25	SFR	77 E	74	77	B (67)	A/E	71 T	6	**69** R,5	**8**	67	10	66	11	65	12	S646/
R 8.26	SFR	76 E	74	76	B (67)	A/E	74 T	2	**71** R	**5**	68	8	66	10	65	11	Property Line
R 8.27	SFR	73 E	72	74	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 8.28	SFR	71 M, ST8.6/CAL	70	72	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	--
R 8.29	SFR	71 E	70	72	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 8.30	SFR	67 E	65	67	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - Receptor does not represent an area of frequent human use. However, this is measurement site.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

* - Non first-row receptor.

TABLE 7-26 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 8

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S631	R8.1,R8.2 and R8.4A	22 MFR	Private Property/ Southbound	3.0 m (10 ft) to 3.7 m (12 ft) 231 m (758 ft)	$48,000	$1,056,000
S633	R8.3,R8.4 and R8.5	1 SFR and 20 MFR	R/W/ Southbound	3.7 m (12 ft) 255 m (837 ft)	$52,000	$1,092,000
S635	R8.6	8 MFR	Shoulder/ Southbound	4.3 m (14 ft) 98 m (322 ft)	$50,000	$400,000
S640	R8.18	2 SFR	R/W/ Northbound	4.3 m (14 ft) 128 m (420 ft)	$46,000	$92,000
S647	R8.10A and R8.11	5 MFR	Shoulder/ Southbound	4.3 m (14 ft) 212 m (696 ft)	$40,000	$200,000
S644 and S646	R8.23 - R8.26	12 SFR	R/W and Private Property/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft)/ 106 m (348 ft) and 3.0 m (10 ft) 181 m (594 ft)	$52,000	$624,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-27 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 8

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S631	R8.1,R8.2 and R8.4A	Private Property/ Southbound	630+90	3.0 (10)	8.5 (28)
			631+36	3.0 (10)	11.9 (39)
			631+36	3.7 (12)	12.6 (41)
			631+87	3.7 (12)	13.2 (43)
			632+40	3.7 (12)	17.2 (56)
			632+25	3.7 (12)	17.2 (56)
			632+25	3.7 (12)	17.2 (56)
		Approximate Length: 231 m (758 ft)			
S633	R8.3,R8.4 and R8.5	R/W/ Southbound	631+66	3.7 (12)	11.7 (38)
			632+05	3.7 (12)	13.6 (44)
			632+11	3.7 (12)	14.2 (46)
			632+25	3.7 (12)	17.2 (56)
			632+50	3.7 (12)	18.7 (61)
			633+05	3.7 (12)	20.7 (68)
			633+35	3.7 (12)	24.7 (81)
			633+60	3.7 (12)	24.9 (82)
			633+90	3.7 (12)	24.5 (80)
			634+10	3.7 (12)	25.0 (82)
		Approximate Length: 255 m (837 ft)			
S635	R8.6	Shoulder/ Southbound	634+00	4.3 (14)	24.7 (81)
			634+12	4.3 (14)	25.6 (84)
			634+50	4.3 (14)	26.2 (86)
			634+97	4.3 (14)	28.0 (92)
		Approximate Length: 98 m (322 ft)			
S640	R8.18	R/W/ Northbound	639+55	4.3 (14)	70.8 (232)
			640+00	4.3 (14)	70.3 (231)
			640+35	4.3 (14)	68.3 (224)
			640+90	4.3 (14)	68.3 (224)
		Approximate Length: 128 m (420 ft)			
S647	R8.10A and R8.11	Shoulder/ Southbound	647+00	4.3 (14)	46.5 (152)
			647+12	4.3 (14)	46.5 (152)
			647+80	4.3 (14)	47.8 (157)
			648+45	4.3 (14)	51.5 (169)
			648+60	4.3 (14)	52.4 (172)
			649+20	4.3 (14)	55.9 (183)
		Approximate Length: 212 m (696 ft)			
S644	R8.23 - R8.24	R/W and Private Property/ Northbound	645+10	3.7 (12)	45.7 (150)
			645+10	3.7 (12)	45.7 (150)
			645+35	3.7 (12)	45.7 (150)
			645+35	4.9 (16)	46.9 (154)
			645+55	4.9 (16)	46.9 (154)
			645+90	4.9 (16)	50.9 (167)
		Approximate Length: 106 m (348 ft)			
S646	R8.25 - R8.26	Property Line/ Northbound	645+80	3.0 (10)	50.0 (164)
			646+30	3.0 (10)	53.0 (174)
			646+70	3.0 (10)	55.0 (181)
			647+00	3.0 (10)	55.2 (181)
			647+20	3.0 (10)	56.0 (184)
			647+35	3.0 (10)	58.0 (190)
			647+50	3.0 (10)	63.0 (207)
		Approximate Length: 181 m (594 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 9 – BIRMINGHAM DRIVE TO SANTA FE DRIVE

Areas with noise abatement

Table 7-28 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-29 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-30 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S652: Soundwall S652 would be located along the property line on the northbound side of I-5 between stations 651+69 and 652+72. The soundwall would provide feasible reduction from highway traffic noise for a group of single-family residences on the northbound side of I-5 along Villa Cardiff Drive represented by Receptors R9.11 and R9.12. Sheets 26 and 27 show the location of the soundwall.

Soundwall S653: Soundwall S653 would be located on the R/W on the southbound side of I-5 between stations 651+89 and 653+95. The soundwall would provide feasible reduction from highway traffic noise for a group of single-family residences represented by Receptors R9.3 and R9.4 but not R9.4A. Soundwall S653 has been raised higher than otherwise required in front of Receptor R9.4 to provide a 5 dB noise reduction to Receptor R9.3. Sheets 26 and 27 show the location of the soundwall.

Soundwall S654: Soundwall S654 would be located along the R/W on the northbound side of I-5 between stations 652+60 and 655+85. It would provide feasible reduction for single-family residences represented by Receptors R9.13 to R9.15 but not R9.15A. Receptor R9.15 represents the front yard outdoor porch area for the single family residence two houses south of the measurement site, while R9.13 and R9.14 are located in the backyard of the single-family residences they represent. Sheet 27 shows the location of the soundwall.

Soundwall S654 (Option 2): Soundwall S654 option 2 is a shorter wall that would wrap around the property line of a residential unit on the northbound side of I-5 between stations 652+98 and 653+34. This wall would provide feasible noise abatement for one single family resident represented by Receptor R9.13 that is severely impacted because the future predicted traffic noise level is equal to 75 dBA. This area is shown on sheet 27.

Soundwall S658: Soundwall S658 would be located along the R/W and the shoulder of northbound I-5 between stations 656+30 and 662+15. The wall would provide feasible reduction from highway traffic noise for single-family residences represented by Receptors R9.17 through R9.22. Receptor R9.17 represents the backyard of the single-family residence. Soundwall S658 has been raised higher than otherwise required in front of Receptor R9.19 to provide a 5 dB noise reduction and meet the line-of-sight requirements at Receptor R9.18.

The northern end of Soundwall S658 would wrap around parallel to Santa Fe Drive to provide feasible reduction for Receptor R9.22. Sheets 27 and 28 show the location of the soundwall.

Areas without noise abatement

Several areas in Segment 9 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R9.1 and R9.2: These receptors are located on the southbound side of I-5, just north of Birmingham Drive. It is not feasible to abate for highway traffic noise in this area because both the R/W line and shoulder of I-5 are lower in elevation compared to these receptors. Table 7-28 shows the results of the traffic noise model in this area with a soundwall located on the shoulder of the southbound Birmingham Drive off-ramp. A soundwall would not provide a 5 dB noise reduction to these receptors; therefore, it would not be feasible. It would also not be feasible to build a soundwall on the property of these receivers due to sloped and tiered backyards of these residences. Sheets 26 and 27 show location of the receptors.

Receptor R9.10: Receptor R9.10 represents the pool area at the Country Inn Hotel on the northbound side of I-5. The results of traffic noise modeling indicate that a soundwall located on the shoulder of the northbound Birmingham Drive on ramp would not provide a 5 dB noise reduction for this receptor because it is higher in elevation than both the R/W line and the shoulder of the on ramp. Constructing a soundwall at the private property is not considered practical for only one receptor. Sheet 26 shows location of this receptor.

TABLE 7-28 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 9

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]												BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)								
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)	
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Birmingham Drive to Santa Fe Drive - Southbound																	
R 9.1	SFR	63 E	67	69	B (67)	A/E	68	1	68	1	68	1	67	2	67	2	Shoulder
R 9.2	SFR	64 E	69	71	B (67)	A/E	71	0	70	1	70	1	70	1	69	2	
R 9.3	SFR	67 E	72	74	B (67)	A/E	71 T	3	**69 R**	**5**	68	6	67	7	67	7	S653/ R/W
R 9.4C	SFR	70 M,LT9.1	75	77	B (67)	A/E	70 T	7	**68 R, 5**	**9**	66	11	65	12	65	12	
R 9.4A	SFR	60 E	65	68	B (67)	A/E	66	2	65	3	65	3	65	3	64	4	
Birmingham Drive to Santa Fe Drive - Northbound																	
R 9.10	HM	67 E	68	69	B (67)	A/E	69	0	68	1	68	1	67	2	67	2	Shoulder
R 9.11	SFR	70 E	71	74	B (67)	A/E	**67 R,T**	**7**	64	10	62	12	62	12	61	13	S652/ Property Line
R 9.12C	SFR	71 E	72	75	B (67)	A/E	**69 R,T**	**6**	66	9	63	12	61	14	61	14	
R 9.13C	SFR	70 M,ST9.1/CAL	71	75	B (67)	A/E	72 T	3	71	4	**70 R**	**5**	68	7	67	8	S654/ R/W
R 9.14B,K	SFR	57 E	60	67	B (67)	A/E	65 T	2	64	3	63	4	**62 R**	**5**	62	5	
R 9.15B,7	SFR	64 M,ST9.2	67	73	B (67)	A/E	70 T	3	69	4	69	4	68	5	**68 R,5**	**5**	
R 9.15AK	SFR	58 E	61	66	B (67)	A/E	64 T	2	63	3	63	3	62	4	62	4	
R 9.16K	SFR	60 E	63	65	B (67)	NONE	64 T	1	63	2	63	2	62	3	62	3	S658/ R/W and Shoulder
R 9.17C	SFR	73 E	76	79	B (67)	A/E	**74 R,T**	**5**	72	7	70	9	69	10	68	11	
R 9.18	SFR	72 E	72	75	B (67)	A/E	71	4	**70 R, T**	**5**	68	7	66	9	66	9	
R 9.19	SFR	71 M,LT9.2	71	74	B (67)	A/E	69 T	5	**68 R, 5**	**6**	67	7	66	8	65	9	
R 9.20	SFR	67 E	69	71	B (67)	A/E	67 T	4	**66 R, 5**	**5**	65	6	64	7	64	7	
R 9.21	SFR	71 M,ST9.3/CAL	73	76	B (67)	A/E	74	2	73	3	**71 R, T**	**5**	69	7	67	9	
R 9.22	SFR	70 E	72	74	B (67)	A/E	73	1	71 T	3	**69 R**	**5**	67	7	66	8	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - This receptor represents the measurement site and an outdoor use area at the front yard of the second house south of this measurement site.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these Receptors to account for attenuation provided by first-row buildings.

R - Recommended height to meet feasibility requirements of the Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

* - Non first-row receptor.

B - The existing and future "No-Build" levels at Receptors R9.14 and R9.15 include the benefits of existing berm that would be removed under the project "Build" scenario.

TABLE 7-28 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 9 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] $L_{eq(h)}$, dBA	FUTURE PEAK HOUR NOISE LEVELS, $L_{eq(h)}$, dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	
Birmingham Drive to Santa Fe Drive - Northbound																	
R 9.13[C]	SFR	70 [M,ST9.1/CAL]	71	75	B (67)	A/E	71 [T]	4	**68** [R]	**7**	65	10	63	12	62	13	S654/ Private Property Option 2

Notes:

1 - $L_{eq(h)}$ are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of the Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

* - Non first-row receptor.

TABLE 7-29 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 9

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S653	R9.3 and R9.4	4 SFR	R/W/ Southbound	3.0 m (10 ft) 216 m (709 ft)	$54,000	$216,000
S652	R9.11 and R9.12	6 SFR	Property Line/ Northbound	2.4 m (8 ft) 124 m (407 ft)	$42,000	$252,000
S654	R9.13 to R9.15	9 SFR	R/W/ Northbound	3.7 m (12 ft) to 4.9 m (16 ft) 327 m (1,073ft)	$40,000	$440,000
S654 Option 2	R9.13	1 SFR	Private Property/ Northbound	3.0 m (10 ft) 57 m (187 ft)	$42,000	$42,000
S658	R9.17 to R9.22	20 SFR	R/W and Shoulder/ Northbound	2.4 m (8 ft) to 3.7 m (12 ft) 651 m (2,136 ft)	$52,000	$1,040,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-30 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 9

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S653	R9.3 and R9.4	R/W/ Southbound	651+89	3.0 (10)	62.0 (204)
			652+00	3.0 (10)	63.0 (207)
			652+40	3.0 (10)	65.0 (213)
			652+80	3.0 (10)	67.7 (222)
			652+85	3.0 (10)	67.8 (223)
			653+00	3.0 (10)	68.0 (223)
			653+35	3.0 (10)	70.2 (230)
			653+60	3.0 (10)	72.8 (239)
			653+95	3.0 (10)	73.5 (241)
		Approximate Length: 216 m (709 ft)			
S652	R9.11 and R9.12	Property Line/ Northbound	651+69	2.4 (8)	61.4 (202)
			651+91	2.4 (8)	61.4 (202)
			652+22	2.4 (8)	61.4 (202)
			652+41	2.4 (8)	61.4 (202)
			652+49	2.4 (8)	58.6 (192)
			652+70	2.4 (8)	58.6 (192)
			652+72	2.4 (8)	58.6 (192)
		Approximate Length: 124 m (407 ft)			
S654	R9.13 to R9.15	R/W/ Northbound	652+60	3.7 (12)	58.5 (192)
			652+73	3.7 (12)	58.7 (192)
			653+00	3.7 (12)	59.4 (195)
			653+25	3.7 (12)	59.9 (196)
			653+50	3.7 (12)	61.7 (202)
			653+50	4.3 (14)	62.3 (204)
			654+35	4.3 (14)	68.3 (224)
			654+85	4.3 (14)	70.3 (231)
			654+85	4.9 (16)	70.9 (233)
			654+95	4.9 (16)	72.4 (237)
			655+15	4.9 (16)	73.4 (241)
			655+85	4.9 (16)	75.2 (247)
		Approximate Length: 327 m (1,073 ft)			
S654 Option 2	R9.13	Private Property/ Northbound	652+98	3.0 (10)	58.0 (190)
			653+03	3.0 (10)	58.1 (191)
			653+07	3.0 (10)	58.2 (191)
			653+25	3.0 (10)	58.4 (192)
			653+34	3.0 (10)	58.6 (192)
		Approximate Length: 57 m (187 ft)			
S658	R9.17 to R9.22	R/W and Shoulder/ Northbound	656+30	2.4 (8)	71.9 (236)
			656+70	2.4 (8)	69.9 (229)
			657+50	2.4 (8)	66.4 (218)
			657+85	2.4 (8)	66.0 (217)
			657+85	3.0 (10)	66.6 (219)
			658+75	3.0 (10)	67.3 (221)
			659+00	3.0 (10)	67.3 (221)
			660+20	3.0 (10)	66.6 (219)
			660+70	3.0 (10)	65.9 (216)
			660+70	3.7 (12)	66.6 (218)
			661+00	3.7 (12)	63.7 (209)
			661+45	3.7 (12)	64.0 (210)
			661+90	3.7 (12)	64.7 (212)
			662+25	3.7 (12)	64.4 (211)
			662+15	3.7 (12)	65.7 (215)
		Approximate Length: 651 m (2,136 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 10 – SANTA FE DRIVE TO ENCINITAS BOULEVARD

Areas with noise abatement

Table 7-31 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-32 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-33 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S664: Soundwall S664 would be located along the northbound side of I-5 between stations 663+60 and 667+40. It would benefit single family and multi-family residences represented by Receptors R10.11 and R10.12, and the Seacoast Community Church/School playground is represented by Receptor R10.13. Receptor R10.11 represents a patio in the front yard of a single-family residence, and Receptor 10.12 represents grassy outdoor areas for multi family residences. Soundwall S664 has been raised higher than otherwise required in front of Receptor R10.11 to provide a 5 dB noise reduction to Receptor R10.12. Receptor 10.13 also represents a measurement site used to determine if Del Mar Hills Elementary School qualifies for building acoustical treatment due to high outdoor noise levels; which is discussed in section 7.3. Sheets 28 and 29 show the location of Soundwall S664.

Soundwall S670: Soundwall S670 would be located along the shoulder of the northbound side of I-5 between stations 667+30 and 671+10. It would benefit the outdoor use area of a nursing/rehab center and the playground area of a multi-family complex, represented by Receptors R10.14 and R10.15 respectively. Soundwall S670 has been raised higher than otherwise required in front of Receptor R10.15 to provide a 5 dB noise reduction to Receptor R10.14. Sheet 29 shows the location of Soundwall S670.

Soundwall S671: Soundwall S671 would be located along the southbound side of I-5 between stations 669+84 and 672+15. The soundwall would benefit single family residences represented by Receptors R10.3B, R10.3A, R10.4, and R10.4A. Receptor R10.3A represents a grassy outdoor use area in the front yard of a single family residence, while Receptors R10.3B, R10.4 and R10.4A are located in the backyards of the single-family residences. Soundwall S671 has been raised higher than otherwise required in front of Receptor R10.3B to provide a 5 dB noise reduction to adjacent residences represented by R10.3A. Sheet 29 shows the location of the soundwall S671.

Soundwall S675: Soundwall S675 would be located along the southbound side of I-5 between stations 672+30 and 676+55. The wall would benefit single family residences represented by Receptors R10.5 through R10.8. Sheets 29 and 30 show the location of Soundwall S675.

Areas without noise abatement

Several areas in Segment 10 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R10.1 and R10.2: These receptors are located on the southbound side of I-5 just south of Requeza Street. Soundwalls at two locations were modeled to abate traffic noise for receptors R10.1 and R10.2. A soundwall located at the shoulder I-5 or along Devonshire Drive would not provide a 5 dB noise reduction to any of these receptors; therefore, it would not be feasible. Sheet 29 shows the locations of the receptors.

Receptor R10.9: Receptor R10.9 represents a group of second-row single family residences located on the southbound side of I-5. The results of traffic noise modeling indicate that a soundwall located at the R/W would not provide a 5 dB noise reduction to Receptor R10.9; therefore, it would not be feasible. The R/W and property line of first row Receptor R10.8 decrease sharply in elevation downhill, which does not allow for a soundwall location to protect Receptor R10.9. Sheet 30 shows the location of Receptor R10.9.

Receptor R10.10: Receptor R10.10 represents a group of third-row single family residences located on the northbound side of I-5. A soundwall located at the R/W would not provide a 5 dB noise reduction to any of the receptors; therefore, it would not be feasible. Sheet 28 shows the location of Receptor R10.10.

Receptors R10.16 and R10.17: Receptor 10.16 represents a group of second-row multi- family residences, and Receptor R10.17 represents a single-family residence located on the northbound side of I-5. A soundwall on the shoulder south of Requeza Street was analyzed and would not provide a 5 dB noise reduction to either receptor; therefore, it would not be feasible. Also, it would not be possible to locate a soundwall at the R/W, because the R/W elevation is significantly lower than the freeway and the Receivers. Sheet 29 shows the location of Receptors R10.16 and R10.17.

Receptors R10.18, R10.19, and R10.19A: These receptors are located on the northbound side of I-5 just north of Requeza Street and they represent a new single-family residential development. The new residential development has a block wall at the property line, then a large landscaped area, and after that transparent walls at each backyard. Soundwalls are not feasible for this area due to the two existing walls. Detailed grading plans were not available at the time of this study; therefore, elevations are based on the estimates. Sheet 29 shows the locations of the receptors.

Receptor R10.20: Receptor R10.20 represents a preschool located on the northbound side of I-5 just north of Requeza Street. There is a commercial property between the preschool and the freeway; therefore, locating a soundwall at the property line is not considered practical. A soundwall located on the R/W was analyzed and would not provide a 5 dB noise reduction to any of the receptors; therefore, it would not be feasible. Sheets 29 and 30 show the locations of this receptor.

TABLE 7-31 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 10

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Santa Fe Drive to Encinitas Boulevard - Southbound																	
R 10.1	SFR	65 E	67	70	B (67)	A/E	70	0	70	0	69	1	68	2	67	3	Shoulder
R 10.2	SFR	66 E	68	71	B (67)	A/E	70	1	69	2	69	2	68	3	67	4	
R 10.3 [8]	SFR	71 M, LT10.1	72	75	B (67)	A/E	72 T	3	71	4	69	6	68	7	66	9	S671/Private Property and R/W
R 10.3B[K]	SFR	67 E	66	68	B (67)	A/E	65 T	3	65	3	63	5	**63** R,5	**5**	62	6	
R 10.3A[C]	SFR	77 M, LT10.1A	76	79	B (67)	A/E	75	4	74	5	73	6	**72** R,T	**7**	71	8	
R 10.4	SFR	77 E	76	78	B (67)	A/E	74	4	73	5	**72** R,T	**6**	71	7	70	8	
R 10.4A	SFR	72 E	71	74	B (67)	A/E	70 T	4	70	4	**69** R	**5**	68	6	68	6	
R 10.5	SFR	72 E	72	74	B (67)	A/E	**69** R,T	**5**	68	6	67	7	66	8	66	8	S675/R/W
R 10.6[C]	SFR	68 M, ST10.4,CAL,7	74	76	B (67)	A/E	**70** R,T	**6**	68	8	67	9	66	10	64	12	
R 10.7	SFR	71 M, ST10.5	71	73	B (67)	A/E	**68** R,T	**5**	66	7	65	8	64	9	63	10	
R 10.8	SFR	71 E	71	73	B (67)	A/E	69 T	4	**68** R	**5**	68	5	67	6	67	6	
R 10.9*	SFR	68 E	68	70	B (67)	A/E	69	1	68	2	68	2	67	3	67	3	R/W
Santa Fe Drive to Encinitas Boulevard - Northbound																	
R 10.10*	SFR	71 E	69	71	B (67)	A/E	71	0	71	0	71	0	70	1	70	1	R/W
R 10.11[C]	SFR	76 M, ST10.1	74	77	B (67)	A/E	75	2	74 T	3	72	5	**70** R,5	**7**	69	8	S664/R/W
R 10.12[K]	SFR	66 E	65	68	B (67)	A/E	66	2	65	3	64 T	4	**63** R	**5**	62	6	
R 10.13	SCH	76 M, ST10.2,CAL	75	77	B (67)	A/E	74	3	73 T	4	**72** R	**5**	71	6	69	8	
R 10.14[C]	REC	69 E	70	73	B (67)	A/E	71	2	71	2	69 T	4	69	4	**68** R	**5**	S670/Shoulder
R 10.15*	REC	70 M, ST10.3	71	74	B (67)	A/E	71	3	70	4	69 T	5	**69** R,5	**5**	67	7	
R 10.16*	MFR	66 E	67	70	B (67)	A/E	69	1	69	1	68	2	67	3	66	4	
R 10.17*	SFR	68 E	69	71	B (67)	A/E	70	1	70	1	69	2	68	3	67	4	
R 10.18[W]	SFR	67 E	68	71	B (67)	A/E	70	1	70	1	69	2	69	2	69	2	R/W
R 10.19[W]	SFR	66 E	67	70	B (67)	A/E	70	0	69	1	69	1	69	1	69	1	
R 10.19A[W]	SFR	66 E	67	69	B (67)	A/E	69	0	69	0	69	0	68	1	68	1	
R 10.20	SCH	67 E	68	70	B (67)	A/E	70	0	69	1	69	1	68	2	68	2	R/W

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - Fire Station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - Measurement position ST10.4 has been moved to receptor R10.6 to represent the backyard area of the residence.

8 - Receptor does not represent an area of frequent human use. However, this is a measurement site.

C - Critical design receiver

K - A shielding factor of 5 dB has been applied to Receptor R10.12 to account for attenuation provided by first-row buildings.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - Includes the benefit of an existing 1.5 meter (5 foot) high block wall and 1.9 meter (6 foot) high glass wall.

* Non first-row receiver.

TABLE 7-32 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 10

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S671	R10.3B, R10.3A, R10.4, R10.4A	11 SFR	Private Property and R/W/ Southbound	3.7 m (12 ft) to 4.3 m (14 ft)/ 262 m (860 ft)	$42,000	$462,000
S675	R10.5 - R10.8	18 SFR	R/W Southbound	2.4 m (8 ft) to 3.0 m (10 ft)/ 436 m (1,430 ft)	$54,000	$972,000
S664	R10.11 - R10.13	3 SFR, 8 MFR and SCH (3 Frontage Units)	R/W/ Northbound	3.7 m (12 ft) to 4.3 m (14 ft)/ 385 m (1,263 ft)	$50,000	$700,000
S670	R10.14 and R10.15	2 REC (2 Frontage Units)	Shoulder/ Northbound	4.3 m (14 ft) to 4.9 m (16 ft) 371m (1,217)	$48,000	$96,000

Notes:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; REC - recreational.

2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-33 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 10

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S671	R10.3B, R10.3A, R10.4, R10.4A	Private Property and R/W/ Southbound	669+84	4.3 (14)	57.8 (190)
			670+33	4.3 (14)	57.8 (190)
			670+80	4.3 (14)	56.3 (185)
			671+05	4.3 (14)	55.3 (181)
			671+40	4.3 (14)	55.6 (182)
			671+40	3.7 (12)	55.0 (180)
			671+75	3.7 (12)	56.3 (185)
			672+15	3.7 (12)	57.1 (187)
		Approximate Length: 262 m (860 ft)			
S675	R10.5 - R10.8	R/W Southbound	672+30	2.4 (8)	55.8 (183)
			672+95	2.4 (8)	54.4 (179)
			673+50	2.4 (8)	54.1 (178)
			674+25	2.4 (8)	55.4 (182)
			674+80	2.4 (8)	54.4 (179)
			675+40	2.4 (8)	54.4 (179)
			676+25	2.4 (8)	56.7 (186)
			676+25	3.0 (10)	57.3 (188)
			676+55	3.0 (10)	53.0 (174)
		Approximate Length: 436 m (1,430 ft)			
S664	R10.11 - R10.13	R/W/ Northbound	663+60	4.3 (14)	61.3 (201)
			664+15	4.3 (14)	62.4 (205)
			664+35	4.3 (14)	62.3 (204)
			664+60	4.3 (14)	62.3 (204)
			665+20	4.3 (14)	62.0 (203)
			665+65	4.3 (14)	61.3 (201)
			665+65	3.7 (12)	60.7 (199)
			666+30	3.7 (12)	59.7 (196)
			666+65	3.7 (12)	58.2 (191)
			667+10	3.7 (12)	53.7 (176)
			667+40	3.7 (12)	53.2 (174)
		Approximate Length: 385m (1,263)			
S670	R10.14 and R10.15	Shoulder Northbound	667+30	4.9 (16)	58.2 (191)
			668+45	4.9 (16)	56.2 (184)
			668+45	4.3 (14)	55.6 (182)
			669+25	4.3 (14)	53.5 (175)
			670+25	4.3 (14)	51.5 (169)
			671+10	4.3 (14)	50.0 (164)
		Approximate Length: 371m (1,217)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 11 – ENCINITAS BOULEVARD TO LEUCADIA BOULEVARD

Areas with noise abatement

Table 7-34 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-35 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-36 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S680: Soundwall S680 would be located on the R/W and private property along the northbound side of I-5 between stations 677+90 and 684+15. The soundwall would benefit a group of multi-family residences represented by Receptors R11.22 and R11.23, and the recreational area at the Encinitas YMCA represented by Receptors R11.24 and R11.25. Receptors R11.22 and R11.23 are behind an existing 2.7 meter (9 foot) high property wall; therefore, a lesser wall height of 2.4 meters (8 feet) has not been considered as an option for Soundwall S680, nor reported in Table 7-34, for these receivers. Sheets 30 and 31 show the location of the soundwall.

Soundwall S686A: Soundwall S686A would be located on private property along the northbound side of I-5 between stations 685+29 and 685+88. The soundwall would benefit a park represented by Receptor R11.27. Sheet 31 shows the location of the Soundwall S686A.

Soundwalls S686B and S686C: Soundwalls S686B and S686C would be located on private property along the northbound side of I-5 between stations 684+90 and 685+82 and 685+88 and 686+28, respectively. The soundwalls would benefit single-family residences represented by Receptors R11.26 and R11.28. Sheet 31 shows the location of Soundwalls S686B and S686C.

Soundwall S688: Soundwall S688 would be located along the northbound side of I-5 between stations 686+20 and 687+55. The soundwall would benefit single-family residence represented by Receptor R11.29. Sheet 31 shows the location of the Soundwall S688.

Soundwall S689: Soundwall S689 would be located along the southbound side of I-5 between stations 683+25 and 696+20. The soundwall would benefit single-family residences represented by Receptors R11.5A, R11.6, R11.7, R11.9, R11.11 through R11.14, R11.16 through R11.18, and R11.20. Soundwall S689 has been raised higher than otherwise required in front of Receptors R11.11, R11.13, R11.14, R11.16, and R11.18 to provide a 5 dB noise reduction to other nearby receivers represented by Receptors R11.12 and R11.17. Residences enclosed by this wall but not benefited are represented by Receptors R11.5, R11.8, R11.10, R11.15, and R11.19. Sheets 31 through 33 show the location of Soundwall S689.

Soundwall S692: Soundwall S692 would be located along the northbound side of I-5 between stations 690+10 and 695+45. The soundwall would benefit Poinsettia Park (Receptors R11.31 and R11.31A) and a group of single-family residences represented by Receptors R11.32 through R11.36. Soundwall S692 has been raised higher than required in front of Receptors R11.32, R11.34, R11.35, and R11.36 to achieve a 5 dB noise reduction at Receptors R11.31A and R11.33. Sheet 32 shows the location of the soundwall.

Areas without noise abatement

Several areas in Segment 11 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R11.1 through R11.4: These receptors are located on the southbound side of I-5 just north of Encinitas Boulevard. It is not feasible to provide highway traffic noise abatement for this area. Both the R/W line and shoulder of I-5 are lower in elevation compared to most of the receptors, whose elevation varies with respect to the freeway. Table 7-34 shows the results of the traffic noise model in this area if Soundwall S689 was extended south to Station 680+00. As the results show, the soundwall would not provide a 5 dB noise reduction to Receptors R11.1 through R11.4; therefore, it would not be feasible to extend the wall beyond Station 683+25. It would also not be practical to build a soundwall at the property line of these receivers due to the topography of the area. Each house is located at a different elevation, and at a different distance to the freeway, which would make it difficult to build a continuous wall. Furthermore, starting from the back of the houses, some of the back yards slope down toward the freeway. Sheets 30 and 31 show location of the receptors.

Receptor R11.30: Receptor R11.30 represents a group of second-row single-family residences located on the northbound side of I-5. The results of traffic noise modeling indicate that a soundwall placed at the shoulder of the highway would not provide a 5 dB noise reduction to these residences due to the geometry of the site and shielding provided by first-row buildings. Based on the results of the analysis, it would not be feasible to build a soundwall at this location. Sheet 31 shows location of Receptor R11.30.

TABLE 7-34 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 11

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Encinitas Boulevard to Leucadia Boulevard - Southbound																	
R 11.1	SFR	66 E	65	68	B (67)	A/E	67	1	66	2	66	2	65	3	65	3	
R 11.1A	SFR	66 E	65	68	B (67)	A/E	68	0	67	1	67	1	66	2	66	2	Shoulder
R 11.2	SFR	66 E	65	67	B (67)	A/E	67	0	67	0	67	0	67	0	66	1	
R 11.3	SFR	70 E	69	71	B (67)	A/E	71	0	70	1	70	1	69	2	69	2	
R 11.4	SFR	69 M, ST11.2/ CAL	68	70	B (67)	A/E	70	0	70	0	70	0	69	1	69	1	
R 11.5*	SFR	69 E	69	71	B (67)	A/E	70	1	70	1	70	1	69	2	68	3	
R 11.5A	SFR	73 E	73	75	B (67)	A/E	72	3	70	5	**70** R,T	**5**	68	7	67	8	S689/
R 11.6	SFR	73 E	73	75	B (67)	A/E	71	4	70	5	**69** R,T	**6**	67	8	66	9	Shoulder
R 11.7	SFR	74 E	74	75	B (67)	A/E	71	4	70	5	**68** R,T	**7**	67	8	66	9	and R/W
R 11.8*	SFR	71 E	71	73	B (67)	A/E	72	1	72	1	71	2	71	2	70	3	
R 11.9	SFR	75 M, ST11.4	75	78	B (67)	A/E	75	3	74	4	73	5	**73** R,T	**5**	71	7	
R 11.10	SFR	69 E	69	72	B (67)	A/E	71	1	71	1	70	2	70 T	2	69	3	
R 11.11	SFR	75 E	76	76	B (67)	A/E	70 T	6	69	7	67	9	66	10	**66** R,5	**10**	
R 11.12*	SFR	68 E	69	72	B (67)	A/E	70	2	70	2	69	3	68	4	**67** R	**5**	
R 11.13	SFR	71 M, ST11.5/ CAL	72	75	B (67)	A/E	73	2	72	3	71 T	4	69	6	**68** R,5	**7**	
R 11.14	SFR	74 E	75	78	B (67)	A/E	75	3	74	4	73 T	5	71	7	**70** R,5	**8**	
R 11.15	SFR	71 E	71	74	B (67)	A/E	73	1	73	1	72	2	72 T	2	71	3	
R 11.16	SFR	73 E	73	76	B (67)	A/E	74	2	73	3	72 T	4	70	6	**69** R,5	**7**	
R 11.17	SFR	72 E	72	75	B (67)	A/E	74	1	73	2	72	3	71 T	4	**70** R	**5**	
R 11.18C	SFR	78 M, LT11.1	78	81	B (67)	A/E	78	3	76 T	5	73	8	71	10	**70** R,5	**11**	
R 11.19*	SFR	71 E	71	74	B (67)	A/E	74	0	73	1	73	1	73	1	72	2	
R 11.20	SFR	70 E	70	72	B (67)	A/E	70	2	69 T	3	68	4	**67** R	**5**	67	5	
R 11.21	FIRE	67 E	67	70	C (72)	NONE	67	3	66 T	4	65	5	65	5	64	6	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - Receptor does not represent an area of frequent human use. However, this is a measurement site.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

* Non first-row receiver.

TABLE 7-34 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 11 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Encinitas Boulevard to Leucadia Boulevard - Northbound																	
R 11.22[K, W]	MFR	66 [E]	66	68	B (67)	A/E	-- [T]	--	67	1	65	3	64	4	**63** [R]	**5**	
R 11.23[K, W]	MFR	70 [M, ST11.1/ CAL]	70	72	B (67)	A/E	-- [T]	--	70	2	68	4	**66** [R]	**6**	65	7	S680/
R 11.24[C]	REC	72 [E]	72	74	B (67)	A/E	70 [T]	4	**68** [R]	**6**	67	7	66	8	65	9	R/W and
R 11.25	REC	71 [E]	71	73	B (67)	A/E	**68** [R, T]	**5**	67	6	66	7	66	7	65	8	Private Property
R 11.26[C]	SFR	67 [E]	70	72	B (67)	A/E	68 [T]	4	**65** [R]	**7**	63	9	61	11	60	12	S686B/C / Private
R 11.28	SFR	66 [E]	69	72	B (67)	A/E	69 [T]	3	**67** [R]	**5**	65	7	64	8	63	9	Property
R 11.27[C]	REC	70 [M, ST11.3]	73	77	B (67)	A/E	**71** [R,T]	**6**	69	8	66	11	65	12	63	14	S686A / Private Property
R 11.29[C]	SFR	69 [E]	72	75	B (67)	A/E	72 [T]	3	71	4	71	4	71	4	**70** [R]	**5**	S688/ Shoulder
R 11.30*	SFR	66 [E]	69	71	B (67)	A/E	69	2	69	2	68	3	68	3	68	3	Shoulder
R 11.31	REC	69 [M, ST11.6]	72	75	B (67)	A/E	72	3	71 [T]	4	**70** [R]	**5**	69	6	68	7	
R 11.31A	REC	67 [E]	70	72	B (67)	A/E	69	3	68 [T]	4	**66** [R]	**6**	65	7	65	7	S692/
R 11.32[C]	SFR	72 [E]	75	78	B (67)	A/E	72 [T]	6	70	8	**69** [R,5]	**9**	67	11	66	12	R/W and
R 11.33	SFR	65 [E]	68	70	B (67)	A/E	67 [T]	3	67	3	66	4	**65** [R]	**5**	65	5	Shoulder
R 11.34	SFR	70 [M, LT11.2]	73	75	B (67)	A/E	72 [T]	3	70	5	69	6	**68** [R,5]	**7**	67	8	
R 11.35[7]	SFR	74 [M, ST11.7]	75	77	B (67)	A/E	72 [T]	5	70	7	**69** [R,5]	**8**	67	10	66	11	
R 11.36	SFR	68 [E]	69	73	B (67)	A/E	69 [T]	4	68	5	**67** [R,5]	**6**	66	7	66	7	
R 11.37	HM	59 [E]	60	62	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	--

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - Receptor does not represent an area of frequent human use. However, this is a measurement site.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - Receivers R11.22 and R11.23 include the benefits of an existing 2.7 meter (9 foot) high wall.

K - Future noise levels at Receivers R11.22 and R11.23 have been adjusted by a "K" or calibration factor of +2 dB.

* Non first-row receiver.

TABLE 7-35 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 11

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S680	R11.22 - R11.25	30 MFR and 1 Recreational Facility (12 Frontage Units)	R/W and Private Property/ Northbound	2.4 m (8 ft) to 4.9 m (16 ft) 664 m (2,178 ft)	$38,000	$1,596,000
S686A	R11.27	1 Park (2 Frontage Units)	Private Property/ Northbound	2.4 m (8 ft) 110 m (361 ft)	$42,000	$84,000
S686B & S686C	R11.26, R11.28	8 SFR	Private Property/ Northbound	3.0 m (10 ft)/ 154 m (505 ft)	$40,000	$320,000
S688	R11.29	1 SFR	Shoulder/ Northbound	4.9 m (16 ft)/ 135 m (443 ft)	$50,000	$50,000
S689	R11.5A - R11.20	26 SFR	Shoulder and R/W/ Southbound	3.7 m (12 ft) to 4.9 m (16 ft) 1,297 m (4,225 ft)	$56,000	$1,456,000
S692	R11.31 - R11.36	10 SFR and 1 Park (6 Frontage Units)	R/W and Shoulder/ Northbound	3.7 m (12 ft) to 4.3 m (14 ft) 542 m (1,778 ft)	$54,000	$864,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-36 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 11

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S680	R11.22 - R11.25	R/W and Private Property/ Northbound	677+90	4.9 (16)	48.9 (160)
			678+25	4.9 (16)	48.9 (160)
			678+70	4.9 (16)	49.0 (161)
			678+70	4.3 (14)	48.4 (159)
			679+25	4.3 (14)	50.1 (164)
			679+70	4.3 (14)	50.6 (166)
			680+30	4.3 (14)	51.3 (168)
			680+30	4.3 (14)	53.3 (175)
			680+30	3.0 (10)	52.0 (171)
			680+60	3.0 (10)	51.0 (167)
			680+95	3.0 (10)	51.5 (169)
			681+55	3.0 (10)	50.5 (166)
			682+10	3.0 (10)	50.5 (166)
			682+10	2.4 (8)	49.9 (164)
			682+15	2.4 (8)	52.9 (174)
			682+95	2.4 (8)	53.4 (175)
			683+45	2.4 (8)	53.9 (177)
			684+15	2.4 (8)	53.4 (175)
		Approximate Length: 664 m (2,178 ft)			
S686A	R11.27	Private Property/ Northbound	685+29	2.4 (8)	46.4 (152)
			685+38	2.4 (8)	42.9 (141)
			685+84	2.4 (8)	42.9 (141)
			685+88	2.4 (8)	43.4 (143)
		Approximate Length: 110 m (361 ft)			
S686B	R11.26	Private Property/ Northbound	684+90	3.0 (10)	47.0 (154)
			685+03	3.0 (10)	47.0 (154)
			685+27	3.0 (10)	48.5 (159)
			685+82	3.0 (10)	48.5 (159)
		Approximate Length: 104 m (341 ft)			
S686C	R11.28	Private Property/ Northbound	685+88	3.0 (10)	48.5 (159)
			685+98	3.0 (10)	49.0 (161)
			686+28	3.0 (10)	49.0 (161)
		Approximate Length: 50 m (164 ft)			
S688	R11.29	Shoulder/ Northbound	686+20	4.9 (16)	45.4 (149)
			686+40	4.9 (16)	45.9 (151)
			687+00	4.9 (16)	50.9 (167)
			687+40	4.9 (16)	50.9 (167)
			687+55	4.9 (16)	50.0 (164)
		Approximate Length: 135 m (443 ft)			
S689	R11.5A - R11.20	Shoulder and R/W/ Southbound	683+25	3.7 (12)	41.0 (134)
			683+70	3.7 (12)	41.5 (136)
			684+65	3.7 (12)	42.5 (139)
			685+60	3.7 (12)	43.5 (143)
			686+50	3.7 (12)	43.9 (144)
			686+50	4.3 (14)	45.1 (148)
			687+45	4.3 (14)	46.1 (151)
			687+45	4.9 (16)	46.7 (153)
			688+15	4.9 (16)	47.5 (156)
			688+80	4.9 (16)	48.2 (158)
			689+50	4.9 (16)	49.0 (161)
			690+15	4.9 (16)	49.7 (163)
			691+15	4.9 (16)	50.7 (166)
			691+60	4.9 (16)	51.1 (168)
			692+20	4.9 (16)	51.8 (170)
			692+80	4.9 (16)	52.1 (171)
			693+58	4.9 (16)	52.7 (173)
			694+00	4.9 (16)	52.8 (173)
			694+15	4.9 (16)	55.7 (183)
			694+15	4.3 (14)	55.1 (181)
			694+58	4.3 (14)	55.4 (182)
			695+18	4.3 (14)	57.6 (189)
			695+40	4.3 (14)	58.0 (190)
			695+50	4.3 (14)	57.5 (189)
			695+78	4.3 (14)	56.5 (185)
			696+20	4.3 (14)	56.3 (185)
		Approximate Length: 1,297 m (4,225 ft)			
S692	R11.31 - R11.36	R/W and Shoulder/ Northbound	690+10	3.7 (12)	50.7 (166)
			690+40	3.7 (12)	49.7 (163)
			690+90	3.7 (12)	51.7 (169)
			691+10	3.7 (12)	49.5 (162)
			691+15	3.7 (12)	49.5 (162)
			692+50	3.7 (12)	50.7 (166)
			692+45	3.7 (12)	53.7 (176)
			293+00	3.7 (12)	55.7 (183)
			693+45	3.7 (12)	55.7 (183)
			693+45	4.3 (14)	56.3 (185)
			694+00	4.3 (14)	56.8 (186)
			694+50	4.3 (14)	57.4 (188)
			694+50	3.7 (12)	56.8 (186)
			695+05	3.7 (12)	57.7 (189)
			695+45	3.7 (12)	58.2 (191)
		Approximate Length: 542 m (1,778 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 12 – LEUCADIA BOULEVARD TO LA COSTA AVENUE

Areas with noise abatement

Table 7-37 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-38 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-39 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S702: Soundwall S702 would be located on the northbound R/W between stations 700+95 and 702+70. Soundwall S702 would provide a 5 dB noise reduction to a single-family residence located at the corner of Piraeus Street and Sparta Drive, represented by Receptor 12.34. Sheet 33 shows the location of Soundwall S702.

Soundwall S706: Soundwall S706 would be located on the northbound R/W between stations 705+00 and 707+70. Soundwall S706 would provide a 5 dB noise reduction to residences represented by Receptor 12.39, but would not be feasible for Receptors 12.40 to 12.42 Sheet 34 shows the location of Soundwall S706.

Soundwall S709: Soundwall S709 would be located along the southbound shoulder of I-5 and R/W between stations 700+20 and 716+80. The soundwall would provide a 5 dB noise reduction for single family residences represented by Receptors R12.5, R12.14, R12.14A, R12.16, R12.16A, R12.17, and R12.19, as well as multi-family residences represented by Receptors R12.22, R12.24, and R12.26A. Soundwall S709 has been raised higher than otherwise required in front of Receptors R12.14, R12.16, R12.16A, R12.17, R12.22 and R12.24 to provide a 5 dB noise reduction to Receptors R12.14A, R12.19, R12.24, and R12.26A. Sheets 33 through 35 show the location of Soundwall S709.

Receptors R12.4, R12.6, R12.7, and R12.21 represent single family residences located on the southbound side of I-5. The results of traffic noise modeling indicate that Soundwall S709 would not provide a 5 dB noise reduction to these residences. However, soundwall S709 is recommended for these receivers because future noise levels are 75 dBA or greater, which would otherwise necessitate the consideration of unusual and extraordinary abatement strategies such as building insulation. Soundwall S709 would reduce the future worst-case noise levels at R12.4, R12.6, R12.7, and R12.21 below 75 dBA. Soundwall S709 would also reduce the noise levels at R12.9, R12.10, R12.11, R12.12A, R12.13, R12.15, R12.18, R12.20, R12.23, R12.25, and R12.26 between 1 and 4 dB. Receptor R12.12 is in a walled front yard that may not be an outdoor use area. This site was modeled because it is a long-term noise measurement site.

Receptors R12.8 through R12.11 represent single family residences located on the southbound side of I-5. Soundwall S709 would not provide a 5 dB noise reduction to these residences due to their high elevation with respect to the freeway and the R/W. A soundwall outside of the State R/W along the eastern edge of Orpheus Avenue was considered as an option to protect these residences; however, a commercial gardening/landscaping business is located between Orpheus Avenue and the freeway. Even with a small gap to allow ingress/egress to the business, a soundwall would isolate the business from Orpheus Avenue, which would not be practical for business. Sheet 34

shows the location of the residences, and the commercial area between them and the freeway.

Soundwall S719: Soundwall S719 would be located on the southbound R/W between stations 717+67 and 718+78. Soundwall S719 would provide a 5 dB noise reduction to a single family residence represented by Receptor 12.29. Soundwall S719 would also reduce the noise levels at R12.30 by 1 dB. Sheet 36 shows the location of Soundwall S719.

Areas without noise abatement

Several areas in Segment 12 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R12.1 through R12.3: These receptors are located on the southbound side of I-5 just north of Leucadia Boulevard. It is not feasible to abate for highway traffic noise in this area due to the high elevation of the receptors with respect to the freeway and the R/W. Table 7-37 shows the results of the barrier analysis in this area with a soundwall located on the shoulder of I-5. A soundwall would not provide a 5 dB noise reduction to any of the receptors; therefore, a soundwall in this area would not be feasible. It was determined that locating a soundwall outside of the State R/W on the eastern edge of Orpheus Avenue would not be feasible because it would block access to the land between Orpheus Avenue and the freeway. Sheet 33 shows the location of the receptors.

Receptors R12.27 and R12.28: Receptors R12.27 and R12.28 represent single-family residences located on the southbound side of I-5 south of La Costa Avenue. Table 7-37 shows the results of the barrier analysis in this area with a soundwall located on the shoulder of the southbound La Costa Avenue on-ramp. A soundwall would not provide a 5 dB noise reduction to any of the receptors; therefore, a soundwall in this area would not be feasible. Also, it would not be practical to build a soundwall at the property line of these receivers due to the topography of the area. Sheets 35 and 36 show the location of the receptors.

Receptors R12.31 to R12.33: Receptors R12.31 through R12.33 represent a group of single-family residences located on the northbound side of I-5 just north of Leucadia Boulevard. Receptor R12.31 is located between Leucadia Boulevard and the entrance of the future Leucadia Boulevard on-ramp. This limits the area available for the location of a soundwall to protect R12.31. There is an existing 2.1 meter (7 foot) high property wall at the residences represented by Receptor R12.32. Table 7-37 shows the results of the barrier analysis in this area with a soundwall located on the R/W in front of Receptors R12.32 and R12.33. A soundwall would not provide a 5 dB noise reduction to Receptors R12.31 or R12.32. It would provide a 5 dB noise reduction to Receptor R12.33, but only to one single-family residence; therefore, a soundwall is not recommended for this receiver. Sheet 33 shows the location of the receptors.

Receptors R12.35 through R12.38: Receptors R12.35 through R12.38 represent single-family residences in a new housing development located on the northbound side of I-5 on Skyros Way. There is an existing 1.8 to 2.1 meter (6 to 7 foot) high property wall along the backyards of these residences. Table 7-37 shows the results of the barrier analysis in this area with a soundwall located on the R/W. A soundwall would not provide a 5 dB noise reduction to these receptors; therefore, a soundwall in this area would not be feasible. Sheets 33 and 34 show the location of the receptors.

Receptors R12.43 through R12.48: These receptors are located on the northbound side of I-5 just south of La Costa Avenue on hills facing I-5. It is not practical to abate for highway traffic noise in this area because the receptors are elevated by approximately 20 to 25 meters (65 to 80 feet) above the freeway and the R/W. It would also not be practical to build a soundwall at the property line of these receivers due to the topography of the area. Furthermore, the backyards of the residences in this area are shallow, and are sloped downhill towards the freeway, with some of the residences having decks. For these reasons, a soundwall analysis was not performed for these receptors. Sheet 35 shows the location of the receptors.

TABLE 7-37 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 12

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] $L_{eq(h)}$, dBA	FUTURE PEAK HOUR NOISE LEVELS, $L_{eq(h)}$, dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	
Leucadia Boulevard to La Costa Avenue - Southbound																	
R 12.1*	SFR	65 E	66	69	B (67)	A/E	69	0	69	0	68	1	68	1	68	1	
R 12.2	SFR	70 E	71	73	B (67)	A/E	73	0	72	1	72	1	71	2	71	2	Shoulder
R 12.3	SFR	70 E	71	73	B (67)	A/E	73	0	73	0	73	0	72	1	72	1	
R 12.4	SFR	73 E	74	76	B (67)	A/E	75	1	74	2	74	2	**73** R,X,T	**3**	72	4	S709/
R 12.5	SFR	74 M, ST12.2A	75	78	B (67)	A/E	76	2	76	2	75	3	**73** R, T	**5**	72	6	Shoulder
R 12.6	SFR	71 E	72	75	B (67)	A/E	74	1	74	1	73	2	**72** R,X	**3**	72	3	and R/W
R 12.7	SFR	72 E	73	76	B (67)	A/E	75	1	75	1	74	2	**73** R,X	**3**	72	4	
R 12.8*	SFR	70 E	71	73	B (67)	A/E	73	0	73	0	73	0	73	0	72	1	
R 12.9	SFR	71 E	72	74	B (67)	A/E	74	0	74	0	73	1	73	1	72	2	
R 12.10	SFR	68 E	69	71	B (67)	A/E	71	0	71	0	71	0	70	1	70	1	
R 12.11	SFR	68 E	69	72	B (67)	A/E	71	1	71	1	70	2	70	2	69	3	
R 12.12[7]	SFR	73 M, LT12.1	74	77	B (67)	A/E	74	3	73	4	71	6	69	8	68	9	
R 12.12A[K]	SFR	64 E	65	68	B (67)	A/E	67	1	67	1	66	2	65	3	64	4	
R 12.13*	SFR	67 E	68	71	B (67)	A/E	70	1	70	1	70	1	69	2	69	2	
R 12.14[C]	SFR	72 E	73	75	B (67)	A/E	73	2	72	3	71 T	4	70	5	**68** R,5	**7**	
R 12.14A[K]	SFR	66 E	67	69	B (67)	A/E	68	1	67	2	66 T	3	65	4	**64** R	**5**	
R 12.15	SFR	69 E	70	72	B (67)	A/E	71	1	71	1	71	1	70	2	70	2	
R 12.16[C]	SFR	71 E	72	75	B (67)	A/E	73	2	72	3	70 T	5	69	6	**68** R,5	**7**	
R 12.16A[K]	SFR	65 E	66	69	B (67)	A/E	67	2	66	3	65 T	4	63	6	**62** R,5	**7**	
R 12.17	SFR	70 E	71	74	B (67)	A/E	72	2	70 T	4	69	5	68	6	**67** R,5	**7**	
R 12.18*	SFR	69 E	70	72	B (67)	A/E	71	1	71	1	70	2	70	2	70	2	
R 12.19	SFR	72 E	72	75	B (67)	A/E	73	2	73	2	72	3	71	4	**70** R	**5**	
R 12.20	SFR	68 E	68	71	B (67)	A/E	71	0	71	0	71	0	70	1	70	1	
R 12.21	SFR	75 M, ST12.4/CAL	75	77	B (67)	A/E	76	1	76	1	75	2	75	2	**74** R, X	**3**	

Notes:

1 - $L_{eq(h)}$ are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - Receptor does not represent an area of frequent human use. However, this is measurement site.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to Receptora R12.12A, R12.14A, and R12.16A to account for attenuation provided by first-row buildings.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

X - Soundwall S709 is recommended for these receivers because future noise levels are 75 dBA or greater, which would otherwise necessitate the consideration of unusual and extraordinary abatement strategies such as building insulation.

* Non first-row receiver.

TABLE 7-37 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 12 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
Leucadia Boulevard to La Costa Avenue - Southbound (Continued)																	
R 12.22[W]	MFR	67 [E]	68	71	B (67)	A/E	67 [T]	4	66	5	65	6	64	7	**64** [R, 5]	**7**	
R 12.23[W]	MFR	65 [M, LT12.3]	66	68	B (67)	A/E	67	1	67 [T]	1	66	2	65	3	64	4	S709/
R 12.24[W]	MFR	69 [E]	70	72	B (67)	A/E	71	1	70	2	68 [T]	4	67	5	**66** [R,5]	**6**	Shoulder
R 12.25[W]	REC	67 [M, ST12.6/CAL]	67	69	B (67)	A/E	69	0	69 [T]	0	68	1	67	2	66	3	and R/W
R 12.26[W]	REC	68 [E]	68	70	B (67)	A/E	70	0	69	1	69 [T]	1	68	2	68	2	
R 12.26A[W]	MFR	69 [E]	69	72	B (67)	A/E	71	1	71	1	70 [T]	2	68	4	**67** [R]	**5**	
R 12.27	SFR	70 [E]	70	72	B (67)	A/E	72	0	72	0	72	0	72	0	72	0	Shoulder
R 12.28[W]	SFR	65 [M, LT12.4]	65	68	B (67)	A/E	68	0	68	0	68	0	68	0	68	0	
R 12.29[C]	SFR	72 [E]	72	74	B (67)	A/E	**69** [R,T]	**5**	67	7	66	8	65	9	64	10	S719/ R/W
R 12.30	SFR	66 [E]	66	67	B (67)	A/E	66	1	66	1	66	1	66	1	66	1	
Leucadia Boulevard to La Costa Avenue - Northbound																	
R 12.31	SFR	65 [E]	68	70	B (67)	A/E	69	1	69	1	68	2	68	2	68	2	
R 12.32[W]	SFR	64 [M, ST12.1]	67	69	B (67)	A/E	69	0	68	1	67	2	67	2	66	3	R/W
R 12.33	SFR	68 [E]	71	73	B (67)	A/E	71	2	70	3	69	4	68	5	68	5	
R 12.34[C]	SFR	68 [E]	71	74	B (67)	A/E	72	2	71	3	70	4	70	4	**69** [R]	**5**	S702/ R/W
R 12.35[W]	SFR	69 [E]	71	73	B (67)	A/E	73	0	72	1	71	2	70	3	69	4	
R 12.36[W]	SFR	68 [E]	71	73	B (67)	A/E	72	1	71	2	71	2	71	2	70	3	R/W
R 12.37[W]	SFR	67 [E]	70	72	B (67)	A/E	71	1	70	2	70	2	69	3	69	3	
R 12.38[W]	SFR	66 [E]	69	71	B (67)	A/E	70	1	70	1	70	1	69	2	69	2	
R 12.39[C]	SFR	68 [E]	71	71	B (67)	A/E	69 [T]	2	68	3	67	4	67	4	**66** [R]	**5**	
R 12.40	SFR	71 [M, 7, LT12.2]	69	70	B (67)	A/E	68 [T]	2	68	2	67	3	66	4	66	4	S706/
R 12.41*	SFR	65 [E]	68	69	B (67)	A/E	68	1	67	2	67	2	66	3	66	3	R/W
R 12.42	SFR	66 [E]	69	70	B (67)	A/E	69	1	68	2	68	2	67	3	67	3	
R 12.43	SFR	62 [E]	65	66	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 12.44	SFR	60 [E]	63	65	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	--
R 12.45	SFR	61 [E]	64	66	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 12.46	SFR	60 [M, ST12.5]	63	66	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 12.47	SFR	61 [E]	64	66	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	
R 12.48	SFR	67 [E]	70	73	B (67)	A/E	--	--	--	--	--	--	--	--	--	--	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.

4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

6 - Traffic noise from the freeway only; other local noise sources are not included.

7 - The position of Receiver R12.40 has been moved from the measurement position (LT12.2) to the human use area at this location.

C - Critical design receiver.

R - Recommended height to meet feasibility requirements of Department's Noise Abatement Protocol.

T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.

W - The existing and future noise levels at this receiver include the benefits of an existing property wall.

* Non first-row receiver.

TABLE 7-38 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 12

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S702	R12.34	1 SFR	R/W/ Northbound	4.9 m (16 ft)/ 175 m (574 ft)	$48,000	$48,000
S706	R12.39	1 SFR	R/W/ Northbound	4.9 m (16 ft)/ 272 m (892 ft)	$48,000	$48,000
S709	R12.5, R12.14, R12.14A, R12.16, R12.16A, R12.17, R12.19, R12.22, R12.24, and R12.26A	14 SFR and 11 MFR	Shoulder and R/W/ Southbound	4.3 m (14 ft) and 4.9 m (16 ft)/ 1,665 m (5,463 ft)	$42,000	$1,050,000
S719	R12.29	1 SFR	R/W/ Southbound	2.4 m (8 ft)/ 111 m (364 ft)	$36,000	$36,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-39 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 12

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S702	R12.34	R/W/ Northbound	700+95	4.9 (16)	50.9 (167)
			701+25	4.9 (16)	51.1 (168)
			702+00	4.9 (16)	48.9 (160)
			702+70	4.9 (16)	46.4 (152)
		Approximate Length:185 m (574 ft)			
S706	R12.39	R/W/ Northbound	705+00	4.9 (16)	45.4 (149)
			705+40	4.9 (16)	44.3 (145)
			705+80	4.9 (16)	43.7 (143)
			706+35	4.9 (16)	44.9 (147)
			707+00	4.9 (16)	47.9 (157)
			707+50	4.9 (16)	48.5 (159)
			707+70	4.9 (16)	48.5 (159)
		Approximate Length: 272 m (892 ft)			
S709	R12.5, R12.14, R12.14A, R12.16, R12.16A, R12.17, R12.19, R12.22, R12.24, and R12.26A	Shoulder and R/W/ Southbound	700+20	4.3 (14)	46.2 (151)
			700+63	4.3 (14)	46.0 (151)
			701+15	4.3 (14)	45.6 (149)
			702+05	4.3 (14)	44.5 (146)
			702+35	4.3 (14)	44.1 (145)
			703+00	4.3 (14)	43.3 (142)
			703+50	4.3 (14)	44.3 (145)
			703+85	4.3 (14)	44.3 (145)
			704+15	4.3 (14)	42.3 (139)
			704+45	4.3 (14)	39.8 (130)
			704+75	4.3 (14)	41.3 (135)
			705+40	4.3 (14)	40.4 (132)
			706+00	4.3 (14)	39.6 (130)
			706+00	4.9 (16)	40.2 (132)
			707+00	4.9 (16)	38.2 (125)
			707+95	4.9 (16)	36.2 (119)
			708+85	4.9 (16)	34.2 (112)
			709+45	4.9 (16)	33.0 (108)
			710+00	4.9 (16)	31.7 (104)
			710+90	4.9 (16)	29.7 (97)
			711+60	4.9 (16)	28.4 (93)
			712+20	4.9 (16)	27.2 (89)
			713+20	4.9 (16)	24.7 (81)
			713+75	4.9 (16)	23.0 (75)
			714+35	4.9 (16)	21.8 (71)
			715+20	4.9 (16)	19.9 (65)
			715+80	4.9 (16)	18.5 (61)
			716+20	4.9 (16)	17.5 (57)
			716+60	4.9 (16)	17.3 (57)
			716+80	4.9 (16)	17.5 (57)
		Approximate Length: 1,665 m (5,463 ft)			
S719	R12.29	R/W/ Southbound	717+67	2.4 (8)	27.4 (90)
			718+63	2.4 (8)	23.9 (78)
			718+78	2.4 (8)	23.9 (78)
		Approximate Length:111 m (364 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 13 – LA COSTA AVENUE TO POINSETTIA LANE

Areas with noise abatement

Table 7-40 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-41 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-42 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S723: Soundwall S723 would be located on private property on the southbound side of I-5 between stations 721+30 and 723+15. The soundwall would benefit single-family residences represented by Receptors R13.1 and R13.2 and R13.2A. A soundwall was considered on private property because these residences are elevated by approximately 19 meters (62 feet) above both the R/W line and shoulder of I-5. Sheet 36 shows the location of the soundwall.

Soundwall S729: Soundwall S729 would be located on private property on the southbound side of I-5 between stations 728+80 and 730+05. The soundwall would benefit a group of single-family residences represented by Receptors R13.3 through R13.5. Soundwall S729 would end into the side of a hill at its northern end, just beyond Receptor R13.5 at station 730+05, while maintaining a level top-of-barrier height. Sheet 37 shows the location of the soundwall.

Soundwall S730: Soundwall S730 would be located along the northbound side of I-5 between stations 729+70 and 731+60 and would be placed on private property. The soundwall would benefit single-family residences represented by Receptors R13.18 through R13.20A, and R13.20. Soundwall S730 has been raised higher than otherwise required in front of Receptor R13.20 to provide a 5 dB noise reduction to residences represented by Receptor R13.19. Sheet 37 shows the location of Soundwall S730.

Soundwall S736: Soundwall S736 would be located along the northbound side of I-5 on private property between stations 732+45 and 740+50. The soundwall would benefit single and multi-family residences represented by Receptors R13.21 and R13.21A through R13.26. Soundwall S736 would replace the existing 1.8 meter (6 foot) high glass/block property wall that runs between station 738+15 and 740+50 along this area. Sheets 38 and 39 show the location of Soundwall S736.

Soundwall S737: Soundwall S737 would be located along the southbound side of I-5 between stations 736+30 and 740+72. The soundwall would benefit mobile homes represented by Receptors R13.13 through R13.16. Soundwall S737 would connect to an existing soundwall at its southern end. It has been raised higher than otherwise required in front of Receptors R13.13 R13.14, and R13.15 to provide a 5 dB noise reduction to Receptor R13.16. Sheets 38 and 39 show the location of the Soundwall S737.

Areas without noise abatement

Several areas in Segment 13 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptor R13.10: Receptor R13.10 represents the backyard of one multi-family residence in a group of multi-family residences represented by Receptors R13.6 through R13.10. Of this group, only R13.10 approaches or exceeds the NAC. These residences are protected from highway traffic noise by an existing 1.8 meter (6 foot) high property wall located on the top of a berm approximately 10 to 20 meters (33 to 66 feet) higher than the freeway. Table 7-40 shows the results of traffic noise modeling with the existing property wall raised from heights of 2.4 to 4.9 meters (8 to 16 feet) in front of Receptor R13.10. As the results show, additional wall height would not provide a 5 dB noise reduction to the residence, and is therefore not feasible. Sheet 38 shows the location of Receptor R13.10.

Receptor R13.17: Receptor R13.17 represents a single family residences located on the northbound side of I-5. The freeway is slightly elevated in front of this receiver, and a hill blocks its northern angle of view towards the freeway. Because the R/W line is significantly lower in this area and crosses through a lagoon to the south, a soundwall was only considered on the shoulder of the roadway. Table 7-40 shows the results of traffic noise modeling, which indicate that a soundwall on the shoulder would not provide a 5 dB noise reduction to this residence due to the geometry of the site and its distances from the freeway. A soundwall was not considered on private property, because constructing a soundwall on private property is not considered practical for only one receptor. Sheet 37 shows location of the receptor.

TABLE 7-40 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 13

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
La Costa Avenue to Poinsettia Lane - Southbound																	
R 13.1	SFR	72 E	71	74	B (67)	A/E	**69** R, T	**5**	68	6	67	7	67	7	66	8	S723/
R 13.2C	SFR	75 M, ST13.1	74	77	B (67)	A/E	**71** R, T	**6**	69	8	67	10	66	11	65	12	Private Property
R 13.2A	SFR	73 E	72	74	B (67)	A/E	**69** R, T	**5**	68	6	66	8	65	9	64	10	
R 13.3	MH	63 E	64	67	B (67)	A/E	66 T	1	64	3	**62** R	**5**	60	7	58	9	
R 13.4	MH	64 E	65	68	B (67)	A/E	64 T	4	**62** R	**6**	61	7	59	9	58	10	S729/
R 13.5C	MH	66 E	67	70	B (67)	A/E	67 T	3	**65** R	**5**	63	7	62	8	61	9	Private Property
R 13.6W	MFR	58 E	59	61	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	
R 13.7W	MFR	54 E	55	57	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	--
R 13.8W	MFR	54 M, LT13.1	59	61	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	
R 13.9W	MFR	53 M, ST13.4	54	57	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	
R 13.10W	MFR	65 E	66	68	B (67)	A/E	67	1	66	2	65	3	65	3	64	4	Private Property
R 13.11W	SFR	57 E	59	61	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	--
R 13.12W	MH	56 M, ST13.5/ CAL	58	61	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	
R 13.13W	MH	66 E	68	71	B (67)	A/E	67 T	4	66	5	65	6	**65** R,5	**6**	64	7	
R 13.14C,W	MH	68 E	70	72	B (67)	A/E	68 T	4	67	5	66	6	**65** R, 5	**7**	64	8	S737/
R 13.15W	MH	65 E	67	70	B (67)	A/E	67 T	3	66	4	65	5	**64** R,5	**6**	64	6	R/W and Shoulder
R 13.16W	MH	64 E	66	68	B (67)	A/E	66 T	2	65	3	64	4	**63** R	**5**	63	5	
La Costa Avenue to Poinsettia Lane - Southbound																	
R 13.17	SFR	66 E	66	68	B (67)	A/E	67	1	67	1	66	2	66	2	66	2	Shoulder
R 13.18C	SFR	67 E	67	69	B (67)	A/E	65 T	4	**62** R	**7**	60	9	58	11	57	12	S730/
R 13.19	SFR	66 E	66	67	B (67)	A/E	63 T	4	**60** R	**7**	58	9	56	11	56	11	Private Property
R 13.20A	SFR	66 M, ST13.2	66	67	B (67)	A/E	63 T	4	**60** R	**7**	58	9	57	10	56	11	
R 13.20	SFR	64 E	64	66	B (67)	A/E	61 T	5	**60** R,5	**6**	58	8	58	8	57	9	
R 13.21	SFR/ MFR	63 E	65	68	B (67)	A/E	65 T	3	64	4	**63** R	**5**	62	6	61	7	
R 13.21A	SFR/ MFR	67 M, ST13.3/CAL	69	71	B (67)	A/E	67 T	4	66	5	**64** R,5	**7**	63	8	61	10	S736/
R 13.22	SFR/ MFR	69 E	71	73	B (67)	A/E	**67** R,T	**6**	65	8	63	10	62	11	61	12	Private Property
R 13.23	SFR/ MFR	70 E	72	74	B (67)	A/E	**66** R,T	**8**	64	10	63	11	62	12	61	13	
R 13.24	SFR/ MFR	72 E	74	76	B (67)	A/E	**69** R,T	**7**	67	9	65	11	63	13	63	13	
R 13.24AC	SFR/ MFR	72 E	74	76	B (67)	A/E	**69** R,T	**7**	67	9	65	11	64	12	63	13	
R 13.25W	SFR/ MFR	68 M, LT13.2	69	71	B (67)	A/E	69 T	2	67	4	**65** R	**6**	64	7	63	8	
R 13.26W	SFR/ MFR	68 E	69	71	B (67)	A/E	69 T	2	67	4	**65** R	**6**	63	8	63	8	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
C - Critical design receiver.
R - Recommended height to meet feasibility requirements of the Department's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
W - Includes the benefits of an existing property wall.
* Non first-row receiver.

TABLE 7-41 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 13

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S723	R13.1 - R13.2 and R13.2A	2 SFR	Private Property/ Southbound	2.4 m (8 ft)/ 215 m (705 ft)	$50,000	$100,000
S729	R13.3 - R13.5	12 SFR	Private Property/ Southbound	3.0 m (10 ft) to 3.7 m (12 ft)/ 184 m (604 ft)	$38,000	$456,000
S730	R13.18 - R13.20A and R13.20	8 SFR	Private Property/ Northbound	3.0 m (10 ft)/ 248 m (814 ft)	$36,000	$288,000
S736	R13.21 - R13.26	32 SFR and 46 MFR	Private Property/ Northbound	2.4 m (8 ft) to 3.7 m (12 ft)/ 873 m (2,864 ft)	$42,000	$3,276,000
S737	R13.13 - R13.16	17 MH	R/W and Shoulder/ Southbound	4.3 m (14 ft)/ 444 m (1,457 ft)	$50,000	$850,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-42 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 13

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S723	R13.1 - R13.2 and R13.2A	Private Property/ Southbound	721+30	2.4 (8)	23.4 (77)
			721+85	2.4 (8)	24.4 (80)
			722+45	2.4 (8)	24.4 (80)
			722+80	2.4 (8)	24.4 (80)
			723+50	2.4 (8)	22.4 (74)
			723+15	2.4 (8)	22.4 (74)
		Approximate Length: 215 m (705 ft)			
S729	R13.3 - R13.5	Private Property/ Southbound	728+80	3.7 (12)	27.7 (91)
			729+10	3.7 (12)	29.7 (97)
			729+10	3.0 (10)	29.0 (95)
			729+45	3.0 (10)	35.0 (115)
			729+60	3.0 (10)	35.0 (115)
			729+95	3.0 (10)	35.0 (115)
			730+05	0.0 (0)	35.0 (115)
		Approximate Length: 184 m (604 ft)			
S730	R13.18 - R13.20A, and R13.20	Private Property/ Northbound	729+70	3.0 (10)	9.5 (31)
			729+75	3.0 (10)	9.5 (31)
			729+95	3.0 (10)	9.5 (31)
			730+10	3.0 (10)	9.5 (31)
			730+35	3.0 (10)	10.0 (33)
			730+72	3.0 (10)	11.0 (36)
			730+75	3.0 (10)	12.5 (41)
			731+00	3.0 (10)	12.5 (41)
			731+14	3.0 (10)	13.0 (43)
			731+14	3.0 (10)	13.0 (43)
			731+21	3.0 (10)	13.5 (44)
			731+35	3.0 (10)	15.0 (49)
			731+46	3.0 (10)	17.0 (56)
			731+60	3.0 (10)	16.0 (53)
		Approximate Length: 248 m (814 ft)			
S736	R13.21 - R13.26	Private Property/ Northbound	732+45	3.7 (12)	46.2 (151)
			732+55	3.7 (12)	46.7 (153)
			732+80	3.7 (12)	46.7 (153)
			732+85	3.7 (12)	46.9 (154)
			732+85	3.0 (10)	46.2 (152)
			733+43	3.0 (10)	46.0 (151)
			733+43	2.4 (8)	45.4 (149)
			734+07	2.4 (8)	45.2 (148)
			734+78	2.4 (8)	44.9 (147)
			735+40	2.4 (8)	45.0 (148)
			736+25	2.4 (8)	44.1 (145)
			736+75	2.4 (8)	43.9 (144)
			737+13	2.4 (8)	43.8 (144)
			737+71	2.4 (8)	43.6 (143)
			738+15	2.4 (8)	43.5 (143)
			738+15	3.7 (12)	44.8 (147)
			738+75	3.7 (12)	44.7 (147)
			739+30	3.7 (12)	45.0 (147)
			739+95	3.7 (12)	43.7 (143)
			740+40	3.7 (12)	44.0 (144)
			740+50	3.7 (12)	44.0 (144)
			740+50	3.0 (10)	43.3 (142)
			740+50	3.0 (10)	43.1 (142)
		Approximate Length: 873 m (2,864 ft)			
S737	R13.13 - R13.16	R/W and Shoulder Southbound	736+30	4.3 (14)	36.8 (121)
			736+95	4.3 (14)	35.3 (116)
			737+65	4.3 (14)	33.9 (111)
			738+10	4.3 (14)	33.3 (109)
			738+55	4.3 (14)	32.3 (106)
			739+15	4.3 (14)	31.8 (104)
			739+40	4.3 (14)	31.5 (103)
			739+80	4.3 (14)	31.2 (102)
			740+08	4.3 (14)	31.0 (102)
			740+40	4.3 (14)	30.7 (101)
			740+72	4.3 (14)	30.4 (100)
		Approximate Length: 444 m (1,457 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 14 – POINSETTIA LANE TO PALOMAR AIRPORT ROAD

Areas with noise abatement

Table 7-43 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-44 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-45 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S750: Soundwall S750 would be located along the northbound side of I-5 between stations 742+95 and 757+45. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences, represented by Receptors R14.8 and R14.10 through R14.28. Receptors R14.7 through R14.19 are located behind an existing 1.8 m (6 ft) property wall, and Receptors R14.20 through R14.27 are located behind an existing 1.5 m (6 ft) property wall. The R/W is 2 to 4 meters lower than the property wall between stations 742+90 and 751+50, and locating the soundwall on the R/W will severely reduce its effectiveness. Because the R/W is between 2 m (6.6 ft) to 4 m (13.1 ft) below the grade at Receptors R14.7 to R 14.19, placing the soundwall at the current property wall location, on private land, would be more effective and would benefit many more receptors. Soundwall S750 has been raised higher than otherwise required in front of Receptor R14.11 to provide a 5 dB benefit for Receptors R14.10 and R14.12. Soundwall S750 has been raised higher than otherwise required in front of Receptor R14.14 to provide a 5 dB benefit for Receptor R14.13. Soundwall S750 has been raised higher than otherwise required in front of Receptors R14.15, R14.17, and R14.19 to provide a 5 dB benefit for Receptors R14.16, and R14.18. Soundwall S750 has been raised higher than otherwise required in front of Receptors R14.20, R14.21 and R14.23 to provide a 5 dB benefit for receptor R14.22. Soundwall S750 has been raised higher than otherwise required in front of Receptors R14.25, R14.26, and R14.28 to provide a 5 dB benefit for Receptors R14.24 and R14.27. Sheets No. 39, 40, and 41 show the location of Soundwall S750.

Second row Receptors R14.7 and R14.9 do not benefit from Soundwall S750 because they are at a much higher elevation than the top of the soundwall.

Areas without noise abatement

Several areas in Segment 14 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R14.1 through R14.6: These receptors are located on the southbound side of I-5 north of Poinsettia Lane. These receptors do not qualify because they are second row receptors behind property walls and are shielded by a row of hotels and commercial structures. Receptors R14.1 through R14.3 are located behind an existing 1.8 m (6 ft) property wall, and Receptors R14.4 through R14.6 are located behind an existing 2.7 m (9 ft) property wall. A soundwall located along the R/W would not provide a 5 dB noise reduction to these second row receptors; therefore, it would not be feasible. There are several hotels in this area, but they do not have outdoor use areas that are exposed to I-5 traffic noise. Sheets No. 39 and 40 show the location of these receptors.

Receptors R14.29 and R14.30: These receptors are located on the northbound side of I-5, south of Palomar Airport Road. Receptor R14.30 represents the pool area at a Motel 6. This location does not benefit from a soundwall located on the R/W because it is shielded by the Motel 6 structure and a soundwall would not provide a 5 dB noise reduction to this receptor; therefore, it would not be feasible.

Receptor R14.29 represents the Discovery Isle Child Development Center's playground. This location does not benefit from a soundwall located on the R/W because it is 120 m (394 ft) from the edge of the highway and is partially shielded by the Motel 6 structure and a soundwall would not provide a 5 dB noise reduction to this receptor; therefore, it would not be feasible. A soundwall on private property for R14.29 must be constructed on the east side of Paseo Del Norte and to be effective. A soundwall at this location will block access to the property and will cover adjacent properties. Therefore, a wall on the property line is not considered practical for this receptor. The measurement taken at Receptor R14.29 includes traffic noise from Paseo Del Norte, a four-lane road directly in front of the building. This extraneous noise caused the existing noise level to be higher than the future "no build" level calculated by the model. Sheet No. 42 shows the location of these receptors.

TABLE 7-43 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 14

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 14.1 * W	SFR	61 E	62	64	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	R/W
R 14.2 * W	SFR	62 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 14.2A * W	HM	57 E	58	60	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 14.3 * W	SFR	63 E	64	66	B (67)	A/E	65	1	64	2	63	3	63	3	62	4	
R 14.4 * W	MFR	62 M, ST14.2	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 14.5 * W	MFR	64 E	65	67	B (67)	A/E	66	1	66	1	65	2	65	2	65	2	
R 14.6 * W	MFR	58 M, ST14.3	63	66	B (67)	A/E	66	0	66	0	65	1	65	1	64	2	
R 14.7 * W	SFR	68 E	69	71	B (67)	A/E	71	0	71	0	71	0	70	1	70	1	S750/Private Property to R/W
R 14.8 W	SFR	68 E	69	71	B (67)	A/E	69 T	2	67	4	**66** R	**5**	64	7	63	8	
R 14.9 * W	SFR	70 E	71	73	B (67)	A/E	73	0	73	0	72	1	71 T	2	70	3	
R 14.10 W	SFR	70 E	71	73	B (67)	A/E	71 T	2	70	3	**68** R	**5**	67	6	66	7	
R 14.11 W	SFR	72 E	73	76	B (67)	A/E	72 T	4	70	6	**68** R,5	**8**	66	10	65	11	
R 14.12 W	SFR	72 E	73	75	B (67)	A/E	73 T	2	71	4	**69** R	**6**	68	7	67	8	
R 14.13 * W	SFR	69 E	70	72	B (67)	A/E	70	2	69	3	68	4	68	4	**67** R	**5**	
R 14.14 W	SFR	71 E	72	75	B (67)	A/E	73 T	2	71	4	70	5	68	7	**68** R,5	**7**	
R 14.15 W	SFR	71 M, ST14.1/CAL	72	74	B (67)	A/E	72 T	2	71	3	69	5	**68** R,5	**6**	67	7	
R 14.16 * W	SFR	70 E	71	73	B (67)	A/E	72	1	71	2	69	4	**68** R	**5**	67	6	
R 14.17 W	SFR	74 E	75	77	B (67)	A/E	75 T	2	73	4	71	6	**69** R,5	**8**	68	9	
R 14.18 * W	SFR	70 E	71	73	B (67)	A/E	72	1	71	2	69	4	**68** R	**5**	67	6	
R 14.19 W	SFR	72 E	73	75	B (67)	A/E	74 T	1	72	3	70	5	**69** R,5	**6**	68	7	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing, future "no build", and future noise levels at this location include benefits of an existing property wall.

* - Non-first row recevier.

TABLE 7-43 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 14 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] $L_{eq(h)}$, dBA	FUTURE PEAK HOUR NOISE LEVELS, $L_{eq(h)}$, dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	
R 14.20 * W	MFR	72 E	72	74	B (67)	A/E	72	2	71	3	69	5	**68** R,5	**6**	67	7	S750/Private Property to R/W
R 14.21 W	MFR	75 M, LT14.1	75	78	B (67)	A/E	76	2	75 T	3	73	5	**71** R,5	**7**	70	8	
R 14.22 * W	MFR	72 E	72	74	B (67)	A/E	72	2	71	3	70	4	**69** R	**5**	68	6	
R 14.23 W	MFR	74 E	74	76	B (67)	A/E	74 T	2	72	4	71	5	**69** R,5	**7**	68	8	
R 14.24 * W	SFR	70 E	70	72	B (67)	A/E	70	2	69	3	68	4	**67** R	**5**	66	6	
R 14.25 W	SFR	73 M, ST14.4/CAL	74	76	B (67)	A/E	73 T	3	71	5	69	7	**68** R,5	**8**	66	10	
R 14.26 W,C	SFR	73 E	74	77	B (67)	A/E	75 T	2	73	4	71	6	**69** R,5	**8**	68	9	
R 14.27 * W	SFR	69 E	70	72	B (67)	A/E	70	2	69	3	68	4	**67** R	**5**	66	6	
R 14.28	SFR	73 E	74	76	B (67)	A/E	71 T	5	70	6	69	7	**68** R,5	**8**	67	9	
R 14.29 * **	SCH	67 M, ST14.5	66	68	B (67)	A/E	67	1	66	2	65	3	65	3	64	4	R/W
R 14.30	HM	62 E	63	66	B (67)	A/E	65 T	1	65	1	65	1	65	1	65	1	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing, future "no build", and future noise levels at this location include benefits of an existing property wall.

* - Non-first row receiver.

**- Traffic on Paseo Del Norte (road), which is very close to the measurement site, caused the existing noise level to be higher than the modeled "no build"

TABLE 7-44 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 14

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S750	R14.8, R14.10 - R14.28	36 SFR 56 MFR	R/W and Property Line/ Northbound	3.7 m (12 ft) to 4.3 m (14 ft) to 4.9 m (16 ft) / 1461 m (4793 ft)	$52,000	$4,784,000

Notes:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence

2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-45 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 14

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)
S750	R14.8, R14.10 - R14.28	36 SFR 56 MFR	ROW and Property Line/ Northbound	742+95	3.7 (12)	38.5 (126)
				743+35	3.7 (12)	38.2 (125)
				743+85	3.7 (12)	35.7 (117)
				744+66	3.7 (12)	31.7 (104)
				745+66	3.7 (12)	31.6 (104)
				746+26	3.7 (12)	31.5 (103)
				746+38	3.7 (12)	29.5 (97)
				746+38	4.9 (16)	30.7 (101)
				747+36	4.9 (16)	30.2 (99)
				747+36	4.3 (14)	29.6 (97)
				748+00	4.3 (14)	29.3 (96)
				749+00	4.3 (14)	28.3 (93)
				749+77	4.3 (14)	28.3 (93)
				750+32	4.3 (14)	27.8 (91)
				750+83	4.3 (14)	27.5 (90)
				751+21	4.3 (14)	27.3 (89)
				751+50	4.3 (14)	24.8 (81)
				751+85	4.3 (14)	25.3 (83)
				752+73	4.3 (14)	25.3 (83)
				753+58	4.3 (14)	25.8 (85)
				754+24	4.3 (14)	25.8 (85)
				754+72	4.3 (14)	26.3 (86)
				755+40	4.3 (14)	26.0 (85)
				755+92	4.3 (14)	26.3 (86)
				756+90	4.3 (14)	27.1 (89)
				757+42	4.3 (14)	27.3 (89)
				757+45	4.3 (14)	27.5 (90)
			Approximate Length: 1461 m (4793 ft)			

1 - Land Use: SFR - single-family residence; MFR - multi-family residence.

SEGMENT 15 – CANNON ROAD

Areas with noise abatement

Table 7-46 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-47 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-48 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraph describes the recommended soundwall:

Soundwall S783: Soundwall S783 would be located on private property along the northbound side of I-5 between stations 783+00 and 783+20. The soundwall would provide protection from highway traffic noise for the outdoor swimming pool area of the West Inn Suites, represented by Receptors R15.1 and R15.2. Soundwall S783 will replace a 1.9 m (6 ft) existing privacy wall. Sheets No. 44 and 45 show the location of Soundwall S783.

Areas without noise abatement

There are no noise sensitive areas in Segment 15 that are impacted by the widening and improvement project where it was not feasible to apply standard noise abatement techniques.

TABLE 7-46 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 15

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] $L_{eq(h)}$, dBA	FUTURE PEAK HOUR NOISE LEVELS, $L_{eq(h)}$, dBA[1, 6]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	$L_{eq(h)}$	I.L.	
Cannon Road - Southbound																	
R 15.1[WC]	HM	71 [E]	71	73	B (67)	A/E	73 [T]	0	72	1	70	3	**68** [R]	**5**	66	7	S783/
R 15.2[W]	HM	68 [E]	68	71	B (67)	A/E	71	0	70	1	70 [T]	1	69	2	68	3	Private Property

Notes:

1 - $L_{eq(h)}$ are A-weighted, peak hour noise levels in decibels.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational area; FIRE - fire station; HM - hotel/motel.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data.
4 - S = Substantial Increase (12 dBA or more); A/E = Approach or exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Traffic noise from the freeway only; other local noise sources are not included.
C - Critical design receiver.
R - Recommended height to meet feasibility requirements of the Department's Noise Abatement Protocol.
T - Minimum height required to block the line-of-sight from the receptor to truck exhaust stacks.
W - Includes the benefits of an existing property wall.
* Non first-row receiver.

TABLE 7-47 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 15

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S783	R15.1	1 HM	Private Property/ Southbound	4.3 m (14 ft)/ 120 m (394 ft)	$36,000	$36,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; HM - hotel/motel.
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-48 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 15

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S783	R15.1	Private Property/ Southbound	782+75	4.3 (14)	18.3 (60)
			782+75	4.3 (14)	18.3 (60)
			782+95	4.3 (14)	18.3 (60)
			782+95	4.3 (14)	18.3 (60)
		Approximate Length: 120 m (394 ft)			

Note:
1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 16 – CANNON ROAD TO TAMARACK AVENUE

Areas with noise abatement

Table 7-49 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-50 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-51 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S796: Soundwall S796 would be located along the northbound shoulder of I-5 between stations 796+00 and 798+22. The soundwall would provide protection from highway traffic noise for a single family residence represented by Receptor R16.2, as well as a water front recreational area represented by Receptor R16.1. Soundwall S796 has been raised higher than otherwise required in front of Receptor R16.1 to provide a 5 dB benefit for Receptor R16.2. Sheets No. 46 and 47 show the location of Soundwall S796.

Soundwall S798: Soundwall S798 would be located along the northbound R/W of I-5 between stations 798+00 and 800+00. Because the terrain south of station 798+25 drops, the top of the wall should remain level south from station 798+25 to station 798+00. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences represented by Receptors R16.3, R16.3A, and R16.4A. Receptors R16.4 (a multi-family residence pool area) and R16.5 (grassy outdoor use area) do not benefit from Soundwall S798 because they are shielded by existing structures. Sheet No. 47 shows the location of Soundwall S798.

Soundwall S802: Soundwall S802 would be located along the northbound R/W of I-5 between stations 800+10 and 801+75. The soundwall would provide protection from highway traffic noise for a group of multi-family residences represented by Receptors R16.6 and R16.7. The existing noise levels at these receptors include the benefits of an existing 1.5 m (5 ft) wooden fence. Sheet No. 47 shows the location of Soundwall S802.

Soundwall S799: Soundwall S799 would be located along the southbound side of I-5 between stations 796+75 and 799+95. The soundwall would provide protection from highway traffic noise for a group of multi-family residences represented by Receptors R16.14, R16.17, and R16.19. Receptor R16.17 is a communal swimming pool and Receptor R16.19 is a grassy outdoor use area. In order to benefit Receptor R16.19 a portion of the soundwall would be located on private property along the top edge of the bluff. The soundwall would follow the R/W between stations 796+60 and 797+40. The R/W drops 4 meters below the receptors between stations 797+40 and 799+95; therefore, a soundwall located along the R/W would not provide the necessary noise abatement. Consequently, this portion of the soundwall would be located at the top of the cut on private property. Second row Receptors R16.15 a communal swimming pool and R16.16 a grassy outdoor use area do not benefit from Soundwall S799 because they are shielded by existing structures. A community gazebo represented by Receptor R16.18 is 3 meters above the base of the wall and could not benefit unless the soundwall was 1.8 m (6 ft) higher than the rest of the wall; however, there is no logical location to step the wall up and down to benefit this single receptor. Soundwall S796 has been raised higher than otherwise required in front of Receptors R16.14 and R16.19

to provide a 5 dB benefit for Receptor R16.17. Sheets No. 46 and 47 show the location of Soundwall S799.

Soundwall S801: Soundwall S801 would be located along the southbound R/W of I-5 between stations 800+10 and 802+30. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences represented by receptors R16.8 through R16.10, and R16.13. Second row Receptors R16.11 and R16.12 do not benefit from Soundwall S801. There is an existing 1.8 m (6 ft) soundwall that extends along the R/W between stations 801+25 and 802+00, which will be replaced by Soundwall S801. Sheet No. 47 shows the location of Soundwall S801.

Areas without noise abatement

There were no other areas in Segment 16 where standard noise abatement techniques would not work.

TABLE 7-49 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 16

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 16.1 C	REC	67 E	67	72	B (67)	A/E	68 T	4	67	5	66	6	**66** R,5	**6**	66	6	S796/Shoulder
R 16.2	SFR	68 E	68	71	B (67)	A/E	69	2	68	3	67 T	4	**66** R	**5**	65	6	
R 16.3 C **	SFR	80 M, LT16.1	80	81	B (67)	A/E	81	0	81	0	78	3	73 T	8	**71** R	**10**	S798/ R/W
R 16.3A	MFR	70 E	70	73	B (67)	A/E	**67** R,T	**6**	67	6	66	7	65	8	65	8	
R 16.4	MFR	66 E	66	69	B (67)	A/E	66	3	66	3	66	3	65	4	65	4	
R 16.4A	MFR	75 E	75	78	B (67)	A/E	**71** R,T	**7**	69	9	67	11	65	13	64	14	
R 16.5	MFR	64 E	64	66	B (67)	A/E	65	1	64	2	64	2	63	3	63	3	
R 16.6 K, F	MFR	75 M, ST16.2/CAL	76	79	B (67)	A/E	**74** R,T	**5**	72	7	70	9	68	11	66	13	S802/ R/W
R 16.7 C,K, F	MFR	75 E	76	79	B (67)	A/E	**71** R,T	**8**	69	10	67	12	66	13	65	14	
R 16.8 W	SFR	70 E	71	74	B (67)	A/E	70	4	**68** R,T	**6**	66	8	65	9	64	10	S801/ R/W
R 16.9 * W	SFR	68 E	69	72	B (67)	A/E	68	4	**67** R,T	**5**	66	6	65	7	64	8	
R 16.10 W	SFR	71 M, LT16.2	72	75	B (67)	A/E	72	3	**70** R,T	**5**	68	7	67	8	66	9	
R 16.11 *	SFR	63 E	64	67	B (67)	A/E	65	2	64	3	63	4	63	4	62	5	
R 16.12 *	MFR	63 E	64	67	B (67)	A/E	65	2	65	2	64	3	64	3	63	4	
R 16.13 C	MFR	74 E	75	78	B (67)	A/E	**70** R,T	**8**	69	9	68	10	67	11	66	12	
R 16.14 N	MFR	72 E	72	75	C (72)	A/E	70 T	5	**69** R,5	**6**	68	7	66	9	66	9	S799/Private Property to R/W
R 16.15 *	MFR	61 E	61	64	B (67)	NONE	62	2	62	2	62	2	61	3	61	3	
R 16.16 *	MFR	64 E	64	67	B (67)	A/E	65	2	65	2	64	3	64	3	63	4	
R 16.17 C	MFR	73 M, ST16.1/CAL	73	75	B (67)	A/E	72 T	3	**70** R	**5**	69	6	67	8	66	9	
R 16.18*	MFR	69 E	69	71	B (67)	A/E	70	1	69	2	68	3	68	3	67	4	
R 16.19	REC	68 E	68	71	B (67)	A/E	66	5	**66** R,5	**5**	64	7	63	8	62	9	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing, future "no build", and future noise levels at this location include benefits of an existing soundwall.

K - Noise level adjusted by +1.8 dB for calibration.

F - The existing noise levels at this location include benefits of an existing wooden fence.

N - This receptor does not represent an outdoor use area.

* - Non-first row receiver.

**- Soundwall is built with a flat top while the bottom follows a hill downward, the wall height ranges from 4.9m (16 ft) at the south end to 2.4m (8 ft) at the top of the hill

TABLE 7-50 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 16

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S796	R16.1 - R16.2	1 SFR and 1 Recreational (3 Frontage Units)	Shoulder / Northbound	4.3 m (14 ft) / 234 m (668 ft)	$50,000	$200,000
S798	R16.3, R16.3A, and R16.4A	2 SFR and 11 MFR	R/W / Northbound	4.9 m (16 ft) and 2.4 m (8 ft) / 200 m (656 ft)	$54,000	$702,000
S799	R16.14, R16.17, and R16.19	9 MFR and 1 Recreational (1 Frontage Unit)	Private Property and R/W / Southbound	2.4 m (8 ft) / 3.0 m (10 ft) / 423 m (1389 ft)	$48,000	$480,000
S801	R16.8 - R16.10, and R16.13	3 SFR and 13 MFR	R/W / Southbound	2.4 m (8 ft) and 3.0 m (10 ft) / 222 m (733 ft)	$42,000	$672,000
S802	R16.6 - R16.7	22 MFR	R/W / Northbound	2.4 m (8 ft) / 166 m (545 ft)	$54,000	$1,188,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-51 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 16

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S796	R16.1 - R16.2	Shoulder / Northbound	796+00	4.3 (14)	12.3 (40)
			797+00	4.3 (14)	14.3 (47)
			797+85	4.3 (14)	14.8 (48)
			798+22	4.3 (14)	15.0 (49)
		Approximate Length: 234 m (668 ft)			
S798	R16.3, R16.3A, and R16.4A	R/W / Northbound	798+00	5.0 (16.4)	21.0 (69)
			798+10	4.9 (16.0)	21.9 (72)
			798+30	2.4 (8)	21.9 (72)
			798+50	2.4 (8)	22.5 (74)
			799+25	2.4 (8)	23.2 (76)
			800+00	2.4 (8)	24.2 (80)
		Approximate Length: 200 m (656 ft)			
S799	R16.14, R16.17, and R16.19	and R/W / Southbound	797+00	2.4 (8)	19.1 (63)
			796+75	2.4 (8)	22.3 (73)
			796+60	3.1 (10)	22.9 (75)
			797+40	3.1 (10)	22.1 (73)
			798+75	3.1 (10)	22.5 (74)
			799+45	3.1 (10)	22.4 (73)
			799+95	3.1 (10)	22.3 (73)
		Approximate Length: 423 m (1389 ft)			
S801	R16.8 - R16.10, and R16.13	R/W / Southbound	800+10	2.4 (8)	21.8 (72)
			801+25	2.4 (8)	21.4 (70)
			801+25	3.0 (10)	22.0 (72)
			801+45	3.0 (10)	21.9 (72)
			802+00	3.0 (10)	22.7 (74)
			802+30	3.0 (10)	23.0 (76)
		Approximate Length: 222 m (733 ft)			
S802	R16.6 - R16.7	R/W / Northbound	800+10	2.4 (8)	23.9 (79)
			801+00	2.4 (8)	24.9 (82)
			801+75	2.4 (8)	25.9 (85)
		Approximate Length: 166 m (545 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 17 – TAMARACK AVENUE TO CARLSBAD VILLAGE DRIVE

Areas with noise abatement

Table 7-52 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-53 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-54 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S810: Soundwall S810 would be located along the northbound side of I-5 between stations 803+35 and 815+00. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences, represented by Receptors R17.5, R17.7, R17.9, R17.11, and R17.13 through R17.15. The soundwall would also provide protection for the St. Patrick School represented by Receptors R17.1A and R17.1, a single family residence and a daycare center playground represented by Receptor R17.4, as well as the 1st Baptist Church represented by Receptor R17.2, and Holiday Park represented by Receptors R17.10 and R17.12. The pool areas at two hotels, the Carlsbad Lodge and the Travel Inn Motel, would also benefit from the soundwall, represented by Receptors R17.6 and R17.8, respectively. Receptors R17.7 and R17.11 are grassy outdoor use areas for apartment buildings. The Motel 8 pool area, Receptor R17.3, is surrounded by a 1.8 m (6 ft) high block and glass wall, which is why the addition of a soundwall is not providing a 5 dB benefit for this receptor. Because the Carlsbad Village Drive northbound off ramp continues to drop below the elevation of the main freeway lanes, extending Soundwall S810 further to the north along the ramp would not provide additional benefit to Receptor R17.16. Between stations 814+00 and 815+00 Soundwall 810 should gradually increase from 4.3 m (14 ft) to 4.9 m (16 ft) as the ramp elevation declines. Soundwall S810 has been raised higher than otherwise required in front of Receptor R17.1 to provide a 5 dB benefit for Receptor R17.1A. Receptor R17.1A represents a measurement site used to determine if St. Patrick School qualifies for building acoustical treatment due to high outdoor noise levels; which is discussed in section 7.3. Soundwall S810 has been raised higher than otherwise required in front of Receptor R17.2 to provide a 5 dB benefit for Receptor R17.4. Soundwall S810 has been raised higher than otherwise required in front of Receptor R17.5 to provide a 5 dB benefit for Receptor R17.6. Soundwall S810 has been raised higher than otherwise required in front of Receptors R17.7, R17.8, R17.9, and R17.10 to provide a 5 dB benefit for Receptors R17.11 and R17.12. Soundwall S810 has been raised higher than otherwise required in front of Receptor R17.13 to provide a 5 dB benefit for Receptors R17.14 and R17.15. Sheets No. 47, 48, and 49 show the location of Soundwall S810.

Soundwall S811: Soundwall S811 would be located along the southbound side of I-5 between stations 803+00 and 815+00. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences, represented by Receptors R17.17 through R17.20, and R17.22 through R17.34. Receptors R17.34 to R17.31 represent individual backyards for multi-family residences, Receptors R17.27 to R17.21 represent communal backyards for multi-family residences, Receptor R20 represents a communal swimming pool, and Receptors R17.19 to R17.17 represent communal backyards for multi-family residences. Soundwall S811 has been raised higher than otherwise required in front of Receptor R17.17 to provide a 5 dB benefit for

Receptor R17.18. Soundwall S811 has been raised higher than otherwise required in front of Receptors R17.19, R17.20, R17.21, and R17.23 to provide a 5 dB benefit for Receptor R17.22. Soundwall S811 has been raised higher than otherwise required in front of Receptor R17.25 to provide a 5 dB benefit for Receptors R17.24, R17.26 and R17.27. Soundwall S811 has been raised higher than otherwise required in front of Receptors R17.32, R17.33, and R17.34 to provide a 5 dB benefit for Receptor R17.31. Sheets No. 47, 48, and 49 show the location of Soundwall S811.

Areas without noise abatement

There were no areas in Segment 17 where conventional noise abatement techniques would not be successful.

TABLE 7-52 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 17

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 17.1A	SCH	72 E	73	74	B (67)	A/E	70 T	4	**69** R	**5**	68	6	67	7	67	7	
R 17.1	SCH	73 M, ST17.1	74	76	B (67)	A/E	71 T	5	**69** R,5	**7**	69	7	67	9	67	9	
R 17.2 ***	CHR	74 E	75	76	B (67)	A/E	72 T	4	70	6	69	7	68	8	**67** R,5	**9**	
R 17.3 W	HM	67 E	68	70	B (67)	A/E	70	0	70	0	69	1	68	2	68	2	
R 17.4 *	SCH	66 E	67	68	B (67)	A/E	66	2	65	3	64	4	64	4	**63** R	**5**	
R 17.5	SFR	70 M, LT17.1	72	73	B (67)	A/E	69	4	67 T	6	66	7	**65** R,5	**8**	64	9	
R 17.6	HM	67 E	69	71	B (67)	A/E	69	2	68 T	3	67	4	**66** R	**5**	65	6	
R 17.7	MFR	75 M, ST17.3/CAL	75	77	B (67)	A/E	70 T	7	69	8	**68** R,5	**9**	67	10	66	11	**S810/ R/W to Shoulder**
R 17.8	HM	74 E	74	76	B (67)	A/E	70 T	6	69	7	**67** R,5	**9**	67	9	66	10	
R 17.9	SFR	71 E	71	73	B (67)	A/E	69	4	68 T	5	**66** R,5	**7**	65	8	64	9	
R 17.10	REC	75 E	75	78	B (67)	A/E	70 T	8	69	9	**67** R,5	**11**	66	12	66	12	
R 17.11 *	MFR	64 E	68	71	B (67)	A/E	68	3	67	4	**66** R	**5**	65	6	64	7	
R 17.12	REC	66 E	70	72	B (67)	A/E	70	2	68	4	**67** R,T	**5**	66	6	65	7	
R 17.13 C	SFR	69 M, LT17.3	73	76	B (67)	A/E	70 T	6	69	7	68	8	**67** R,5	**9**	66	10	
R 17.14 * K	SFR	62 E	66	68	B (67)	A/E	66	2	65	3	63	5	**63** R	**5**	62	6	
R 17.15 **	SFR	68 E	72	74	B (67)	A/E	72	2	71	3	70	4	**69** R,T	**5**	68	6	
R 17.16 * K	SFR	61 E	65	67	B (67)	A/E	66	1	65	2	65	2	64	3	63	4	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing, future "no build", and future noise levels at this location include benefits of an existing soundwall.

* - Non-first row receiver.

**- Soundwall gradually increases from 4.3m (14 ft) to 4.9m (16 ft) between stations 814+00 and 815+00.

***- Soundwall steps up from 3.0m (10 ft) to 4.9m (16 ft) between stations 804+50 to 804+90.

TABLE 7-52 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 17 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 17.17	MFR	70 M, LT17.4	70	72	B (67)	A/E	67 T	5	**66** R,5	**6**	65	7	64	8	64	8	
R 17.18 *	SFR	70 E	70	73	B (67)	A/E	69	4	**67** R	**6**	67	6	66	7	65	8	
R 17.19	MFR	72 E	72	71	B (67)	A/E	66 T	5	66	5	65	6	65	6	**65** R,5	**6**	
R 17.20 *	MFR	69 E	69	70	B (67)	A/E	66	4	65	5	64	6	64	6	**64** R,5	**6**	
R 17.21 *	MFR	61 E	61	63	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 17.22 *	MFR	64 E	64	66	B (67)	A/E	63	3	63	3	62	4	62	4	**61** R	**5**	
R 17.23	MFR	71 E	71	72	B (67)	A/E	67	5	65 T	7	65	7	64	8	**64** R,5	**8**	
R 17.24 *	SFR	67 E	70	72	B (67)	A/E	68	4	**67** R	**5**	65	7	64	8	64	8	
R 17.25	MFR	70 M, ST17.4	73	74	B (67)	A/E	68 T	6	**67** R,5	**7**	66	8	65	9	65	9	**S811/ Shoulder**
R 17.26 *	SFR	67 E	70	72	B (67)	A/E	68	4	**67** R	**5**	66	6	65	7	64	8	
R 17.27	MFR	67 E	70	72	B (67)	A/E	68 T	4	**67** R	**5**	65	7	65	7	64	8	
R 17.28	SFR	73 M, LT17.2	74	76	B (67)	A/E	**69** R,T	**7**	68	8	67	9	66	10	65	11	
R 17.29	SFR	72 E	73	76	B (67)	A/E	**69** R,T	**7**	68	8	67	9	66	10	65	11	
R 17.30 *	SFR	71 E	72	75	B (67)	A/E	**70** R	**5**	69	6	68	7	66	9	65	10	
R 17.31	MFR	72 E	73	74	B (67)	A/E	71	3	70	4	**69** R,T	**5**	67	7	66	8	
R 17.32	MFR	72 E	73	76	B (67)	A/E	73	3	71 T	5	**70** R,5	**6**	68	8	67	9	
R 17.33	MFR	72 M, ST17.2/CAL	72	75	B (67)	A/E	71	4	69 T	6	**68** R,5	**7**	67	8	66	9	
R 17.34 C	MFR	74 E	74	77	B (67)	A/E	70 T	7	68	9	**67** R,5	**10**	66	11	65	12	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.
4 - A/E = Approach or Exceed NAC; S = Substantial.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
R - Minimum required height based on Department Noise Analysis Protocol.
- Emboldened levels indicate the acheivement of at least 5 dB attenuation.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
* - Non-first row receiver.

TABLE 7-53 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 17

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S810	R17.1A - R17.2, R17.4 - R17.15	10 SFR, 16 MFR (2 Hotel Pools), 1 Church, 1 Daycare, School and Park (13 frontage units)	R/W to Shoulder / Northbound	3.0 m (10 ft), 3.7 m (12 ft), 4.3 m (14 ft), and 4.9 m (16 ft) / 1170 m (3838 ft)	$54,000	$2,214,000
S811	R17.17 - R17.20, R17.22 - R17.34	28 SFR and 116 MFR	Shoulder / Southbound	2.4 m (8 ft), 3.0 m (10 ft), 3.7 m (12 ft), and 4.9 m (16 ft) / 1208 m (3963 ft)	$54,000	$7,776,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-54 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 17

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S810	R17.1A - R17.2, R17.4 - R17.15	R/W to Shoulder / Northbound	803+35	3.0 (10)	26.5 (87)
			803+70	3.0 (10)	26.3 (86)
			804+10	3.0 (10)	25.9 (85)
			804+50	3.0 (10)	25.3 (83)
			804+90	4.9 (16)	27.1 (89)
			806+00	4.9 (16)	27.6 (91)
			806+00	4.3 (14)	27.0 (89)
			806+95	4.3 (14)	29.1 (95)
			806+95	3.7 (12)	28.5 (93)
			808+00	3.7 (12)	29.9 (98)
			809+00	3.7 (12)	31.2 (102)
			810+00	3.7 (12)	31.7 (104)
			811+00	3.7 (12)	31.7 (104)
			812+00	3.7 (12)	31.5 (103)
			813+10	3.7 (12)	31.5 (103)
			813+10	4.3 (14)	32.1 (105)
			814+00	4.3 (14)	31.8 (104)
			815+00	4.3 (14)	30.3 (99)
		Approximate Length: 1170 m (3838 ft)			
S811	R17.17 - R17.20, R17.22 - R17.34	Shoulder / Southbound	803+00	3.7 (12)	24.5 (80)
			804+00	3.7 (12)	23.9 (78)
			805+00	3.7 (12)	23.8 (78)
			806+00	3.7 (12)	26.4 (86)
			806+00	2.4 (8)	25.1 (82)
			807+00	2.4 (8)	27.2 (89)
			807+87	2.4 (8)	28.7 (94)
			807+87	3.0 (10)	29.3 (96)
			809+00	3.0 (10)	30.4 (100)
			810+00	3.0 (10)	30.9 (102)
			810+00	3.7 (12)	31.6 (104)
			810+70	4.9 (16)	32.7 (107)
			811+00	4.9 (16)	32.6 (107)
			812+00	4.9 (16)	32.7 (107)
			813+00	4.9 (16)	32.6 (107)
			813+00	3.0 (10)	30.7 (101)
			813+55	3.0 (10)	30.8 (101)
			814+20	3.0 (10)	30.6 (101)
			814+30	3.0 (10)	30.4 (100)
			815+00	3.0 (10)	28.2 (93)
		Approximate Length: 1208 m (3963 ft)			

Note:

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 18 – CARLSBAD VILLAGE DRIVE TO VISTA WAY (SR-78)

Areas with noise abatement

Table 7-55 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-56 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-57 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S822/S818: Soundwall S822 and S818 represent a barrier system that would be located along the northbound side of I-5. Soundwall S818 would be located between stations 816+30 and 817+90 along the I-5 shoulder between the Tamarack Avenue overpass and the north bound on ramp. Soundwall S822 would be located between stations 817+80 and 824+55 along the I-5 shoulder and the right of way. Soundwall S818 is solely to provide a benefit for Receptor R18.1. If Soundwall S818 is not constructed Soundwall S822 would still provide feasible reduction from highway traffic noise for a group of single family residences, represented by Receptors R18.1A, R18.2, R18.3, and R18.7. Soundwall S822 would also provide feasible reduction from highway traffic noise for a recreational area represented by Receptor R18.2A, as well as The Buena Vista Elementary School's recreational area represented by Receptor R18.5. Soundwall S822 did not provide feasible reduction for Receptor R18.6 because the receptor is further back from the freeway which cannot block line of sight to the traffic and the wall can't be extended north in this area due to a surface road. Soundwall S822 has been raised higher than otherwise required in front of Receptor R18.2A to provide a 5 dB benefit for Receptors R18.1A and R18.2. Soundwall S822 has been raised higher than otherwise required in front of Receptor R18.7 to provide a 5 dB benefit for Receptor R18.5. Sheets No. 49 and 50 show the location of Soundwall S822.

Soundwall S826: Soundwall S826 would be located along the northbound side of I-5 between stations 824+75 and 826+05. The soundwall would provide protection from highway traffic noise for a single family residence, represented by Receptor R18.7A. Sheets No. 50 and 51 show the location of Soundwall S826.

Soundwall S821: Soundwall S821 would be located along the southbound side of I-5 between stations 818+80 and 825+50. This soundwall replaces an existing 2.4m (8 ft) soundwall located on the R/W line between stations 818+75 to 824+32. The entire existing soundwall will need to be demolished for the highway construction. Soundwall S821 would provide protection from highway traffic noise for single family residences, represented by Receptors R18.15 through R18.20 and R18.22, as well as the first row units and outdoor recreational areas of the Las Villas de Carlsbad retirement community represented by Receptors R18.24 and R18.25. Receptor R18.14 does not benefit because it is located between Soundwall S821 and Soundwall S827, providing an unobstructed path from the freeway to the receptor. Second row Receptor R18.21 does not benefit from the soundwall design. Receptor R18.23, which represents the pool area of the Las Villas de Carlsbad retirement community is shielded by intervening structures and is not impacted by highway traffic noise. Soundwall S821 has been raised higher than otherwise required in front of Receptors R18.16 and R18.17 in order to provide a 5 dB benefit for Receptor R18.15. Soundwall S821 has been raised higher than otherwise required in front of Receptors R18.18, R18.20, and R18.22 in order to provide a 5 dB

benefit for Receptor R18.19. Sheets No. 49 and 50 show the location of Soundwall S821.

Soundwall S827: Soundwall S827 would be located along the southbound side of I-5 between stations 825+82 and 827+60. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R18.11 through R18.13. Receptor R18.11 has an existing 2.3 m (7.5 ft) high wooden fence that surrounds the back yard. Soundwall S827 has been raised higher than otherwise required in front of Receptors R18.11 and R18.12 to provide a 5 dB benefit for Receptor R18.13. Sheets No. 50 and 51 show the location of Soundwall S827.

Soundwall S829: Soundwall S829 would be located along the southbound side of I-5 between stations 827+75 and 828+40. The soundwall would provide protection from highway traffic noise for a single family residence represented by Receptor R18.10. Sheet No. 51 shows the location of Soundwall S829.

Areas without noise abatement

Several areas in Segment 18 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R18.8 and R18.9: These receptors are located on the northbound side of I-5 just south of Jefferson Street. It is not feasible to abate for highway traffic noise in this area because the receptors are located on a bluff overlooking the Buena Vista Lagoon and I-5. The freeway extends across the lagoon at a much lower elevation than the receptors; the soundwall would have to extend northeast along the edge of the bluff (off of the State R/W) to achieve a sufficient reduction at this location. Table 7-52 shows the results of the traffic noise model for this area with a soundwall located on the R/W from stations 826+00 to 827+80. Sheet No. 51 shows the location of these receptors.

Receptors R18.26 and R18.27: Receptor R18.27 represents a single family residence located on the southbound side of I-5. The results of traffic noise modeling indicate that a soundwall would not be feasible for this residence due to the geometry of the site and shielding provided by first-row buildings. Receptor R18.26 represents the pool area at the Extended Stay America hotel located on the southbound side of I-5. The results of traffic noise modeling indicate that a soundwall would have little effect on this area behind the building due to the significant shielding provided by the structure of the hotel. Based on the results of the analysis, a soundwall would not be feasible at these locations. Table 7-52 shows the results of the traffic noise model for this area with a soundwall located on the R/W. Sheet No. 49 shows the location of the receptors.

TABLE 7-55 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 18

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 18.1	SFR	66 E	71	73	B (67)	A/E	72	1	71	2	70 T	3	69	4	**68** R	**5**	
R 18.1A	SFR	69 E	74	76	B (67)	A/E	75	1	74	2	73 T	3	**71** R	**5**	70	6	
R 18.2	SFR	69 E	74	76	B (67)	A/E	74	2	73	3	72 T	4	**71** R	**5**	69	7	
R 18.2A C	REC	71 E	76	79	B (67)	A/E	75	4	74	5	72 T	7	**71** R,5	**8**	70	9	**S822/ R/W to Shoulder and S818 Shoulder**
R 18.3 *	SFR	69 M, LT18.1	74	76	B (67)	A/E	74	2	73	3	72 T	4	**70** R	**6**	69	7	
R 18.4 * K	SCH	58 E	63	65	B (67)	NONE	63	2	62	3	62	3	61	4	60	5	
R 18.5	SCH	67 M, ST18.3	72	74	B (67)	A/E	72	2	71	3	70 T	4	**69** R	**5**	68	6	
R 18.6 *	SFR	65 E	70	72	B (67)	A/E	70	2	70	2	69	3	68	4	67	5	
R 18.7	SFR	67 E	72	74	B (67)	A/E	72 T	2	70	4	69	5	**68** R,5	**6**	67	7	
R 18.7A C	SFR	68 E	73	75	B (67)	A/E	71	4	**70** R,T	**5**	68	7	67	8	65	10	**S826/ R/W**
R 18.8 *	SFR	60 E	65	67	B (67)	A/E	66	1	66	1	65	2	65	2	65	2	**R/W**
R 18.9	SFR	62 E	67	69	B (67)	A/E	68 T	1	68	1	67	2	67	2	67	2	
R 18.10 C	SFR	71 E	72	73	B (67)	A/E	69 T	4	69	4	69	4	69	4	**68** R	**5**	**S829/ R/W**

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing, future "no build", and future noise levels at this location include benefits of an existing soundwall.

* - Non-first row receiver.

TABLE 7-55 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 18 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 18.11 C,F	SFR	68 M, ST18.5 CAL	70	76	B (67)	A/E	71 T	5	70	6	68	8	67	9	**66** R,5	**10**	
R 18.12	SFR	69 E	71	73	B (67)	A/E	69 T	4	68	5	67	6	66	7	**66** R,5	**7**	**S827/ R/W**
R 18.13	SFR	67 E	69	71	B (67)	A/E	68 T	3	67	4	67	4	67	4	**66** R	**5**	
R 18.14 K	SFR	62 E	64	66	B (67)	A/E	64	2	64	2	64 T	2	63	3	63	3	
R 18.15 K	SFR	63 E	65	67	B (67)	A/E	64	3	64	3	63 T	4	**62** R	**5**	62	5	
R 18.16 K	SFR	65 E	67	69	B (67)	A/E	65 T	4	64	5	63	6	**63** R,5	**6**	62	7	
R 18.17	SFR	67 M, ST18.4	73	76	B (67)	A/E	71 T	5	70	6	69	7	**69** R,5	**7**	67	9	
R 18.18 D	SFR	69 E	72	78	B (67)	A/E	74 T	4	72	6	**70** R,5	**8**	69	9	68	10	
R 18.19 D, K	SFR	63 E	66	71	B (67)	A/E	68	3	67	4	**66** R	**5**	65	6	64	7	**S821/ R/W to Shoulder**
R 18.20 D	SFR	71 M, LT18.2	74	79	B (67)	A/E	75 T	4	73	6	**72** R,5	**7**	72	7	69	10	
R 18.21 * D, K	SFR	63 E	66	69	B (67)	A/E	68	1	67	2	66	3	65	4	63	6	
R 18.22 C,D	SFR	70 E	73	82	B (67)	S	75 T	7	73	9	**71** R,5	**11**	71	11	68	14	
R 18.23 * D	MFR	61 E	62	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 18.24 D	MFR	70 M, ST18.2 CAL	71	78	B (67)	A/E	-	-	74	4	**73** R,T	**5**	71	7	73	5	
R 18.25 D	MFR	71 E	72	78	B (67)	A/E	-	-	73 T	5	**72** R,5	**6**	70	8	69	9	
R 18.26	HM	58 E	63	64	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	**R/W**
R 18.27	SFR	64 M, ST18.1	69	71	B (67)	A/E	71	0	71	0	70	1	70	1	69 T	2	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing, future "no build", and future noise levels at this location include benefits of an existing soundwall.

F - The existing and future "no build" noise levels at this location include benefits of an existing wooden fence.

D - Project "build" Without Barrier does not include the benefits of an existing wall; which will be demolished for the project.

* - Non-first row receiver.

TABLE 7-56 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 18

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S818	R18.1	1 SFR	Shoulder / Northbound	4.9 m (16 ft) / 673 m (2208 ft)	$48,000	$48,000
S821	R18.15 - R18.20, R18.22, R18.24, and R18.25	17 SFR 34 MFR	R/W to Shoulder / Southbound	3.6 m (12 ft) to 4.3 m (14 ft) / 673 m (2208 ft)	$50,000	$2,550,000
S822	R18.1A - R18.3 R18.5 and R18.7	16 SFR Park (5 frontage units)	R/W to Shoulder / Northbound	4.9 (16 ft) to 4.3 m (14 ft) / 664 m (2178 ft)	$56,000	$1,176,000
S826	R18.7A	1 SFR	R/W / Northbound	3.0 m (10 ft) / 132 m (433 ft)	$50,000	$50,000
S827	R18.11 - R18.13	3 SFR	R/W / Southbound	4.9 m (16 ft) / 178 m (584 ft)	$56,000	$168,000
S829	R18.10	1 SFR	R/W / Southbound	4.9 m (16 ft) / 67 m (220 ft)	$46,000	$46,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-57 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 18

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)
S818	R18.1	1 SFR	Shoulder	816+30	4.9 (16)	33.6 (110)
				817+30	4.9 (16)	32.7 (107)
				817+90	4.9 (16)	31.8 (104)
			Approximate Length: 161 m (529 ft)			
S821	R18.15 - R18.20, R18.22, R18.24, and R18.25	17 SFR 34 MFR	R/W to Shoulder / Southbound	818+80	3.7 (12)	28.3 (93)
				819+00	3.7 (12)	27.9 (91)
				820+00	3.7 (12)	27.5 (90)
				821+00	3.7 (12)	28.1 (92)
				822+00	3.7 (12)	27.8 (91)
				823+00	3.7 (12)	27.0 (88)
				823+85	3.7 (12)	27.2 (89)
				824+37	3.7 (12)	27.2 (89)
				824+37	4.3 (14)	27.8 (91)
				824+45	4.3 (14)	27.8 (91)
				824+50	4.3 (14)	27.8 (91)
				824+55	4.3 (14)	27.8 (91)
				824+67	4.3 (14)	27.8 (91)
				825+30	4.3 (14)	27.9 (92)
				825+50	4.3 (14)	28.3 (93)
			Approximate Length: 671 m (2203 ft)			
S822	R18.1A - R18.3, R18.5 and R18.7	16 SFR Park (5 frontage units)	R/W to Shoulder / Northbound	817+80	4.9 (16)	31.1 (102)
				818+00	4.9 (16)	31.4 (103)
				819+20	4.9 (16)	31.2 (102)
				819+20	4.3 (14)	30.6 (100)
				820+00	4.3 (14)	29.8 (98)
				821+00	4.3 (14)	29.8 (98)
				822+00	4.3 (14)	30.8 (101)
				823+00	4.3 (14)	30.3 (99)
				824+00	4.3 (14)	30.3 (99)
				824+55	4.3 (14)	30.8 (101)
			Approximate Length: 664 m (2178 ft)			
S826	R18.7A	1 SFR	ROW / Northbound	824+75	3.0 (10)	29.0 (95)
				825+00	3.0 (10)	28.7 (94)
				826+05	3.0 (10)	28.5 (94)
			Approximate Length: 132 m (433 ft)			
S827	R18.11 - R18.13	3 SFR	ROW / Southbound	825+82	4.9 (16)	28.7 (94)
				826+00	4.9 (16)	28.8 (94)
				826+55	4.9 (16)	28.7 (94)
				827+00	4.9 (16)	28.7 (94)
				827+60	4.9 (16)	27.6 (91)
			Approximate Length: 178 m (584 ft)			
S829	R18.10	1 SFR	ROW / Southbound	827+75	4.9 (16)	28.1 (92)
				828+00	4.9 (16)	27.6 (90)
				828+10	4.9 (16)	26.9 (88)
				828+22	4.9 (16)	24.9 (82)
				828+40	4.9 (16)	24.4 (80)
			Approximate Length: 67 m (220 ft)			

Note:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreational area.

SEGMENT 19 – VISTA WAY (SR-78) TO OCEANSIDE BOULEVARD

Areas with noise abatement

Table 7-58 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-59 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-60 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S836: Soundwall S836 would be located along the northbound side of I-5 between stations 835+65 and 837+62. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R19.1 through R19.3. There is an existing 2.1 m (7 ft) soundwall at this location which extends between stations 835+80 through 837+62. A portion of the soundwall, between stations 835+80 and 836+55, will be demolished during construction of the northbound on ramp from State Route 78; it was assumed that the soundwall would be replaced during highway construction. The soundwall between stations 836+53 and 837+62 would not need to be torn down for highway construction; however, Receptor R19.3 qualifies for abatement and would benefit from a taller replacement soundwall. The non-first row Receptor R19.4 cannot benefit from a higher soundwall because it is at a slightly higher elevation, 50 m (164 ft) away from the soundwall, and shielded by the existing soundwall. Soundwall S836 has been raised higher than otherwise required in front of Receptors R19.1 and R19.2 to provide a 5 dB benefit for Receptor R19.3. Sheet No. 52 shows the location of Soundwall S836.

Soundwall S840 Soundwall S840 would be located along the northbound side of I-5 between stations 839+00 and 843+00. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R19.6A through R19.8. There is an existing soundwall composed of several different heights in this area. Between stations 837+83 and 840+25 the existing soundwall is 1.8 m (6 ft) tall, between stations 840+25 and 842+50 the existing soundwall is 2.7 m (9 ft) tall, and between stations 842+50 and 843+75 the existing soundwall is 3.0 m (10 ft) tall. The measured level at Receptor R19.7 includes the effect of the existing soundwall and the existing 1.8 m (6 ft) private property wood fence. It is assumed that this soundwall will be demolished and rebuilt as part of the project to make room for the new northbound alignment for I-5. Therefore, future build noise levels are predicted assuming a soundwall with the same heights as the existing soundwall.

Receptors R19.5, R19.5A, R19.9, and R19.10 would not benefit from a higher soundwall because they are near the ends of Soundwall S840. Receptor R19.6 (ST19.4) was a measurement location in a front yard, which is a non-outdoor use area; Receptor R19.5A was modeled in the backyard of this measurement location and there is no impact. Therefore, the backyard of the four residences represented by Receptor R19.5A would not qualify for noise abatement. Receptor R19.11 is not impacted because it is shielded by existing structures as well as the existing soundwall and there is no impact. Sheets No. 52 and 53 show the location of Soundwall S840.

Soundwall S846: Soundwall S846 would be located along the northbound side of I-5 between stations 844+00 and 848+55. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R19.12 through R19.18. Between stations 847+60 and 848+55 the R/W encounters a 5 m (16.2 ft) depression, which is why the soundwall has to be built around the depression on private land at the top of the bluff. Soundwall S846 has been raised higher than otherwise required in front of Receptors R19.12 and R19.14 to provide a 5 dB benefit for Receptor R19.13. Soundwall S846 has been raised higher than otherwise required in front of Receptor R19.15 to provide a 5 dB benefit for Receptor R19.16. Although Soundwall S846 will benefit the side yard of Receptor R19.18, the north facing side of this residence at the edge of a bluff will not benefit. Because of the sudden change in elevation, the use of a soundwall to abate the noise for the north side of the property is not feasible. However, since the after project noise levels are calculated to be higher than 75 dB at the outdoor use areas of the four houses along the bluff represented by Receptor R19.18, they would qualify for unusual and extraordinary noise abatement strategies. Sheet No. 53 and 54 show the location of Soundwall S846.

Soundwall S835: Soundwall S835 would be located along the southbound side of I-5 between stations 834+50 and 837+60. The soundwall would follow the R/W north of the Park and Ride, continue along the I-5, and along the southbound on ramp from Cassidy Street. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R19.41 through R19.47. At station 835+60 the soundwall transitions from the R/W to the shoulder of the highway. Second row Receptors R19.49 and R19.50 would not benefit from a soundwall because they are shielded by existing structures and more than 100 m (328 ft) from the edge of the highway. Receptor R19.48 would not benefit from a soundwall because it is shielded by an existing property wall and more than 100 m (328 ft) from the edge of the highway. There is an existing 1.5 m (5 ft) block property wall surrounding the Park and Ride from stations 833+58 to 834+70. There is an existing 1.8 m (6 ft) wooden private property fence that extends between stations 835+60 and 837+55, a potion of this fence between stations 835+80 and 837+03 will be demolished for the Cassidy Street on ramp construction. Soundwall S835 has been raised higher than otherwise required in front of Receptors R19.43 through R19.46 to provide a 5 dB benefit for Receptors R19.41 and R19.42. Sheet No. 52 shows the location of Soundwall S835.

Soundwall S841: Soundwall S841 would be located along the southbound side of I-5 and the southbound off ramp to Cassidy Street between stations 837+85 and 843+75. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R19.30 through R19.33, R19.36, R19.39, and R19.40, as well as the recreational area represented by Receptor R19.37.

There is an existing 1.8 m (6 ft) property wall that extends between stations 837+85 and 839+87. A portion of the property wall between stations 838+55 through 839+85 will have to be demolished for the Cassidy Street off ramp construction. The areas represented by Receptors R19.39 and R19.40 qualify for abatement, replacing the property wall with a higher soundwall would benefit these Receptors.

There is an existing 1.8 m (6 ft) wooden fence that extends between stations 842+20 and 843+80, this entire fence will be demolished for highway construction. Between stations 842+20 and 842+40 the soundwall would follow the R/W to the retaining wall along the shoulder of the road. Between stations 842+40 and 843+75 the soundwall would rest on top of a retaining wall and terminate at the bridge abutment by station 843+75. Receptor R19.38 is not benefiting from Soundwall S841 because it is shielded

by existing structures and located 50 m (164 ft) away from the soundwall. Receptor R19.34 does not benefit from Soundwall S841. Soundwall S841 has been raised higher than otherwise required in front of Receptor R19.30 and R19.31 to prevent unusual and extraordinary abetment at this location. Soundwall S841 has been raised higher than otherwise required in front of Receptors R19.35 and R19.37 to provide a 5 dB benefit for Receptor R19.36.

Receptors R19.33 and R19.34 represent backyards of the houses along Griffin Street. Although the backyards of these residences do not qualify, a soundwall is recommended in front of these houses for two reasons. First, the southern part is needed to provide adequate abatement for Receptor R19.36. The second reason is to avoid a gap in Soundwall S841. Sheets No. 52 and 53 show the location of Soundwall S841.

Soundwall S845: Soundwall S845 would be located along the southbound side of I-5 between stations 843+95 and 847+20. Soundwall S845 would terminate at the bridge abutment between stations 843+95 and 844+00. Soundwall S845 extends west along the edge of a bluff onto private property to benefit Receptor R19.25. The soundwall would provide protection from highway traffic noise for a group of single family residences represented by Receptors R19.25 through R19.28. There is an existing 1.8 m (6 ft) fence that extends between stations 843+95 and 847+15, this entire fence will be demolished for highway construction. In addition to its proximity to the end of Soundwall S845, second row Receptor R19.29 did not receive benefit because it is located 45 m (148 ft) from the soundwall. Sheet No. 53 shows the location of Soundwall S845.

Soundwall S849: Soundwall S849 would be located along the southbound side of I-5 between stations 847+20 and 851+12. Due to a high retaining wall and a safety barrier that will be added after highway construction, noise at the second row receivers was the worst case due to the topography of the region. The soundwall would provide protection from highway traffic noise for mobile homes as well as a clubhouse in the Cavalier Mobile Estates represented by Receptors R19.20 through R19.24. Soundwall S849 has been raised higher than otherwise required in front of Receptors R19.22 and R19.23 in order to provide a 5 dB benefit for Receptors R19.20, R19.21, and R19.24. Sheets No. 53 and 54 show the location of Soundwall S849.

Soundwall S849 (Option 2): Soundwall S849 option 2 is a longer wall that would be located along the southbound side of I-5 between stations 847+20 and 852+00. The soundwall would span across the I-5/Oceanside Boulevard overpass and would provide feasible reduction from highway traffic noise for an additional 18 mobile homes. This area is represented by Receptors R19.19 and R19.19A. These receptors are shown on Sheet No. 54.

Areas without noise abatement

If option 2 for Soundwall S849 is used, there are no noise sensitive areas in Segment 19 that are impacted by the widening and improvement project where it was not feasible to apply standard noise abatement techniques. Otherwise, there would be 18 mobile homes, represented by Receptors R19.19 and R19.19A, that would not have noise abatement.

TABLE 7-58 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 19

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 19.1A	CHR	59 E	61	63	B (67)	NONE	--	--	--	--	--	--	--	--	--	--	--
R 19.1 G	SFR	68 E	70	75	B (67)	A/E	71 T	4	71	4	70	5	**69** R,5	**6**	69	6	**S836/ R/W to Shoulder**
R 19.2 C,G	SFR	69 M, LT19.1	71	76	B (67)	A/E	72 T	4	70	6	69	7	**68** R,5	**8**	68	8	
R 19.3 W	SFR	68 E	70	73	B (67)	A/E	71 T	2	70	3	69	4	**68** R	**5**	67	6	
R 19.4 * W	SFR	67 E	69	71	B (67)	A/E	70	1	69	2	68	3	67	4	67	4	
R 19.5 W	SFR	69 E	69	71	B (67)	A/E	70 T	1	69	2	69	2	68	3	68	3	--
R 19.5A W,K	SFR	62 E	62	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 19.6 W,O	SFR	70 M, ST19.1	70	72	B (67)	A/E	71 T	1	69	3	68	4	67	5	66	6	
R 19.6A W	SFR	72 E	72	73	B (67)	A/E	- T	-	71	2	70	3	69	4	**68** R	**5**	**S840/ R/W to Shoulder**
R 19.7 C,G	SFR	67 M, LT19.3	74	75	B (67)	A/E	-	-	75 T	0	73	2	71	4	**70** R	**5**	
R 19.8 G	SFR	66 E	73	74	B (67)	A/E	- T	-	-	-	72	2	70	4	**69** R	**5**	
R 19.9 G	SFR	70 M, ST19.3/CAL	69	71	B (67)	A/E	- T	-	-	-	69	2	68	3	68	3	
R 19.10 W	SFR	69 E	68	70	B (67)	A/E	- T	-	-	-	69	1	68	2	68	2	--
R 19.11 * W,K	SFR	64 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 19.12 F	SFR	69 E	72	76	B (67)	A/E	73	3	71 T	5	**69** R,5	**7**	68	8	66	10	**S846/ R/W to Private Property**
R 19.13 * F,K	SFR	59 E	61	66	B (67)	A/E	63	3	62	4	**61** R	**5**	60	6	59	7	
R 19.14 F	SFR	68 E	71	75	B (67)	A/E	71	4	70 T	5	**68** R,5	**7**	67	8	66	9	
R 19.15 C, F	SFR	68 M, LT19.6	71	76	B (67)	A/E	71 T	5	**69** R,5	**7**	68	8	67	9	65	11	
R 19.16 F	SFR	73 E	74	77	B (67)	A/E	74	3	**72** R,T	**5**	70	7	68	9	67	10	
R 19.17	SFR	69 M, ST19.4/CAL	70	72	B (67)	A/E	**66** R,T	**6**	65	7	65	7	64	8	64	8	
R 19.18	SFR	73 E	75	77	B (67)	A/E	**72** R,T	**5**	71	6	69	8	68	9	67	10	
R 19.19	MH	69 E	72	70	B (67)	A/E	69	1	68 T	2	68	2	68	2	67	3	**S849/Shoulder**
R 19.19A* K	MH	64 E	65	66	B (67)	A/E	64 T	2	63	3	62	4	62	4	62	4	
R 19.20 C	MH	68 E	69	71	B (67)	A/E	68 T	3	67	4	**65** R	**6**	65	6	65	6	
R 19.21 *	MH	69 M, ST19.5/CAL	70	69	B (67)	A/E	66 T	3	66	3	65	4	**64** R	**5**	64	5	
R 19.22 * K	MH	64 E	65	65	B (67)	NONE	62	3	61	4	60	5	**60** R,5	**5**	59	6	
R 19.23 * K	MH	62 E	63	65	B (67)	NONE	62	3	61	4	60	5	**60** R,5	**5**	59	6	
R 19.24 *	MH	68 E	69	69	B (67)	A/E	66 T	3	65	4	64	5	**64** R	**5**	63	6	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing and future noise levels at this location include benefits of an existing soundwall.

F - The existing and future "no build" noise levels at this location include benefits of an existing wooden fence.

D - The existing noise levels at this receiver include the benefits of a soundwall that was demolished for highway construction.

G - The existing and future noise levels at this receiver include the benefits of a soundwall that was demolished and rebuilt for highway construction.

O - Non-Outdoor use area.

* - Non-first row receiver.

TABLE 7-58 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 19 (CONT'D.)

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 19.25 H	SFR	66 E	67	73	B (67)	A/E	**68** R,T	**5**	67	6	66	7	66	7	65	8	
R 19.26 C, H	SFR	69 E	70	77	B (67)	A/E	**70** R,T	**7**	69	8	68	9	67	10	66	11	**S845/ R/W to Private Property**
R 19.27 H	SFR	70 M, LT19.5	70	78	B (67)	A/E	**72** R,T	**6**	70	8	69	9	68	10	67	11	
R 19.28 H	SFR	68 E	69	75	B (67)	A/E	**70** R,T	**5**	69	6	68	7	67	8	67	8	
R 19.29 * H	SFR	66 E	67	71	B (67)	A/E	68	3	68	3	67	4	66	5	65	6	
R 19.30 H	SFR	73 E	74	79	B (67)	A/E	74 T	5	**72** R	**7**	71	8	69	10	68	11	
R 19.31 H	SFR	75 M, LT19.4	76	80	B (67)	A/E	74 T	6	**72** R	**8**	70	10	69	11	68	12	
R 19.32 K	SFR	67 E	67	70	B (67)	A/E	68 T	2	67	3	66	4	**65** R	**5**	64	6	
R 19.33 K2	SFR	60 E	61	64	B (67)	NONE	63 T	1	62	2	61	3	**59** R	**5**	58	6	
R 19.34 K2	SFR	60 E	61	64	B (67)	NONE	63 T	1	63	1	61	3	60	4	59	5	
R 19.35 O	SFR	71 M, ST19.2/CAL	73	78	B (67)	A/E	75 T	3	74	4	72	6	**71** R,5	**7**	71	7	**S841/ R/W to Shoulder**
R 19.36 D	SFR	69 E	71	76	B (67)	A/E	75 T	1	74	2	72	4	**71** R	**5**	70	6	
R 19.37 C, D	REC	73 E	74	80	B (67)	A/E	78 T	2	76	4	74	6	**72** R,5	**8**	70	10	
R 19.38 * D	SFR	68 E	69	73	B (67)	A/E	72	1	71	2	71	2	69	4	69	4	
R 19.39 W	SFR	66 E	68	72	B (67)	A/E	71 T	1	70	2	68	4	**67** R	**5**	66	6	
R 19.40 W	SFR	65 E	67	71	B (67)	A/E	69 T	2	68	3	67	4	**66** R	**5**	65	6	
R 19.41 F	SFR	68 E	68	72	B (67)	A/E	69 T	3	**67** R	**5**	65	7	67	5	63	9	
R 19.42 F	SFR	69 E	69	73	B (67)	A/E	69	4	**68** R,T	**5**	66	7	68	5	64	9	
R 19.43 C, H	SFR	73 E	73	81	B (67)	A/E	74 T	7	**71** R,5	**10**	70	11	71	10	67	14	**S835/ R/W to Shoulder**
R 19.44 H	SFR	73 M, LT19.2	73	82	B (67)	A/E	74 T	8	**72** R,5	**10**	70	12	69	13	68	14	
R 19.45 * H	SFR	70 E	70	77	B (67)	A/E	71	6	**70** R,5	**7**	69	8	68	9	67	10	
R 19.46 K	SFR	67 E	67	70	B (67)	A/E	65 T	5	**63** R,5	**7**	63	7	62	8	61	9	
R 19.47 * K	SFR	63 E	63	66	B (67)	A/E	63	3	62	4	**61** R	**5**	60	6	60	6	
R 19.48	SFR	67 E	67	70	B (67)	A/E	68 T	2	68	2	67	3	67	3	67	3	
R 19.49 * K	SFR	66 E	61	64	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	--
R 19.50 * K	SFR	65 E	60	63	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	

Notes:

1 - Leq(h) are A-weighted, peak hour noise levels in decibels.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

K2 - A shielding factor of 11 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing and future noise levels at this location include benefits of an existing soundwall.

D - The existing noise levels at this receiver include the benefits of a soundwall that was demolished for highway construction.

F - The existing and future "no build" noise levels at this location include benefits of an existing wooden fence.

H - The The future noise levels do not include the benefits of a fence that was demolished for highway construction.

O - Non-Outdoor use area.

* - Non-first row receiver.

TABLE 7-59 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 19

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence[2]	Reasonable Allowance Cost Per Barrier(s)
S835	R19.41 - R19.47	16 SFR	R/W to Shoulder / Southbound	3.0 m (10 ft) and 3.7 m (12 ft) / 448 m (1470 ft)	$56,000	$896,000
S836	R19.1 - R19.3	3 SFR	R/W to Shoulder / Northbound	4.3 m (14 ft) / 212 m (695 ft)	$52,000	$156,000
S840	R19.6A - R19.8	12 SFR	R/W to Shoulder / Northbound	4.9 m (16 ft) / 424 m (1390 ft)	$52,000	$624,000
S841	R19.30 - R19.33, R19.35 - R19.37, R19.39, and R19.40	17 SFR and 1 REC (5 Frontage Units)	R/W to Shoulder / Southbound	3.0 m (10 ft) and 4.3 m (14 ft) / 674 m (2213 ft)	$54,000	$1,188,000
S845	R19.25 - R19.28	10 SFR	R/W to Private Property / Southbound	2.4 m (8 ft) / 385 m (1264 ft)	$54,000	$540,000
S846	R19.12 - R19.18	18 SFR	R/W to Private Property / Northbound	2.4 m (8 ft) / 3.0 m (10 ft) and 3.7 m (12 ft) / 455 m (1494 ft)	$54,000	$972,000
S849	R19.20 - R19.24	20 MH Clubhouse (1 Frontage Unit)	Shoulder / Southbound	3.7 m (12 ft) and 4.3 m (14 ft)/ 393 m (1289 ft)	$50,000	$1,050,000

Notes:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes.

2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-60 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 19

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S835	R19.41 - R19.47	R/W to Shoulder / Southbound	834+50	3.7 (12)	26.6 (87)
			834+60	3.7 (12)	26.4 (87)
			834+65	3.7 (12)	26.7 (88)
			834+75	3.7 (12)	27.1 (89)
			834+70	3.7 (12)	27.0 (89)
			835+60	3.7 (12)	27.6 (91)
			835+60	3.0 (10)	26.9 (88)
			836+60	3.0 (10)	26.9 (88)
			836+80	3.0 (10)	26.8 (88)
			837+00	3.0 (10)	26.8 (88)
			837+30	3.0 (10)	26.9 (88)
			837+50	3.0 (10)	25.9 (85)
			837+60	3.0 (10)	25.3 (83)
		Approximate Length: 448 m (1470 ft)			
S836	R19.1 - R19.3	R/W to Shoulder / Northbound	835+65	4.3 (14)	29.9 (98)
			836+55	4.3 (14)	30.4 (100)
			837+00	4.3 (14)	31.4 (103)
			837+50	4.3 (14)	32.3 (106)
			837+62	4.3 (14)	33.6 (110)
		Approximate Length: 212 m (695 ft)			
S840	R19.6A - R19.8	R/W to Shoulder / Northbound	839+00	4.9 (16)	33.0 (108)
			839+25	4.9 (16)	32.9 (108)
			839+70	4.9 (16)	33.1 (108)
			840+18	4.9 (16)	32.4 (106)
			840+30	4.9 (16)	32.5 (107)
			841+30	4.9 (16)	33.0 (108)
			842+50	4.9 (16)	34.6 (114)
			843+00	4.9 (16)	35.6 (117)
		Approximate Length: 424 m (1390 ft)			
S841	R19.30 - R19.33, R19.35 - R19.37, R19.39, and R19.40	R/W to Shoulder / Southbound	837+85	4.3 (14)	25.9 (85)
			837+85	4.3 (14)	25.8 (85)
			838+20	4.3 (14)	27.3 (90)
			838+55	4.3 (14)	27.1 (89)
			839+90	4.3 (14)	28.5 (94)
			840+00	4.3 (14)	28.5 (93)
			841+00	4.3 (14)	29.3 (96)
			842+00	4.3 (14)	30.4 (100)
			842+25	4.3 (14)	30.5 (100)
			842+25	3.0 (10)	29.3 (96)
			843+00	3.0 (10)	30.2 (99)
			843+70	3.0 (10)	30.6 (100)
			843+75	0.0 (0)	30.6 (100)
		Approximate Length: 674 m (2213 ft)			

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

TABLE 7-60 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 19 (CONT'D.)

Barrier No.	Receptor No.	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)[1]
S845	R19.25 - R19.28	R/W to Private Property / Southbound	843+95	0.0 (0)	30.3 (99)
			844+00	2.4 (8)	30.3 (99)
			845+00	2.4 (8)	31.2 (102)
			846+00	2.4 (8)	31.6 (104)
			847+00	2.4 (8)	31.6 (104)
			847+20	2.4 (8)	32.1 (105)
			847+20	2.4 (8)	30.6 (101)
		Approximate Length: 385 m (1264 ft)			
S846	R19.12 - R19.18	R/W to Private Property / Northbound	844+00	3.7 (12)	35.8 (117)
			845+00	3.7 (12)	36.2 (119)
			845+00	3.0 (10)	35.6 (117)
			846+00	3.0 (10)	36.6 (120)
			847+00	3.0 (10)	36.6 (120)
			847+60	3.0 (10)	37.1 (122)
			847+60	2.4 (8)	36.4 (119)
			847+90	2.4 (8)	36.4 (119)
			848+20	2.4 (8)	35.5 (116)
			848+35	2.4 (8)	35.4 (116)
			848+40	2.4 (8)	35.4 (116)
			848+55	2.4 (8)	34.4 (113)
		Approximate Length: 455 m (1494 ft)			
S849	R19.20 - R19.24	20 MH Clubhouse (1 Frontage Unit)	847+20	3.7 (12)	23.4 (77)
			848+00	3.7 (12)	21.9 (72)
			849+00	3.7 (12)	19.6 (64)
			849+28	3.7 (12)	19.2 (63)
			849+28	4.3 (14)	19.8 (65)
			850+00	4.3 (14)	18.4 (60)
			851+12	4.3 (14)	19.3 (63)
		Approximate Length: 393 m (1289 ft)			

1 -Top of barrier elevations take precedence over the recommended barrier height. Therefore, the barrier shall be constructed according to the top-of-barrier elevations as listed in this table.

SEGMENT 20 – OCEANSIDE BOULEVARD TO MISSION AVENUE

Areas with noise abatement

Table 7-61 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-62 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-63 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S862: Soundwall S862 would be located along the northbound side of I-5 between stations 859+95 and 862+40. The soundwall would provide protection from highway traffic noise for the Ron Ortega Recreational Park represented by Receptors R20.1 through R20.3. Sheets No. 55 and 56 show the location of Soundwall S862.

Soundwall S855: Soundwall S855 would be located along the southbound side of I-5 between stations 852+40 and 856+50. Between stations 853+60 and 856+00 the soundwall would rest on top of a retaining wall. The soundwall would provide protection from highway traffic noise for a backyard outdoor use area for a multi-family residence represented by Receptor R20.23, as well as the outdoor gathering area near the clubhouse for the Ocean Breeze Senior Village represented by Receptor R20.25. Receptors R20.21 and R20.22 are behind the soundwall, but do not get the required 5 dB reduction to be benefited because they are located on a bluff that overlooks the freeway. An effective soundwall for these receptors would need to be at least 5.6 m (18.5 ft) tall. Receptor R20.24 represents a pool area for a group of multi-family units located on the southbound side of I-5 just south of Minnesota Avenue. This area is in a canyon adjacent to the I-5 and it is shielded by a group of large multi-family residences as well as the shoulder of the off ramp to Oceanside Boulevard; therefore, this area is not impacted by the highway traffic noise. Soundwall S855 has been raised higher than otherwise required in front of Receptor R20.23 in order to prevent R20.21 from being severely impacted. Sheets No. 54 and 55 show the location of Soundwall S855.

Soundwall S859: Soundwall S859 would be located along the southbound side of I-5 between stations 858+00 and 859+70. The soundwall would provide protection from highway traffic noise for a single-family residence represented by Receptor R20.15 as well as the playground for a Camp Fire Girls center represented by Receptor R20.13. Receptor R20.17 represents a single-family residence. Receptors R20.14 and R20.16 represent non-outdoor use areas. Soundwall S859 terminates at the Brooks Street Bridge abutment between stations 859+62 and 859+70. The top of the soundwall at station 859+70 should remain level with the top of the soundwall at station 859+00 as the bottom of the wall rises. Receptor R20.17 did not qualify for noise abatement, but Soundwall S859 does provide 2 dB of noise reduction. Soundwall S859 has been raised higher than otherwise required in front of Receptor R20.13 to provide a 5 dB benefit for Receptor R20.15. Sheet No. 55 shows the location of Soundwall S859.

Soundwall S863: Soundwall S863 would be located along the southbound side of I-5 between stations 859+82 and 866+50. The soundwall would provide protection from highway traffic noise for the Oceanside High School athletic fields represented by Receptors R20.5 through R20.7. The soundwall would also provide protection for a group of single-family residences represented by Receptors R20.8 and R20.10. The soundwall would also provide protection for a group of multi-family residences

represented by Receptor R20.11. There is an existing 2.4 m (8 ft) soundwall running between stations 859+82 and 863+00. A portion of the existing soundwall between stations 861+50 and 862+15 will have to be demolished to make room for the southbound Mission Avenue on ramp construction; it was assumed that the soundwall will be replaced during the highway construction. Receptor 20.12 did not benefit from the replacement soundwall because it is shielded by an existing soundwall. Receptors R20.5 through R20.11 qualify for abatement and would benefit from replacing the entire existing soundwall. Soundwall S863 has been raised higher than otherwise required in front of Receptor R20.7 in order to provide a 5 dB benefit for Receptor R20.6. Soundwall S863 has been raised higher than otherwise required in front of Receptors R20.8 and R20.11 in order to provide a 5 dB benefit for Receptor R20.10. Sheets No. 55 and 56 show the location of Soundwall S863.

Areas without noise abatement

Several areas in Segment 20 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptor R20.1A: This receptor is located on the northbound side of I-5 just north of Oceanside Boulevard on the grounds of the Oceanside Center City Golf Course. The results of traffic noise modeling indicate that a soundwall located on the R/W would not provide a 5 dB noise reduction for this receptor because the golf course is atop a bluff overlooking the I-5. Sheets No. 54 and 55 show the location of the golf course.

Receptor R20.4: This receptor represents the Econo Lodge pool area and is located on the northbound side of I-5 just south of Mission Avenue. The results of traffic noise modeling indicate that a soundwall located on the R/W would not provide a 5 dB noise reduction for this receptor because the receptor is shielded by existing commercial structures and the Mission Avenue bridge abutment. Sheet No. 56 shows the location of the receptor.

Receptors R20.18 through R20.20: These single family residential receptors are located on the southbound side of I-5 just south of Missouri Avenue. The results of traffic noise modeling indicate that a soundwall located on the R/W would not provide a 5 dB noise reduction for this receptor because the receptors in this area are located at the top of a bluff with the front yards overlooking the I-5. Also, Receptors R20.18 and R20.20 did not qualify for highway traffic noise abatement because they are not impacted. Receptor R20.19 would not achieve a 5 dB benefit from a soundwall because it is shielded by a single-family residential structure. Sheet No. 55 shows the location of these receptors.

Receptor R20.26: This receptor represents the pool area for the Best Western Motel located on the southbound side of I-5 just north of Oceanside Boulevard. Because the receptor is located in a canyon adjacent to the south bound off ramp to Oceanside Boulevard and it is shielded by the Best Western Hotel, there was no impact due to highway traffic noise. Sheet No. 54 shows the location of the receptor.

TABLE 7-61 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 20

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 20.1A	REC	66 E	65	67	B (67)	A/E	65	2	65	2	64	3	64	3	63	4	R/W
R 20.1	REC	73 E	72	74	B (67)	A/E	71	3	71 T	3	70	4	**69** R	**5**	69	5	
R 20.2 C	REC	76 M, ST20.2	75	77	B (67)	A/E	75	2	73	4	**71** R,T	**6**	70	7	69	8	S862/ R/W
R 20.3	REC	72 E	71	73	B (67)	A/E	70	3	69 T	4	**68** R	**5**	67	6	66	7	
R 20.4	HM	71 E	70	68	B (67)	A/E	67	1	66	2	65 T	3	65	3	64	4	R/W
R 20.5	SCH	72 E	72	73	B (67)	A/E	70	3	69 T	4	**67** R	**6**	66	7	65	8	
R 20.6	SCH	69 E	69	71	B (67)	A/E	69	2	68	3	67 T	4	**66** R	**5**	64	7	
R 20.7 C	SCH	75 E	75	77	B (67)	A/E	75	2	74 T	3	72	5	**70** R,5	**7**	69	8	
R 20.8 W	SFR	73 E	73	74	B (67)	A/E	-	-	73 T	1	71	3	70	4	**69** R	**5**	S863/ R/W
R 20.9 * G,K	SFR	66 E	66	67	B (67)	A/E	-	-	66	1	65	2	63	4	63	4	
R 20.10 G,K	SFR	67 E	67	68	B (67)	A/E	-	-	67 T	1	65	3	64	4	**63** R	**5**	
R 20.11 W	SFR	73 M, LT20.1	73	74	B (67)	A/E	- T	-	72	2	70	4	69	5	**67** R,5	**7**	
R 20.12 W,K	SFR	65 E	65	66	B (67)	A/E	- T	-	65	1	63	3	62	4	62	4	
R 20.13 C	REC	73 E	73	75	B (67)	A/E	70 T	5	70	5	**70** R,5	**5**	67	8	66	9	
R 20.14	MFR	72 E	72	74	B (67)	A/E	69 T	5	68	6	68	6	67	7	66	8	
R 20.15 K	MFR	65 E	65	67	B (67)	A/E	63 T	4	63	4	**62** R	**5**	61	6	60	7	S859/ R/W
R 20.16	MFR	75 E	75	77	B (67)	A/E	71 T	6	69	8	68	9	67	10	66	11	
R 20.17 * K	SFR	63 E	63	65	B (67)	NONE	62	3	61	4	61	4	60	5	60	5	
R 20.18 K	SFR	63 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 20.19 K	SFR	64 E	64	66	B (67)	A/E	65	1	64	2	64	2	63	3	63 T	3	R/W
R 20.20 * K	SFR	63 E	63	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 20.21	SFR	73 E	74	76	B (67)	A/E	75	1	75	1	75	1	74	2	72 T	4	
R 20.22	MFR	71 E	72	74	B (67)	A/E	74	0	73	1	73	1	72	2	72 T	2	
R 20.23	MFR	69 M, ST20.1/CAL	70	69	B (67)	A/E	65 T	4	65	4	64	5	**63** R,5	**6**	62	7	S855/Shoulder
R 20.24	MFR	59 E	60	62	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 20.25 C	MFR	65 E	66	69	B (67)	A/E	65 T	4	**64** R	**5**	64	5	62	7	61	8	
R 20.26	HM	59 E	60	63	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	--

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.
3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.
4 - A/E = Approach or Exceed NAC; S = Substantial.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
R - Minimum required height based on Department Noise Analysis Protocol.
- Emboldened levels indicate the acheivement of at least 5 dB attenuation.
C - Critical design receiver.
K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
G The existing and future noise levels at this receiver include the benefits of a soundwall that was demolished and rebuilt for highway construction.
D - Project "build" Without Barrier does not include the benefits of an existing wall; which will be demolished for the project.
O - Non-Outdoor use area.
* - Non-first row receiver.

TABLE 7-62 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 20

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence	Reasonable Allowance Cost Per Barrier(s)
S855	R20.23 & R20.25	4 MFR and 1 Rec (1 frontage unit)	Shoulder / Southbound	3.0 m (10 ft) and 4.3 m (14 ft) / 423 m (1389 ft)	$38,000	$190,000
S859	R20.13 and R20.15	1 SFR and 1 REC (1 frontage units)	R/W / Southbound	3.7 m (12 ft) / 171 m (560 ft)	$48,000	$96,000
S862	R20.1 - R20.3	REC (6 frontage units)	R/W / Northbound	3.7 m (12 ft) and 4.3 m (14 ft) / 258 m (845 ft)	$50,000	$300,000
S863	R20.5 - R20.8, R20.10, and R20.11	6 SFR, 5 MFR, and 1 SCH (15 frontage units)	R/W / Southbound	3.6 m (12 ft), 4.3 m (14 ft), 4.9 m (16 ft) / 667 m (2189 ft)	$50,000	$1,300,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; MH - mobile homes; SCH - school
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-63 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 20

Barrier No.	Receptor No.	Type1 and No. of Benefited Residences	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)
S855	R20.23 & R20.25	4 MFR and 1 Rec (1 frontage unit)	Shoulder / Southbound	852+40	3.0 (10)	14.3 (47)
				853+00	3.0 (10)	17.8 (58)
				853+58	3.0 (10)	21.1 (69)
				853+80	3.0 (10)	22.2 (73)
				854+15	3.0 (10)	23.9 (78)
				854+60	3.0 (10)	25.5 (83)
				855+20	3.0 (10)	27.1 (89)
				855+20	4.3 (14)	28.3 (93)
				856+00	4.3 (14)	30.8 (101)
				856+20	4.3 (14)	31.7 (104)
				856+50	4.3 (14)	31.8 (104)
			Approximate Length: 423 m (1389 ft)			
S859	R20.13 and R20.15	1 SFR and 1 REC (1 frontage units)	ROW / Southbound	858+00	3.7 (12)	42.2 (138)
				859+00	3.7 (12)	43.5 (143)
				859+70	1.2 (4)	43.5 (143)
			Approximate Length: 171 m (560 ft)			
S862	R20.1 - R20.3	REC (6 frontage units)	ROW / Northbound	859+95	4.3 (14)	45.3 (149)
				861+00	4.3 (14)	45.1 (148)
				861+00	3.7 (12)	44.5 (146)
				861+58	3.7 (12)	45.5 (149)
				862+40	3.7 (12)	46.6 (153)
			Approximate Length: 258 m (845 ft)			
S863	R20.5 - R20.8, R20.10, and R20.11	6 SFR, 5 MFR, and 1 SCH (15 frontage units)	ROW / Southbound	859+82	3.7 (12)	45.1 (148)
				860+00	4.9 (16)	45.1 (148)
				861+00	4.9 (16)	45.0 (148)
				861+55	4.9 (16)	45.8 (150)
				861+75	4.9 (16)	45.6 (150)
				862+00	4.9 (16)	45.7 (150)
				862+80	4.9 (16)	46.1 (151)
				862+80	4.3 (14)	45.5 (149)
				863+00	4.3 (14)	45.1 (148)
				863+00	4.3 (14)	45.1 (148)
				864+00	4.3 (14)	43.8 (144)
				864+00	3.7 (12)	43.2 (142)
				865+00	3.7 (12)	42.4 (139)
				865+40	3.7 (12)	41.9 (137)
				865+90	3.7 (12)	41.5 (136)
				866+50	3.7 (12)	40.1 (131)
			Approximate Length: 667 m (2189 ft)			

Note:

1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreational area; SCH - school.

SEGMENT 21 – MISSION AVENUE TO STATE ROUTE 76

Areas with noise abatement

Table 7-64 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-65 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-66 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S868: Soundwall S868 would be located along the northbound side of I-5 near the northbound on ramp for Mission Avenue between stations 865+82 and 868+15. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences represented by Receptors R21.3 through R21.5. Receptor R21.5 represents the backyard outdoor use areas for a single and multi-family residence. Soundwall S868 has been raised higher than otherwise required in front of Receptors R21.4 and R21.5 to provide a 5 dB benefit for Receptor R21.3. Sheet No. 56 shows the location of Soundwall S868.

Soundwall S871: Soundwall S871 would be located along the southbound side of I-5 between stations 869+15 and 874+45. The soundwall would provide protection from highway traffic noise for a group of single and multi-family residences, represented by Receptors R21.12 through R21.17. The soundwall would also provide protection for a community garden and a playground represented by Receptors R21.18 and R21.20. Non-first row Receptor R21.19 is located behind Soundwall S871, but did not qualify for noise abatement because it is not impacted. Where Soundwall S871 terminates at the Neptune Way Bridge abutment, the top of the soundwall between stations 874+25 and 874+45 should remain level with the top of the soundwall at station 874+25 as the bottom of the soundwall rises. Soundwall S871 has been raised higher than otherwise required in front of Receptors R21.13 and R21.14 to provide a 5 dB benefit for Receptor R21.12. Soundwall S871 has been raised higher than otherwise required in front of Receptor R21.17 to provide a 5 dB benefit for Receptor R21.16. Sheets No. 56 and 57 show the location of Soundwall S871.

Soundwall S875: Soundwall S875 would be located along the southbound on ramp from State Route 76 to I-5 between stations 874+70 and 876+95. The soundwall would provide protection from highway traffic noise for a group of single-family residences represented by Receptors R21.10 and R21.11. The soundwall would also provide protection for the pool area at the Comfort Suites Hotel represented by Receptor R21.9. Where Soundwall S875 terminates at the Neptune Way Bridge abutment, the top of the soundwall between stations 874+70 and 874+80 should remain level with the top of the soundwall at station 874+80 as the bottom of the soundwall rises. Soundwall S875 has been raised higher than otherwise required in front of Receptors R21.9 and R21.11 to provide a 5 dB benefit for Receptor R21.10. Sheet No. 57 shows the location of Soundwall S875.

Areas without noise abatement

Several areas in Segment 21 are impacted by the widening and improvement project, but were not feasible to abate with standard noise abatement techniques. The receptor locations for these areas and the explanation for non-abatement are described in the following paragraphs:

Receptors R21.1 and R21.2: These receptors are located on the northbound side of I-5 just north of Mission Avenue. It is not feasible to achieve a 5 dB benefit for Receptor R21.1 because of the large distance that it is located from the highway. Receptor R21.2 did not qualify for noise abatement because of the distance from the highway as well as shielding that is provided by neighboring houses there is no impact at this location. A soundwall was not considered on private property for Receptor R21.1, because constructing a soundwall on private property is not considered practical for only one receptor. Table 7-61 shows the results of the traffic noise model for this area with a soundwall located on the R/W from stations 865+45 to 866+50. Sheet No. 56 shows the location of these receptors.

Receptors R21.6, R21.8, and R21.8A: These receptors are located on the northbound side of I-5 just north of Bush Street. It is not feasible to abate for highway traffic noise in this area because the receptors are on a bluff overlooking the I-5. Locating a soundwall at the top of the bluff along the west side of these properties would not be appropriate because the soundwall would divide two private properties. A soundwall was not considered on private property for Receptors R21.6, R21.8, and R21.8A, because each receptor would require it own stand alone soundwall due to the surface roads in this area, and constructing a soundwall on private property is not considered practical for only one receptor. Table 7-61 shows the results of the traffic noise model for this area with a soundwall located on the R/W from stations 868+15 to 873+00. Sheet No. 56 shows the location of the receptors.

TABLE 7-64 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 21

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1, 3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 21.1	SFR	67 E	67	68	B (67)	A/E	68	0	67 T	1	67	1	67	1	66	2	R/W
R 21.2 K	SFR	62 E	61	63	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 21.3 K	SFR	65 E	64	66	B (67)	A/E	64	2	63 T	3	63	3	62	4	**61 R**	**5**	S868/ R/W
R 21.4 K	SFR	67 E	66	68	B (67)	A/E	66	2	65	3	64 T	4	63	5	**63 R,5**	**5**	
R 21.5* C	SFR	78 M, LT21.1	73	74	B (67)	A/E	71 T	3	70	4	69	5	68	6	**68 R,5**	**6**	
R 21.6	SFR	70 E	70	71	B (67)	A/E	69	2	69	2	68	3	68	3	67 T	4	R/W
R 21.7 * K	SFR	64 E	64	65	B (67)	NONE	64	1	63	2	63	2	62	3	62 T	3	
R 21.8	SFR	69 E	69	71	B (67)	A/E	69	2	69	2	68	3	67	4	67 T	4	
R 21.8A	SFR	67 E	67	69	B (67)	A/E	68	1	67	2	67	2	66	3	65 T	4	
R 21.9	HM	65 E	68	71	B (67)	A/E	68	3	67	4	64 T	7	**64 R,5**	**7**	63	8	S875/ R/W
R 21.10 K	SFR	61 E	64	66	B (67)	A/E	65	1	64	2	63	3	62 T	4	**61 R**	**5**	
R 21.11 C	SFR	68 E	71	73	B (67)	A/E	71	2	70	3	69	4	67 T	6	**66 R,5**	**7**	
R 21.12 * K	MFR	64 E	64	66	B (67)	A/E	62	4	**61 R**	**5**	60	6	59	7	58	8	S871/ R/W
R 21.13 K	MFR	68 E	68	70	B (67)	A/E	65 T	5	**64 R,5**	**6**	63	7	61	9	60	10	
R 21.14 C	SFR	76 M, LT21.2	75	78	B (67)	A/E	73 T	5	**71 R,5**	**7**	69	9	68	10	67	11	
R 21.15 * K	SFR	63 E	63	65	B (67)	NONE	61	4	**60 R**	**5**	60 R	5	59	6	58	7	
R 21.16 K	MFR	66 E	66	67	B (67)	A/E	63 T	4	**62 R**	**5**	62 R	5	60	7	60	7	
R 21.17	SFR	71 E	71	73	B (67)	A/E	68 T	5	**67 R,5**	**6**	67	6	66	7	65	8	
R 21.18	REC	76 E	76	77	B (67)	A/E	74 T	3	**72 R**	**5**	71	6	70	7	68	9	
R 21.19 *	MFR	63 E	63	65	B (67)	NONE	63	2	62	3	62	3	61	4	61	4	
R 21.20	REC	75 M, ST21.1/CAL	75	76	B (67)	A/E	**71 R,T**	**5**	69	7	68	8	68	8	67	9	

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

* - Non-first row receiver.

TABLE 7-65 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 21

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence [2]	Reasonable Allowance Cost Per Barrier(s)
S868	R21.3 - R21.5	8 SFR and 2 MFR	R/W / Northbound	4.9 m (16 ft) / 223 m (731 ft)	$48,000	$480,000
S871	R21.12 - R21.18, and R21.20	9 SFR, 14 MFR, REC (6 frontage units)	R/W / Southbound	2.4 m (8 ft), 3.0 m (10 ft) / 535 m (1755 ft)	$50,000	$1,450,000
S875	R21.9 - R21.11	4 SFR and 1 HM	R/W / Southbound	4.3 m (14 ft), 4.9 m (16 ft) / 220 m (722 ft)	$50,000	$250,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreation facility; HM - hotel/motels; SCH - school
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-66 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 21

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)
S868	R21.3 - R21.5	8 SFR and 2 MFR	ROW / Northbound	865+82	4.9 (16)	43.7 (143)
				866+50	4.9 (16)	42.7 (140)
				866+45	4.9 (16)	41.4 (136)
				866+90	4.9 (16)	42.3 (139)
				867+30	4.9 (16)	41.7 (137)
				868+15	4.9 (16)	42.1 (138)
			Approximate Length: 223 m (731 ft)			
S871	R21.12 - R21.18, and R21.20	9 SFR, 14 MFR, REC (6 frontage units)	ROW / Southbound	869+15	2.4 (8)	38.6 (127)
				869+70	2.4 (8)	39.9 (131)
				869+75	2.4 (8)	39.4 (129)
				870+58	2.4 (8)	41.1 (135)
				870+58	3.0 (10)	41.7 (137)
				871+60	3.0 (10)	43.8 (144)
				872+65	3.0 (10)	41.2 (135)
				873+50	3.0 (10)	35.4 (116)
				874+25	3.0 (10)	33.0 (108)
				874+45	0.0 (0)	33.1 (108)
			Approximate Length: 535 m (1755 ft)			
S875	R21.9 - R21.11	4 SFR and 1 HM	ROW / Southbound	874+70	0.0 (0)	33.9 (111)
				874+80	4.9 (16)	33.9 (111)
				875+15	4.9 (16)	31.9 (105)
				876+00	4.9 (16)	28.7 (94)
				876+00	4.3 (14)	28.1 (92)
				876+55	4.3 (14)	27.0 (88)
				876+95	4.3 (14)	25.2 (83)
			Approximate Length: 220 m (722 ft)			

Note:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence; REC - recreational area; HM - hotel/motel; SCH - school.

SEGMENT 22 – STATE ROUTE 76 TO WIRE MOUNTAIN ROAD

Areas with noise abatement

Table 7-67 represents a summary of the future noise levels and barrier analysis, along with the locations of the recommended noise barriers. All barrier heights and locations are based on the latest available drawings and elevation information at the time of this study. Table 7-68 provides a summary of the recommended barriers, including the number of benefited residences, reasonable cost allowance per residence, and reasonable allowance cost per barrier. Table 7-69 provides a summary of barrier location, elevation, and length. Worksheets A and B of the cost analysis are included in Appendix F. The following paragraphs describe the recommended soundwalls:

Soundwall S882: Soundwall S882 would be located along the northbound side of I-5 between stations 881+08 and 882+95. The soundwall would provide protection from highway traffic noise for a group of single-family residences represented by Receptors R22.2 through R22.5. Second-row receptor R22.1 did not get the required 5 dB noise reduction from Soundwall S882 because it is located at the edge of a bluff overlooking the I-5. Soundwall S882 has been raised higher than otherwise required in front of Receptors R22.2, R22.4, R22.4A, and R22.5 in order to provide a 5 dB benefit for Receptor R22.3. Sheets No. 58 and 59 show the location of Soundwall S882.

Soundwall S884: Soundwall S884 would be located along the northbound side of I-5 between stations 883+15 and 885+45. The soundwall would provide protection from highway traffic noise for a group of single-family residences represented by Receptors R22.6 through R22.8A. Soundwall S884 has been raised higher than otherwise required in front of Receptors R22.7 and R22.8 to provide a 5 dB benefit for Receptors R22.6 and R22.8A. Sheets No. 58 and 59 show the location of Soundwall S884.

Areas without noise abatement

One area in Segment 22 is impacted by the widening and improvement project, but was not feasible to mitigate with standard noise abatement techniques. The receptor locations for this area and the explanation for non-abatement are described in the following paragraph:

Receptor R22.12: This receptor represents the second-floor deck area for the Travelodge Motel just north of Monterey Drive on the southbound side of I-5. It is not feasible to abate highway traffic noise in this area because the receptor is on a second floor area overlooking the I-5. The Worldmark Oceanside Harbor Timeshare is located south of Receptor R22.12; the complex has no sensitive outdoor use areas exposed to I-5 traffic noise. Table 22-1 shows the results of the traffic noise model for this area with a soundwall located on the R/W from stations 881+25 to 884+60. Sheet No. 58 shows the location of the receptor.

TABLE 7-67 – PREDICTED FUTURE NOISE AND BARRIER ANALYSIS – SEGMENT 22

REC. NO.	LAND USE[2]	EXISTING NOISE LEVELS[1,3] Leq(h), dBA	FUTURE PEAK HOUR NOISE LEVELS, Leq(h), dBA[1]														BARRIER NO./LOCATION
			FUTURE "NO-BUILD"	PROJECT "BUILD" WITHOUT BARRIER	ACTIVITY CATEGORY and NAC ( )	IMPACT TYPE (S, A/E or NONE)[4]	NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.)										
							2.4 m (8 ft)		3.0 m (10 ft)		3.7 m (12 ft)		4.3 m (14 ft)		4.9 m (16 ft)		
							Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	Leq(h)	I.L.	
R 22.1 *	SFR	72	73	74	B (67)	A/E	73	1	72	2	72	2	71	3	71	3	
R 22.2 C	SFR	80 M, ST22.1/CAL	81	82	B (67)	A/E	76 T	6	72	10	**69 R,5**	**13**	67	15	66	16	
R 22.3 * K	SFR	68	69	70	B (67)	A/E	67	3	66	4	**65 R**	**5**	65	5	64	6	S882/ R/W
R 22.4	SFR	76	76	78	B (67)	A/E	74	4	72 T	6	**71 R,5**	**7**	70	8	69	9	
R 22.4A	SFR	80 M, LT22.1	80	81	B (67)	A/E	74	7	73 T	8	**71 R,5**	**10**	70	11	69	12	
R 22.5	SFR	75	75	76	B (67)	A/E	72 T	4	71	5	**70 R,5**	**6**	69	7	68	8	
R 22.6	SFR	75	75	76	B (67)	A/E	74 T	2	72	4	**71 R**	**5**	70	6	69	7	
R 22.7 C	SFR	76	76	78	B (67)	A/E	73 T	5	71	7	**69 R,5**	**9**	67	11	66	12	S884/ R/W
R 22.8	SFR	75	75	76	B (67)	A/E	72 T	4	71	5	**69 R,5**	**7**	68	8	67	9	
R 22.8A *	SFR	72	72	73	B (67)	A/E	70 T	3	69	4	**68 R**	**5**	67	6	66	7	
R 22.9 W	MIL	59 M, ST22.3	58	59	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	R/W
R 22.10 * K2	MH	62 M, ST22.2	64	65	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	
R 22.11 * K2	MH	58	60	61	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	R/W
R 22.12	HM	68	70	71	B (67)	A/E	71	0	70	1	69	2	69 T	2	68	3	
R 22.13	HM	57	59	60	B (67)	NONE	-	-	-	-	-	-	-	-	-	-	R/W

Notes:

1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.

2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile homes; MIL - military; SCH - school; CHR - church; COM - commercial; REC - recreational; HM - hotel/motels.

3 - M - Measured noise level; STxx or LTxx - measurement site number; E - Calculated using future "No-Build" and measured data; CAL - model calibration point.

4 - A/E = Approach or Exceed NAC; S = Substantial.

5 - Barrier height recommended to meet requirements at adjacent receptor(s).

R - Minimum required height based on Department Noise Analysis Protocol.

- Emboldened levels indicate the acheivement of at least 5 dB attenuation.

C - Critical design receiver.

T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.

W - The existing and future noise levels at this location include benefits of an existing property wall.

K2 - Adjusted by -2 dB for calibration.

K - A shielding factor of 5 dB has been applied to these receptors to account for attenuation provided by first-row buildings.

* Non-first row receiver.

TABLE 7-68 – SUMMARY OF RECOMMENDED BARRIERS – SEGMENT 22

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location/ Hwy. Side	Barrier Height/ Total Length	Reasonable Cost per Residence [2]	Reasonable Allowance Cost Per Barrier(s)
S882	R22.2 - R22.5	11 SFR	R/W / Northbound	3.7 m (12 ft) / 181 m (596 ft)	$56,000	$616,000
S884	R22.6 - R22.8A	9 SFR	R/W / Northbound	3.7 m (12 ft) / 223 m (730 ft)	$52,000	$468,000

Notes:
1 - Land Use: SFR - single-family residence; MFR - multi-family residence
2 - Based on the updated base reasonable allowance of $32,000 per residence (Caltrans, 2006).

TABLE 7-69 – BARRIER LOCATIONS AND ELEVATIONS – SEGMENT 22

Barrier No.	Receptor No.	Type[1] and No. of Benefited Residences	Barrier Location	I-5 Barrier Station	Barrier Height, m (ft)	Top of Barrier Elevation, m (ft)
S882	R22.2 - R22.5	11 SFR	R/W / Northbound	881+08	3.7 (12)	23.2 (76)
				881+30	3.7 (12)	24.5 (80)
				882+00	3.7 (12)	28.2 (92)
				882+95	3.7 (12)	27.7 (91)
			Approximate Length: 181 m (596 ft)			
S884	R22.6 - R22.8A	9 SFR	R/W / Northbound	883+15	3.7 (12)	27.5 (90)
				883+88	3.7 (12)	27.7 (91)
				884+12	3.7 (12)	27.9 (91)
				884+50	3.7 (12)	28.8 (94)
				885+00	3.7 (12)	28.9 (95)
				885+45	3.7 (12)	29.4 (96)
			Approximate Length: 223 m (730 ft)			

Note:

1 - Land Use: SFR - single-family residence.

7.3 CLASSROOM NOISE

As discussed in Section 6, several simultaneous indoor/outdoor noise measurements were taken at five schools that are adjacent to I-5. The measurements were used to determine the noise impact for classrooms due to the widening of I-5.

Each of the sensitive receptor locations presented in Table 7-70 represents a school of interest for this project. At each of the five schools, indoor classroom areas were examined to determine the benefits of the recommended barriers. Table 7-70 shows the future predicted indoor peak-hour noise levels and compares them with the FHWA Activity Category "E" criterion of 52 dBA to determine impacts.

As the results of Table 7-70 indicate, existing indoor noise levels at all of the schools exceed the 52 dBA criterion, except for Del Mar Hills Elementary. The existing and predicted future outdoor peak-hour noise levels with the recommended barriers are also shown in Table 7-70. The reported noise reduction provided by each of the buildings was obtained by the simultaneous indoor and outdoor noise measurements conducted at each school.

The recommended barriers reduce the outdoor noise levels at three of the schools: Santa Fe Christian School, Sea Coast Community Church/School, and St. Patrick's School. However, these reductions do not bring the indoor levels below the 52 dBA impact criterion. The future interior noise levels are above the 52 dBA impact criterion due to windows that are inadequate at isolating the classrooms from outdoor noise. California Streets and Highways Code Section 216.1 requires that the department "undertake a noise abatement program" to "reduce the freeway traffic noise level by measures including, but not limited to, installing acoustical materials, eliminating windows, installing air conditioning, or constructing sound baffle structures" (State of California, 2002). It is recommended that new windows be installed at all of the impacted locations to reduce noise levels to below 52 dBA. Air Conditioning (AC) units should be installed with the windows, because the window treatments will only be effective if the windows are kept closed, which then the AC will provide the required air circulation. A detailed study needs to be performed for each of the impacted class rooms to determine the exact abatement treatment.

TABLE 7-70 – CLASSROOM NOISE LEVELS WITH BARRIERS

Rec. No.	School Name	Existing outdoor Peak Hour Noise Levels, dBA[1]	Existing Indoor Peak Hour Noise Levels, dBA[1]	Future Outdoor Noise Level, with Barrier, dBA[1]	Measured Building Reduction, dB[2]	Future Indoor Noise Level, with Barrier, dBA[1]	Activity Category and NAC ( )	Impact (Yes or No)
ST5.3A	Del Mar Hills Elementary School 14085 Mango Drive, Del Mar	64	43	67	21*	46	E (52)	No
ST6.5A	Santa Fe Montessori School 1010 Solano Drive, Solano Beach	69	49	74	20	54	E (52)	Yes
ST6.7A	Santa Fe Christian School 838 Academy Drive, Solano Beach	76	63	70	13	57	E (52)	Yes
ST10.2A	Sea Coast Community Church/ School, 1050 Regal Road, Encinitas	76	72	72	4	68	E (52)	Yes
ST17.1A	St. Patrick's School 3820 Pico Drive, Carlsbad	73	55	70	21	52	E (52)	Yes

Notes:

1- Peak-hour nose levels, $L_{eq(h)}$.

2- Noise reduction provided by each building, as measured in the field.

* The actual building attenuation at Site 5.3A could not be determined due to a noisy central AC system, and an average of ST6.5A and ST17.1A building attenuation was utilized instead

8.0 CONSTRUCTION NOISE

Noise at the construction sites would be intermittent and the intensity of it would vary. The degree of construction noise may vary for different areas of the project site and also vary depending on the construction activities. During the construction period, the contractors may be required to comply with local noise ordinance. In addition, Caltrans Standard Specifications includes the following two noise control requirements that restrict construction noise (Caltrans, 1999):

- The contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract.
- Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall operate without a muffler.

Construction Mitigation Measures

The anticipated construction noise in the project area from the two alternatives is discussed in this section.

No-Build Alternative - No highway construction is planned and no improvements beyond routine maintenance would be provided for this alternative; therefore, there would be no project related construction noise.

Build Alternative - Long-term noise exposure descriptors are difficult to quantify due to the intermittent nature of construction noise. Highway construction is accomplished in several different phases. Table 8-1 lists the calculated noise levels for typical construction activity that can be expected in the project area.

During the construction period, some of the sensitive receptors that are close to the highway may be exposed to high noise levels. Effective noise control during the construction of a project means minimizing noise disturbances to the surrounding community. A combination of mitigation techniques with equipment noise control and administrative measures will be selected to provide the most effective means to minimize effects of the construction activity noise.

The following control measures shall be implemented in order to minimize noise disturbances at sensitive receptors during periods of construction:

Equipment Noise Control

- ❖ Ensure that all equipment items have the manufacturers' recommended noise abatement measures, such as mufflers, engine enclosures, and engine vibration isolators, intact and operational. All construction equipment should be inspected at periodic intervals to ensure proper maintenance and presence of noise control devices (e.g., mufflers and shrouding, etc.) (Caltrans, 1999).
- ❖ Turn off idling equipment.

Administrative Measures

- Implement a construction noise monitoring program to limit the impacts.
- Plan noisier operations during times least sensitive to receptors.
- Keep noise levels relatively uniform and avoid impulsive noises.
- Maintain good public relations with the community to minimize objections to the unavoidable construction impacts. Provide frequent activity updates of all construction activities.

Application of the mitigation measures will reduce the construction noise at the sensitive receptors; however, a temporary increase in noise would likely occur.

TABLE 8-1 – TYPICAL CONSTRUCTION NOISE LEVEL

Construction Operation Noise Levels

No. of Items	Equipment Type	Maximum Equipment Noise Level at 15 m, dBA	Hourly Equivalent Noise Levels at 15 m, dBA [1]	Hourly Equivalent Noise Levels at 30 m, dBA 1
Clear and Grub				
1	Excavator	83	80	74
1	Backhoe	75	72	66
4	Heavy Duty Dump Trucks	73	70	64
		Overall $L_{eq}(h)$	82	76
Bridge Demolition				
1	Front Loader	76	73	67
1	Hoe Ram	89	86	80
4	Heavy Duty Dump Trucks	73	70	64
		Overall $L_{eq}(h)$	87	81
Retaining Walls				
1	Backhoe	75	72	66
1	Bormag BMP 851	80	77	71
1	Concrete Pump	74	71	65
1	Compressor	68	65	59
3	Ready Mix Trucks	72	69	63
4	Medium Duty Dump Trucks	77	74	68
2	Flatbed Truck	70	67	61
		Overall $L_{eq}(h)$	84	78
Paving				
1	Grader	75	72	66
1	Water Truck	77	74	68
1	Vibratory Roller	78	75	69
1	Compactor	76	73	67
1	Concrete Pump	74	71	65
3	Ready Mix Trucks	72	69	63
1	Asphalt Paver	79	76	70
1	Asphalt Roller	78	75	69
1	Sweeper	79	76	70
4	Medium Duty Dump Trucks	73	70	64
2	Flatbed Truck	70	67	61
		Overall $L_{eq}(h)$	85	79

No. of Items	Equipment Type	Maximum Equipment Noise Level at 15 m, dBA	Hourly Equivalent Noise Levels at 15 m, dBA [1]	Hourly Equivalent Noise Levels at 30 m, dBA [1]
Earthwork				
1	Excavator	83	80	74
1	Backhoe	75	72	66
1	Front Loader	76	73	67
1	Dozer	85	82	76
1	Trencher	80	77	71
4	Heavy Duty Dump Trucks	73	70	64
		Overall $L_{eq}(h)$	86	80
Structures				
1	Excavator	83	80	74
1	Backhoe	75	72	66
1	Bormag BMP 851	80	77	71
1	Crane	78	75	69
1	Concrete Pump	74	71	65
1	Compressor	68	65	59
1	Bridge Deck Paver	77	74	68
2	Flatbed Truck	75	72	66
1	Pile Driver	80	77	71
4	Medium Duty Dump Trucks	73	70	64
3	Ready Mix Trucks	81	78	72
		Overall $L_{eq}(h)$	88	82
Misc.				
1	Front Loader	76	73	67
1	Dozer	79	76	70
2	Medium Duty Dump Trucks	73	70	64
		Overall $L_{eq}(h)$	79	73

Notes: Calculated construction noise levels assume that all equipment operates for six hours out of an eight hour day. Calculations also assume that all equipment are operated at full load 70 % of the time.

1 - Predicted noise levels are from the center of the construction activity.

Source: Parsons

9.0 REFERENCES

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