Reconstruct Interchanges-Carpinteria ***NSR***

Final Noise Study Report

Linden Avenue and Casitas Pass Road Interchanges Project

SB-101-PM 2.2/3.4

EA 05-4482U0

September 9, 2008

Caltrans

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September 2008

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The environmental review, certification and any other action required in accordance with applicable federal laws for this project is being, or has been, carried out by Caltrans under its assumption of responsibility pursuant to 23 U.S.C. 327

Executive Summary

Purpose of Noise Report

This report reviews the potential long and short-term noise impacts from a proposed project that would improve two interchanges and make other improvements on Route 101 in Carpinteria, Santa Barbara County (see Figures 1, 2 and 3). The project is needed to reduce existing and projected congestion in this area, and to reduce floodplain impacts.

Project Description and Alternatives

Currently Route 101 in the project area is two-lanes in each direction. Increasing local congestion in this area has created the need for the proposed project.

The proposed action includes reconstructing the Linden Avenue and Casitas Pass Road interchanges, reconfiguring on- and off-ramps, replacing Route 101 bridges over Carpinteria Creek, extending Via Real frontage road from Bailard Avenue through to Casitas Pass Road, adding a new bridge over Carpinteria Creek at Via Real, and reconstructing bike paths. The proposed action will take place on Route 101 and adjacent streets from west of Franklin Creek to just east of Carpinteria Creek. The project area is approximately one mile in length.

The proposed project has four build alternatives. All Alternatives would widen and raise the existing over-crossings of Linden Avenue and Casitas Pass Road, and would connect Via Real from its current terminus south of Carpinteria Creek, to Linden Avenue. These improvements would require new structures for Linden Avenue, Casitas Pass Road, and Carpinteria Creek. Alternatives 1 and 4 would extend the northbound onramp from Linden Avenue across Franklin Creek requiring a new structure at that location. No new lanes would be added to the highway with this project.

Land Use and Terrain

Route 101 through Carpinteria is currently two-lanes in each direction with a 40-foot median. The highway is bordered with a mix of commercial, residential and agricultural properties, and open space. Carpinteria is situated on a coastal plain adjacent to the Pacific Ocean. Elevations in the project area are 20 to 50 feet above mean sea level.

Existing Noise Levels (ambient and background)

Existing noise levels for residents that border the highway are at or above the Federal Highway Administration noise abatement criterion for residences (67-dBA) at most

locations in the project vicinity where noise levels were measured or predicted, except where there are existing noise barriers.

Future Predicted Noise Levels

Based on the predicted increase in traffic volumes in the area, noise levels at residences near the highway should increase by up to 4-dBA by the project design year of 2036 without the proposed project. However, the relocation of Via Real and the proposed ramps is anticipated to result in additional impacts at several receptors.

Traffic Noise Impacts

Table 8 from the noise report (below) shows that no receptor is anticipated to undergo a significant increase in traffic noise levels (12-dBA) over existing noise levels, while several receptors are predicted to approach or exceed the noise abatement criterion for residences (67-dBA) shown in Table 3 of this report.

Predicted Traffic Noise Impacts

Receiver I.D. Number	Type, Location or Address	Development Predates 1978 or Project is new Highway Construction (Yes or No)	Existing Noise Level, dBA Leq(h) 2007	Predicted Noise Level, dBA Leq(h) 2036 No Build	Predicted Noise Level, dBA Leq(h) (Increase over existing) 2036 Build	Activity Category and NAC dBA Leq(h)	Impact Type[1]
1	1069 Casitas Pass[2]	No	65	**69**	**69 (+4)**	B (67)	A/E
2	1160 Eugenia Pl.	No	**73**	**76**	**76 (+3)**	B (67)	A/E
3	1233B Vallecito Rd.	Yes	**66**	**69**	**73 (+7)**	B (67)	A/E
4	1204 Vallecito Rd.	Yes	**68**	**71**	**75 (+7)**	B (67)	A/E
5	4895 Nipomo Dr.	Yes	**73**	**77**	**80 (+7)**	B (67)	A/E
6	4801 Nipomo Dr.	Yes	**72**	**76**	**78 (+6)**	B (67)	A/E
7	1159 Vallecito Rd.	Yes	**71**	**76**	**77 (+6)**	B (67)	A/E
8	5415 Hales Ln. [2]	Yes	64	**67**	**67 (+3)**	B (67)	A/E
9	5700 Via Real #13 [2]	No	64	65	**67 (+3)**	B (67)	A/E
10	5700 Via Real #54 [1]	No	65	**68**	**69 (+4)**	B (67)	A/E
11	5557 Cameo Rd.	Yes	61	64	**66 (+5)**	B (67)	A/E
12	5155 Ogan Rd.	No	**68**	**72**	**75 (+7)**	B (67)	A/E
13	5007 Pacific Village Ct.	No	**66**	**70**	**69 (+3)**	B (67)	A/E
14	1240 Casitas Pass	Yes	65	**66**	64 (-1)	B (67)	None
15	1339 Linden	Yes	62	64	64 (+2)	B (67)	None
16	1313 June Court	Yes	**70**	**73**	**77 (+7)**	B (67)	A/E
17	Park[3]	No	65	**67**	61 (-4)	B (67)	None
18	1095 Holly	Yes	76	**80**	**81 (+5)**	B (67	A/E

Predicted Traffic Noise Impacts table continued

[1] Impact Type: S = Substantial Increase (12-dBA or more)
A/E = Approach or Exceed NAC
CR = Class Room Noise (Sec 216 of Streets & Highways Code)

[2] Existing barrier

[3] Influence from construction of Via Real between Route 101 and the park

Noise Abatement Considered

While no substantial noise increases (12-dBA) are predicted for this project, existing noise levels at most areas adjacent to the highway currently exceed the noise abatement criteria level for residences (67 decibels Leq(h). Project construction will raise these noise levels by up to 7-decibels over existing noise levels. Because of these impacts, noise abatement in the form of sound walls will be considered with the project. Recommended noise abatement is shown on Table 9. The normal form of noise abatement employed by Caltrans is soundwalls. At locations where existing barriers provide at least 5-dBA of noise attenuation, additional noise abatement will not be recommended.

Areas Where Abatement Is Not Feasible

Noise abatement is not feasible at Receptor 10, where an existing driveway opening exposes that receptor to traffic noise impacts.

Construction

Project construction is anticipated to last 900 working days (4.1 years). It is likely that local noise levels will be affected during the period equipment is operating. Normal construction activities can cause noise levels of 86-dBA at 50 feet, and extraordinary activities like pile driving can cause peak noise levels of 100-dBA at 50 feet. Methods to minimize impacts of construction noise and vibration are recommended in the body of this report. The most useful of these is scheduling noisier construction operations as early in the evening as possible.

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Noise Study Report

Introduction

This report reviews the potential long and short-term noise impacts from a proposed project that would improve the Linden Avenue and Casitas Pass Road Interchanges on Route 101 in Carpinteria. The project would also connect a local frontage road (Via Real), raise the Carpinteria Creek Bridge, and make other infrastructure improvements. See Project Location Map (Figure 1).

The proposed project has four build alternatives. Alternatives 1 and 4 would extend the northbound onramp from Linden Avenue across Franklin Creek requiring the replacement of the northbound Route 101 bridge over Franklin Creek. All Alternatives (1-4) would replace the existing structures over Carpinteria Creek, and would connect Via Real between Bailard Avenue and Linden Avenue.

Build Alternatives

Four alternatives are proposed for construction of the interchanges in addition to the No Build Alternative. Alternatives 1 and 4 would replace the northbound and southbound Franklin Creek bridges in addition to the other improvements. Table 1 depicts the differences between the current build alternatives. Approximately 20 other alternatives have been considered and rejected over the life of the project. Please see Figures 2 and 3.

Figure 1—Project Location Map

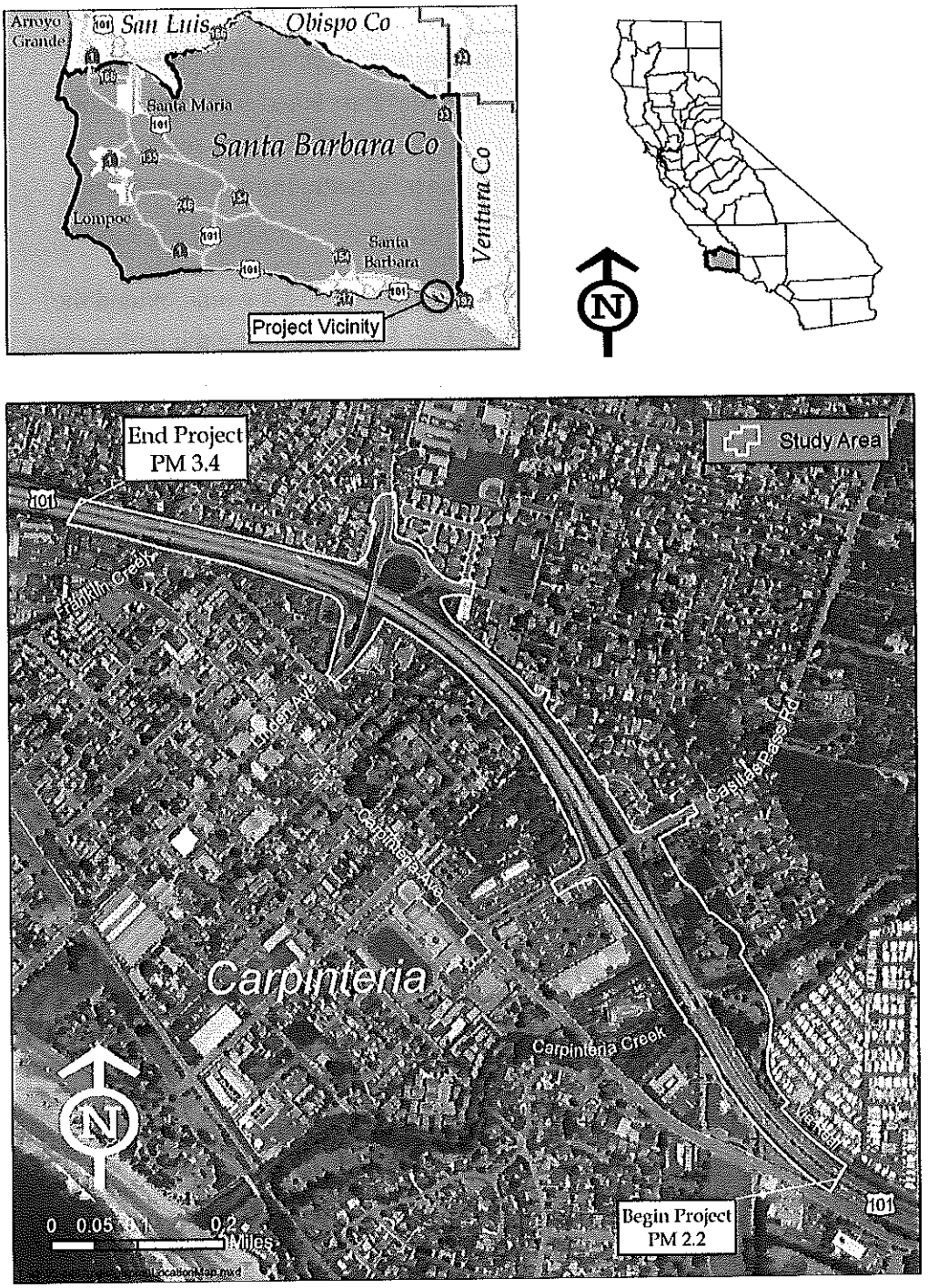


Figure 2—Noise Receptors and Barrier Locations Alternatives 1, 4

Figure 3—Noise Receptors and Barrier Locations Alternatives 2,3

Table 1—Comparison Of Proposed Alternatives

DESCRIPTION	ALT. 1	ALT. 2	ALT. 3	ALT. 4
Replace existing 2-lane Casitas Pass Road over-crossing with 5-lane over-crossing, including bike lanes and 5-foot sidewalks	X	X	X	X
Upgrade southbound on and off-ramps at Casitas Pass Road overcrossing	X	X	X	X
Construct new northbound on and off-ramps at Via Real south of Casitas Pass Road overcrossing	X	X	X	X
Extend Via Real as a frontage road between mobile home park across Carpinteria Creek to Linden Avenue	X	X	X	X
Replace and widen northbound and southbound Route 101 bridges over Capinteria Creek	X	X	X	X
Construct new 2-lane bridge over Carpinteria Creek on Via Real	X	X	X	X
Remove northbound cloverleaf on-ramp at Linden Ave	X	X	X	X
Remove northbound on ramp at Vallecito Avenue	X	X	X	X
Replace existing 2-lane Linden Avenue over-crossing with 4-lane over-crossing including bike lanes and 5-foot sidewalks		X	X	
Replace existing 2-lane Linden Avenue over-crossing with 5-lane over-crossing including bike lanes and 5-foot sidewalks	X			X
Replace northbound on-ramp and southbound off-ramp at Linden Avenue	X	X	X	X
Replace and widen northbound Franklin Creek Bridge	X			X
Signalize intersections at: Casitas Pass southbound on-ramp and off-ramp, Casitas Pass northbound on and off-ramps at Via Real, Casitas Pass Road/Via Real, Linden Avenue/Via Real, Linden Avenue northbound on-ramp, Linden Avenue southbound off-ramp	X	X	X	X
Repave and raise the profile of Route 101 from the south project limit to just north of Casitas Pass Road over-crossing	X	X	X	X

Alternatives 1 and 4--The major feature of Alternatives 1 and 4 is that they would extend the northbound on-ramp across, replace, and or widen the northbound Franklin Creek Bridge. The new on-ramp would not loop under the Linden Avenue structure as does the existing on-ramp, and as would Alternatives 2 and 3. The difference between Alternative 1 and 4 is that Alternative 1 affects slightly more of the Verizon Property located just east of the Via Real, Linden Avenue Interchange.

Alternatives 2 and 3-- Alternates 2 and 3 do not cross or replace the northbound Franklin Creek Bridge. Both Alternatives 2 and 3 would mimic the existing loop northbound on-ramp. Alternative 2 would have a standard intersection with Via Real slightly off-set from the intersection of Ogan Road, while Alternative 3 would create a roundabout intersection with Via Real, Ogan Road and the northbound (loop) on-ramp meeting about 400-feet east of the junction of Via Real and Linden Avenue.

No-Build Alternative

The no-build alternative would not alter the existing highway alignment. Therefore, local congestion would continue to worsen and the existing impediments to flow in Carpinteria (represented by the highway bridges) would continue to exist. Local noise impacts would not be considered to occur as a result of the no-build alternative.

Fundamentals of Traffic Noise

The California Environmental Quality Act (CEQA) considers noise to be a "significant effect" when it "increase(s) substantially the ambient noise levels for adjoining areas". This report will determine if the project may cause substantial noise impacts to local receptors, or if Caltrans noise abatement criteria will be exceeded.

The following information is condensed from Caltrans Traffic Noise Supplement (TeNs) that can be found under Environmental Engineering on Caltrans Internal web site at http://trenv.dot.ca.gov/.

Noise is defined as "unwanted sound." Sound is a vibratory disturbance that has 3 elements. These elements are *source*, *path* and *receiver*. Sound cannot exist without these three. Sound can be described in different ways. The noise descriptor used by Caltrans is decibels[2] on the A-weighted scale (dBA) which best represents the human response to sound. L_{eqh} represents the steady state equivalent of the time varying sound level over the period of measurement (1 hour).

[2] The decibel is a logarithmic measure of sound energy where an increase of 10 decibels doubles the apparent noise level, and an increase of 20 decibels quadruples it.

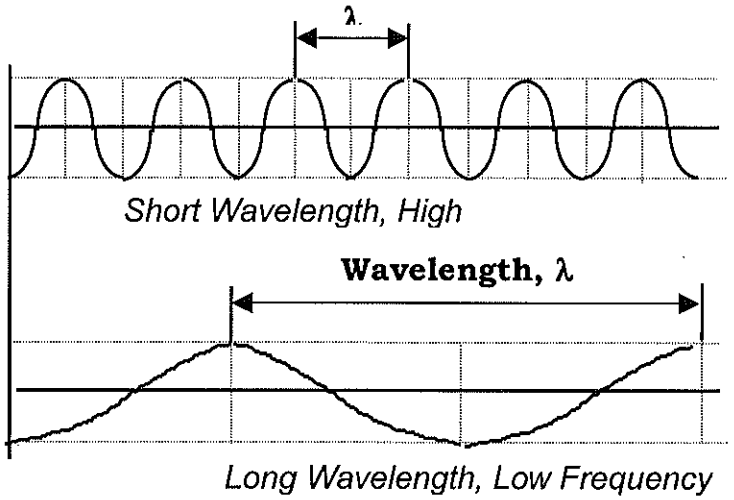


Figure 4—Caltrans TENS Figure N-2131.2 - Frequency And Wavelength

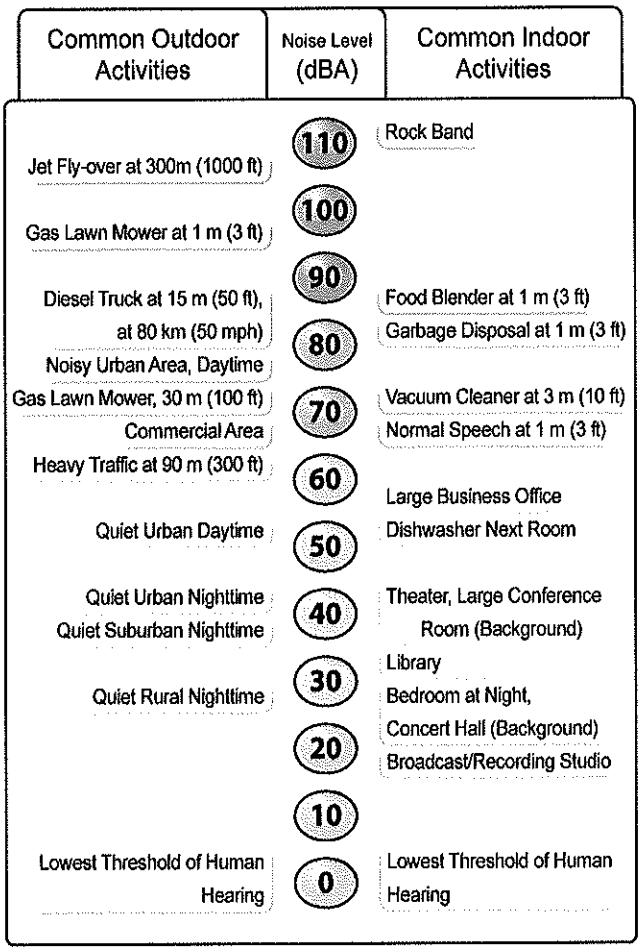
A sound is determined by its frequency (or wavelength), and its amplitude (loudness). Imagining sound as a sinusoidal wave, its frequency is the distance between consecutive peaks. Frequency is measured in hertz (Hz). The longer the distance between peaks, the lower the frequency, and the lower the sound. Very low frequency sounds (16 Hz) can have amplitudes of 70 feet. Examples of low frequency sounds are truck exhausts and base guitar notes. Conversely, the shorter the distance between peaks, the higher the frequency and the pitch of the sound. High frequency sounds (16,000 Hz) can have amplitudes of 0.07 feet. Examples of low frequency sounds include tire noise and the noise from a vacuum cleaner or electric motor. High frequency sounds with their shorter amplitudes are easier to block with soundwalls than lower frequency noise.

The distance between the peak and trough of the sinusoidal wave is the amplitude or loudness of the sound. Amplitude is measured in decibels (dB). 0 dB is not the absence of sound, but an extreme value that only the most sensitive ears can detect. For most people, the threshold of hearing is closer to 10-dB.

Under laboratory conditions, the trained human ear can detect changes in sound levels of 1-dBA when exposed to pure tone (single frequency) sounds in the mid-frequency range. (Human beings can hear frequencies between 10 and 60,000 Hz.) Outside laboratory conditions, the trained ear can detect changes of 2-dBA in normal environmental noise. It is widely accepted that the average healthy ear can barely perceive noise level changes of 3-dBA.

Excessive noise levels can cause irritation, interference with communication, and even hearing damage if a high enough level is sustained for a long enough period. The level that has been determined to be detrimental to hearing is 90-decibels for 8 hours. Table 3 gives a rough correlation of common indoor and outdoor activities to noise levels.

Figure 5—Comparison Of Indoor/Outdoor Activities To Noise Levels



Drop-off Rate

Noise attenuates or "drops-off" from a line source (like a highway) at a rate of 4.5-dBA per distance doubled from a soft site, and 3.0-dBA from a hard site. This means that over a soft site, if the noise level is 70-dBA at 50 feet, it is 65.5-dBA at 100 feet, and 61-dBA at 200 feet.

From a point source (like construction equipment), noise attenuates at 7.5-dBA per distance doubled over a soft site, and at 6-dBA over a hard site. Table 9 clarifies this point.

Table 2—Attenuation With Distance From Noise Source

Noise Source Type	Noise Level change (in decibels) at various distances from the source				
	50'	100'	200'	400'	800'
Point Source (Construction Equipment) Hard Site*	0	-6	-12	-18	-24
Soft Site**	0	-7.5	-15	-22.5	-30
Line Source (Highway Traffic) Hard Site	0	-3	-6	-9	-12
Soft Site	0	-4.5	-9	-13.5	-18

* Smooth (paved). ** Irregular and vegetated.

It is important to note that there are three noise sources from a vehicle. These are the tires, the engine and the exhaust. On automobiles, the average noise source is about 1.5 feet above the road surface. From medium and heavy-duty trucks, the average noise source is much higher. The exhaust stacks of trucks are about 11.5-feet above the road surface.

Decibel Addition

When two equal noise sources are placed next to each other, the noise level increases by 3-dBA that is barely perceptible to most people in an outdoor situation. Similarly, when highway traffic volumes are doubled, a phenomenon that often occurs at about 20- year intervals, noise levels would be expected to increase by 3-dBA. Noise from various sources, like a network of urban streets can also be added to help determine the major contributor to local noise levels.

When noise levels differ by 0 to-1 dBA, add 3-dBA to the higher level.
When noise levels differ by 2 to 3-dBA, add 2-dBA to the higher level.
When noise levels differ by 4 to 9-dBA, add 1-dBA to the higher level.
When noise levels differ by more than 9-dBA, the lower noise level does not contribute to the ambient noise at any particular location.

Federal and State Policies and Procedures

The California Environmental Quality Act (CEQA) considers highway traffic noise to be a "significant effect" when it "increase(s) substantially the ambient (pre-project) noise levels for adjoining areas". The Federal Highway Administration (FHWA) noise policy as promulgated in FHPM 7-7-3 requires consideration of noise abatement measures when a Type I project[3] causes a "traffic noise impact", or when the predicted traffic noise levels substantially exceed the existing noise levels. A substantial exceedance occurs when after project levels are 12-dBA Leq or higher than pre project noise levels. A traffic noise impact occurs when project noise levels approach or exceed the noise abatement criterion (NAC) found on Table 3.

Caltrans noise policy is contained in Caltrans Traffic Noise Analysis Protocol (CATNAP) dated October 1998, and revised in August 2006. Portions of Caltrans noise policy are found in the Highway Design Manual, Chapter 1100. FHWA noise policy is contained in Title 23, Code of Federal Regulations Part 772, but FHWA has accepted CATNAP for use on projects in this state. Caltrans provides noise abatement mitigation in the form of sound barriers when it is considered "reasonable" and "feasible". CATNAP contains decision-making tools that aid in determining when mitigation is "reasonable and feasible." Some of the factors that weigh in this decision are: the number of residences affected, pre and post construction noise levels, how long the residences have existed, the cost of noise abatement and how much attenuation a sound barrier could attain.

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3 According to Caltrans Highway Design Manual, Chapter 1100, Section 1106.1, a Type I Project is " A proposed Federal or Federal-aid highway project for the construction of a highway on new location or the physical alteration of an existing highway which significantly changes the horizontal or vertical alignment or increases the number of through-traffic lanes. This definition also applies to State only funded highway projects."

Table 3— Activity Categories and Noise Abatement Criteria

Source: Caltrans Traffic Noise Analysis Manual, (October 2006)

Activity Category	Noise Abatement Criteria, A-weighted Noise Level[1], Average Decibels Over One Hour (dBA Leq $_h$)	Description of Activities
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 sport 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

[1] A-weighted decibels are adjusted to approximate the way humans perceive sound

Study Methods and Procedures

Several receptors were chosen on both sides of the highway within the project limits to represent sensitive receivers that have the potential to be adversely affected by the proposed construction project. Receptors were selected for their proximity to the dominant noise source, and their ability to reflect the highest noise levels that would be expected in a particular neighborhood. The selected receptors and their current, worst hour traffic noise levels are shown on Table 7. Note that many of the existing noise levels approach or exceed the noise abatement criteria level for Category B shown on Table 3.

Because traffic noise measurements cannot always be taken at the peak traffic noise hour, the noise model is calibrated by taking controlled field measurements and then predicting for the same conditions with the noise model. If the readings are within 1-2-dBA, the calibration is considered successful, and it is assumed that any future traffic volumes input to the model will give an accurate prediction. To arrive at the peak hour traffic noise levels, peak hour traffic volumes from Tables 4 and 5 were input to the model. As long as these volumes are below the highway capacity (about 1800 vehicles per lane per hour according to District 5 Traffic Operations Department), the noise prediction should be accurate.

To calibrate the Traffic Noise Model, simultaneous noise readings and traffic counts were taken at two locations in September 2007. One location was at the south end of the project,

near a mobile home park (Location 9). One location was in the middle of the project (Receptor 7) at the end of Vallecito Street, south of Route 101. At Location 7, a 20-minute reading and simultaneous traffic classification count was taken. Heavy-duty trucks, medium duty trucks and automobiles were counted. The results of the traffic count were multiplied by three to get a one-hour traffic volume. This process was repeated at Location 9 where a 10-minute traffic count was performed along with the noise reading. The results of the traffic counts and other site parameters including distance from the roadway, meteorology, physical obstructions and speeds were entered into the Federal Highway Administration's Traffic Noise Model, and a prediction was made to attempt to arrive at the same noise level that was measured in the field. The results were within 0.4-dBA at location 9, and within 0.2-dBA at Location 7. This was a successful calibration of the model, and no adjustment factor is needed. Calibration sheets and model results are included in the Appendices of this report. Traffic noise model calibration is discussed in Section N-3312 of Caltrans Traffic Noise Supplement (TeNS)

The Federal Highway Administration's Traffic Noise Model, based on FHWA-PD-96-009 and – 010, was calibrated using field-measured data. The model was then used to determine peak traffic noise hour sound levels for the current year, and for the future build and no build conditions at the 17 receptors selected to represent locations that could be adversely affected by project construction. Impacts result from increasing traffic volumes, and from moving traffic closer to receptors. The results of these predictions are shown on Table 8.

Existing Noise Environment

The project along Route 101 is in a suburban area in Carpinteria, Santa Barbara County. The terrain is relatively flat, with elevations of 20 to 50 feet above mean sea level. The city is situated on a broad coastal plain with the Pacific Ocean to the south and west, and the tops of the Santa Ynez Mountains with heights up to 4600 feet, about 4 miles to the east. The coastline is oriented approximately northwest to southeast, and the highway is roughly parallel with the coastline. Noise levels taken at various receptors between 1991 and 2007 show that many residences near the highway in the project area already experience noise levels at or above the noise abatement criteria level for residences (approaching 67-dBA Leq). Table 6 shows land uses in the project area.

Traffic

Current and projected traffic on Route 101 in the project area is shown on Table 4. Current and projected volumes were taken from Traffic Analysis Report for the US 101/Casitas Pass Road and Linden Avenue Interchange Improvement Project (Fehr & Peers, June 2007). Projected volumes are based on growth factors derived from the travel demand model maintained by the Santa Barbara County Association of Governments. Vehicle percentages

for highway traffic are taken from 2006 Annual Average Daily Truck Traffic on the California State Highway System, California Department of Transportation, December 2006. Average peak hour vehicle percentages on Route 101 in the project area are 90.4% autos, 3.9 % medium trucks, and 5.7 % heavy-duty trucks. Knowing the volume and percentage of vehicle types on the roadway is important in predicting future noise impacts. Note that 2036 peak hour traffic volumes on Route 101 exceed the theoretical capacity of the highway (2000 vehicles per lane per hour.)

Table 4—Current And Projected Highway Traffic Volumes In The Project Area

Route 101 Segment	Post Miles	Peak Hour (%)	2006 (Pk Hr)	2036 No build (Pk Hr)	2036 Build (Pk Hr)
Bailard- Casitas Pass	1.62-2.44	.11			
Autos (90.4%)			6961	8814	8398
Medium trucks (3.9%)			300	380	362
Heavy trucks (5.7%)			439	556	530
Casitas Pass-Linden	2.44-3.06	.11			
Autos (90.4%)			6870	8281	8235
Medium trucks (3.9%)			296	357	355
Heavy trucks (5.7%)			433	522	519

Table 5—Ramp And Local Road Volumes In The Project Area

Route 101 Ramp	Direction	Peak Hour 2006	Peak Hour 2036 No Build	Peak Hour 2036 Build
@Casitas Pass	NB On	255	490	420
	NB Off	280	690	610
	SB On	265	790	600
	SB Off	290	560	610
@Linden Ave.	NB On	270	490	520
	SB Off	240	540	560
Local Roads		**Peak Hour 2006**	**Peak Hour 2036 No Build**	**Peak Hour 2036 Build**
Casitas Pass-east of 101		410	825	850
Casitas Pass-west of 101		1100	1620	1570
Linden Ave.-east of 101		870	820	1180
Linden Ave.-west of 101		1030	1420	1420
Via Real–Bailard-Casitas Pass		260	350	570
Via Real–Casitas Pass-Linden		411	625	400
Ogan Rd.		-	810	550

From 2005 Ramp Volumes on the California State Freeway System and Traffic Analysis Report for the US 101/Casitas Pass Road and Linden Avenue Interchange Improvement Project (Fehr & Peers, June 2007). Traffic volumes assume 10% of average daily traffic occurs in the peak hour

Topography and Land Uses

The area is located on a broad coastal terrace with elevations gradually increasing from south to north. The area is a mix of residential and commercial uses, with the residences generally found north of the highway as shown on Table 6.

Table 6—Land Uses In The Project Area

	Casitas Pass South of 101	**Casitas Pass** North of 101	**Linden Ave** South of 101	**Linden Ave** North of 101
North of Rte 101	1 residence, orchard, mobile homes	Residential, commercial		Residential
South of Rte 101	Restaurant, commercial, 2 motels	2 motels, commercial		Residential, commercial

Table 7—Existing Noise Levels

Receiver ID Number	Location or Address	Type of Develop-ment	Number of Units Represented	Noise Abatement Category and (Criterion)	Existing Worst Hour Noise Level, Leq(h), dBA	Noise Level Measured* or Modeled**?
R1	1069 Casitas Pass	Residential	4	B (approach 67)	65	Modeled
R2	1160 Eugenia Place	Residential	3	B (approach 67)	73	Modeled
R3	1233B Vallecito Rd.	Residential	5	B (approach 67)	66	Modeled
R4	1204 Vallecito Rd.	Residential	6	B (approach 67)	68	Modeled
R5	4901 Nipomo Dr.	Residential	7	B (approach 67)	73	Modeled
R6	4825 Nipomo Dr.	Residential	8	B (approach 67)	72	Modeled
R7	1159 Vallecito Rd.	Residential	6	B (approach 67)	71	Modeled
R8	5415 Hales Ln.	Residential	7	B (approach 67)	64	Modeled
R9	5700 Via Real #13	Residential	8	B (approach 67)	64	Modeled
R10	5700 Via Real #54	Residential	7	B (approach 67)	65	Modeled
R11	5957 Cameo Rd.	Residential	8	B (approach 67)	61	Modeled
R12	5155 Ogan Rd.	Residential	2	B (approach 67)	68	Modeled
R13	5007 Pacific Village Court	Residential	5	B (approach 67)	66	Modeled
R14	1240 Casitas Pass	Residential	4	B (approach 67)	65	Modeled
R15	4985 Nipomo Dr.	Residential	5	B (approach 67)	62	Modeled
R16	1313 June Court	Residential	7	B (approach 67)	70	Modeled
R17***	Proposed Park	Recreation	1.6	B (approach 67)	65	Modeled
R18	1095 Holly	Residential	2	B (approach 67)	76	Modeled

* Unless otherwise indicated, all measurements shown reflect worst hour noise levels, i.e. they were adjusted to worst hour traffic characteristics through modeling (TNAP Section N-3312).
** Unless otherwise indicated modeled receivers include a calibration constant (TNAP Sections N-3120, N-5330 and N-5400)
*** Non-residential receptors are evaluated as 1 residential equivalent for each 100 front-feet along the highway.

Future Noise Environment, Impacts, and Considered Abatement

The proposed project would not directly affect highway speeds or volumes since the major improvements created by this project will be on the local road system. However highway traffic remains the major noise source in the area. Since traffic volumes on the highway are expected to exceed the theoretical capacity of the highway (2000 vehicles per lane) within the study area by 2036, it is likely that traffic noise levels would correspondingly lessen at least in peak hour periods as the highway becomes increasingly congested. For the purposes of determining the worst traffic noise hour, future year predictions in this report use the volumes and speeds that exist just before the flow breaks down. According to Fundamentals of Traffic Engineering (12th Edition Homberger and Kell, 1989) page 4-4, the "California Experience" differs from the Highway Capacity Manual in that more cars can sustain speeds over 50 mph before a sudden breakdown in speeds at the 2000 passenger cars per lane per hour point. Since there are trucks involved in the vehicle mix, the breakdown

point would occur somewhat earlier. Page 4-5 of Homberger shows a table of flow rates suggesting that Level of Service D has a flow rate of 1550-1850 vehicles per hour at speeds of 46-54 miles per hour. Level of Service E has a flow rate of 1850 – 2000 vehicles per lane per hour at speeds of 30-46 miles per hour. Discussions with District 5 Traffic Operations Department suggests that in District 5, freeway lanes can sustain volumes of 1800 vehicles per lane before a breakdown in Level of Service occurs. Since TNM predicts higher noise levels for a smaller volume of traffic at a greater rate of speed, *predictions for 2036 build and no-build scenarios assume that highway traffic is distributed over 6 lanes. Current year (2006) vehicle percentages will be applied to this traffic volume.*

Bailard to Casitas Pass

Because the proposed project would change traffic patterns in the area, project proponents worried that putting Via Real through to Linden Avenue would increase traffic on Via Real, thus increasing noise levels for residents along Via Real between Bailard and Casitas Pass. According to the Fehr and Peers Traffic Report, there would be about 220 more vehicles on Via Real between Bailard Avenue and Casitas Pass in the peak hour with the build alternatives than with the no build. This represents a noise increase of about 2-decibels Leq(h). This increase is barely perceptible in an outdoor situation (See Traffic Section).

This means that the project would not significantly contribute to an increase in noise levels at the residences between Bailard and Casitas Pass, except perhaps, where a realigned Via Real is moved near homes represented by Receptor 10. Because of existing and predicted noise impacts, sound barriers are recommended with the project. Noise barrier heights are relative to the road surface when the base elevation of the residence is below the grade of the highway, (therefore if a 10-foot tall barrier was constructed with its' base 2-feet below the grade of the highway, its actual height would be 12-feet). When the base elevation of the residence is above the grade of the highway, the barrier height is relative to the base elevation of the residence. Barriers are recommended when they are reasonable and feasible to construct. The feasibility of construction is simply whether or not a barrier can be constructed that will get 5-decibels of attenuation. The reasonability decision is made through the use of Worksheets A and B from Caltrans Traffic Noise Analysis Protocol. These sheets are attached (in the Appendices) for all proposed barriers.

Figure 6—Between Bailard and Casitas Pass Road

Proposed noise abatement measures and recommended heights are shown on Table 9. Barrier heights and locations are preliminary and subject to change.

Barriers can have negative impacts, such as interfering with the passage of air, interrupting scenic views, or creating objectionable shadows. They can also create maintenance access problems that make it difficult to maintain landscaping, create drainage problems, and provide pockets for trash and garbage to accumulate. In certain circumstances, they may raise concerns about safety by blocking areas from the view of patrolling police. Noise barriers can also raise concerns about traffic safety by reducing stopping or merging sight distance, or by reducing errant vehicle recovery room. On the other hand, they can increase privacy from passing traffic, and reduce noise impacts. Landscape treatments can often soften the barrier's angular appearance.

Table 8—Predicted Traffic Noise Impacts (bold values approach or exceed the NAC)

Receiver I.D. Number	Type, Location or Address	Development Either Predates 1978 or Project is a new Highway Construction (Yes or No)	Existing Noise Level, dBA Leq(h) 2007	Predicted Noise Level, dBA Leq(h) 2036 No Build	Predicted Noise Level, dBA Leq(h) (Increase over existing) 2036 Build	Activity Category and NAC dBA Leq(h)	Impact Type[1]
1	1069 Casitas Pass[2]	?	65	**69**	**69 (+4)**	B (67)	A/E
2	1160 Eugenia Pl.	No	**73**	**76**	**76 (+3)**	B (67)	A/E
3	1233B Vallecito Rd.	Yes	**66**	**69**	**73 (+7)**	B (67)	A/E
4	1204 Vallecito Rd.	Yes	**68**	**71**	**75 (+7)**	B (67)	A/E
5	4895 Nipomo Dr.	Yes	**73**	**77**	**80 (+7)**	B (67)	A/E
6	4801 Nipomo Dr.	Yes	**72**	**76**	**78 (+6)**	B (67)	A/E
7	1159 Vallecito Rd.	Yes	**71**	**76**	**77 (+6)**	B (67)	A/E
8	5415 Hales Ln. [2]	Yes	64	**67**	**67 (+3)**	B (67)	A/E
9	5700 Via Real #13 [2]	No	64	65	**67 (+3)**	B (67)	A/E
10	5700 Via Real #54 [2]	No	65	**68**	**69 (+4)**	B (67)	A/E
11	5557 Cameo Rd.	Yes	61	64	**66 (+5)**	B (67)	A/E
12	5155 Ogan Rd.	No	**68**	**72**	**75 (+7)**	B (67)	A/E
13	5007 Pacific Village Court	No	**66**	**70**	**69 (+3)**	B (67)	A/E
14	1240 Casitas Pass	Yes	65	**66**	64 (-1)	B (67)	None
15	1339 Linden	Yes	62	64	64 (+2)	B (67)	None
16	1313 June Court	Yes	**70**	**73**	**77 (+7)**	B (67)	A/E
17	Park[3]	No	65	**67**	**61 (-4)**	B (67)	None
18	1095 Holly	Yes	76	**80**	**81 (+5)**	B (67)	A/E

1 Impact Type: S = Substantial Increase (12-dBA or more)
A/E = Approach or Exceed NAC
CR = Class Room Noise (Sec 216 of Streets & Highways Code)

2 Existing barrier

3 Influence from existing barrier (for R17 barrier is Via Real)

Table 9 shows the predicted noise level from various barrier heights. Normally, a barrier will reduce noise levels about 0.5-dBA with every additional foot in height after the line of sight to truck stacks (that are about 11.5 feet off the road surface) from the receiver (that is about 5 feet off the ground surface) has been broken. Recommended barrier heights are enclosed in an emboldened box.

An 830-foot long, 12-foot tall, overlapping panel sound barrier was evaluated to minimize projected noise impacts at eight residences along Cameo Drive represented by Receptor 11. Impacts at Receptor 11 are just at the Noise Abatement Criteria level for residences (approaching 67-dBA). The reasonable cost for this barrier is $416,000 ($52,000 per residence.) The engineer's estimate for constructing this barrier is $458,160. Based on the engineer's estimate ($46 per square foot of barrier), the barrier is considered to be unreasonable to construct.

A 210-foot long, 10-foot tall barrier was evaluated for 2 residences represented by Receptor 18. The reasonable cost for the barrier is $120,000. The engineer's estimated cost for the barrier is $126,000 based on a cost of $60 per square foot since the barrier is in an area of high groundwater. The barrier is determined to be unreasonable to construct. However, since the noise impacts at these residences are severe (greater than 75-dBA) the barrier will be evaluated by the Federal Highway Administration reviewer as *unusual and extraordinary abatement.*[4]

[4] See Traffic Noise Analysis Protocol, page 17

Table 9— Noise Abatement with Existing and Proposed Soundwalls (2036)

Receiver I.D. Number	Without Wall	With Wall 8' High[4]		With Wall 10' High[4]		With Wall 12' High[4]		Existing Barrier	Proposed Barrier @ Right of Way Line (RW) or Edge of Shoulder (ES)
		Leq(h)	I.L.[1]	Leq(h)	I.L.[1]	Leq(h)	I.L.[1]		
R1[2,3]	69			64	5			BE4	B7 @ RW
R2	76	67	9	**66**	10	65	11		B7
R3	73	68	5	67	6	**66**	7		B4 @ RW
R4	75	71	4	70	5	**69**	6		B5, B6 @ RW
R5	80	66	14	65	12	**64**	13		B2 @ RW
R6	78	67	11	66	12	**65**	13		B2
R7	77	66	11	**65**	12	64	13		B7
R8[2]	67							BE3	
R9[2]	67							BE5, BE6	
R10[2]	69							BE5	
R11	66								NR[5]
R12	75	69	6	68	7	**67**	8		B8@RW
R13	69	**62**	7	61	8	60	9		B3 @RW
R14[3]	64							BE3	
R15[3]	64					62	2		B2, B3
R16	77	67	10	66	11	**65**	12		B1 @RW
R17	61								
R18	81	73	8	**71**	10	70	11	BE1	B9@ RW

(Emboldened noise values are recommended barrier heights)

1 I.L. = insertion loss (noise reduction)

2 Existing barrier

3 Influence from existing or proposed barrier

4 Design note: Barrier heights are relative to the road surface

5 Barrier not reasonable at this location

Table 10— Data for Reasonableness Determination

Soundwall I.D.: B1			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	77		
Build versus No-Build, dBA*	+4		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	10	11	12
Number of Benefited Residences	7	7	7
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$56,000	$56,000	$56,000

*Future year peak hour noise level at critical receiver(s)

Soundwall I.D.: B2			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	80		
Build versus No-Build, dBA*	+3		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	11	12	13
Number of Benefited Residences	15	15	15
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$58,000	$58,000	$58,000

*Future year peak hour noise level at critical receiver(s)

Soundwall I.D.: B3			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	69		
Build versus No-Build, dBA*	-1		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	8	9	10
Number of Benefited Residences	5	5	5
New highway, or more than 50% of residences predate 1978 (Yes or No)	No	No	No
Reasonable allowance per benefited residence	$44,000	$44,000	$44,000

*Future year peak hour noise level at critical receiver(s)

Soundwall I.D.: B4			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	73		
Build versus No-Build, dBA*	+4		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	9	10	11
Number of Benefited Residences	5	5	5
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$56,000	$56,000	$56,000

*Future year peak hour noise level at critical receiver(s)

Table 10 continued

Soundwall I.D.: B5, B6			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	75		
Build versus No-Build, dBA*	+4		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	7	8	9
Number of Benefited Residences	6	6	6
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$56,000	$56,000	$56,000

*Future year peak hour noise level at critical receiver(s)

Soundwall I.D.: B7			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	76		
Build versus No-Build, dBA*	+0		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	11	12	13
Number of Benefited Residences	6	6	6
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$58,000	$58,000	$58,000

*Future year peak hour noise level at critical receiver(s)

Soundwall I.D.: B8			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	75		
Build versus No-Build, dBA*	+3		
Predicted with Soundwall	8-foot High	10-foot High	12-foot High
Insertion Loss (Noise Reduction), dBA*	6	7	8
Number of Benefited Residences	2	2	2
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$56,000	$56,000	$56,000

*Future year peak hour noise level at critical receiver(s)

Soundwall I.D.: B9			
Predicted, without soundwall			
Absolute Noise Level, Leq(h), dBA*	81		
Build versus No-Build, dBA*	+1		
Predicted with Soundwall	12-foot High	14-foot High	16-foot High
Insertion Loss (Noise Reduction), dBA*	10	11	12
Number of Benefited Residences	2	2	2
New highway, or more than 50% of residences predate 1978 (Yes or No)	Yes	Yes	Yes
Reasonable allowance per benefited residence	$60,000	$60,000	$60,000

*Future year peak hour noise level at critical receiver(s)

Table 11—Reasonableness Determination

Barrier	Reasonable cost/ residence	Resi-dences	Reasonable cost per barrier	Barrier Height (Feet)	Barrier Length (Feet)	Barrier Area (Sq. Ft)	Preliminary Engineers Estimate	Reasonable and Feasible?
B1	$56,000	7	$392,000	12	667	8004	$368,184	Yes
B2	$58,000	15	$870,000	12	1217	14604	$671,784	Yes
B3	$44,000	6	$264,000	8	574	4592	$211,132	Yes
B4	$56,000	5	$280,000	12	397	4764	$219,144	Yes
B5, B6	$56,000	6	$336,000	12	345	4140	$190,440	Yes
B7	$58,000	6	$348,000	10	712	7120	$327,520	Yes
B8	$56,000	2	$112,000	12	190	2280	$104,880	Yes
B9	$60,000	2	$120,000	10	210	2100	$126,000	Yes*

* An additional consideration at this residence is that a severe noise impact (>75-dBA) exists here.

The preliminary engineer's estimates for the cost of the proposed barriers were obtained from the project Design Engineer. The estimates use a figure of $46 per square foot for barrier construction except for Barrier 9 where a cost of $60 per square foot was derived. The difference in costs is due to the fact that groundwater is exceptionally high in the vicinity of Barrier 9, and longer piles are required to support it. According to the Protocol (page 17--Unusual and Extraordinary Abatement), severe noise impacts can be evaluated on a case-by-case basis for noise abatement when ordinary means of abatement are considered unreasonable. The evaluation was originally done by Federal Highway Administration, but the responsibility now lies with Caltrans under National Environmental Policy Act (NEPA) delegation. One solution allowed for severe noise impacts is approval of a noise barrier that might otherwise be considered unreasonable. Due to the closeness of the engineer's estimate and the reasonable cost for barrier B9, approval of that barrier is recommended with this document.

The engineer's estimate includes all items necessary for construction of the barrier, including footings, drainage modifications, retaining walls, landscaping for graffiti abatement, right-of-way costs, and standard aesthetic treatment. All barriers proposed for construction were considered reasonable and feasible, or resulted from a severe noise impact (greater than 75-decibels at B9). A barrier was considered for residences on Cameo, but it was determined to be unreasonable to construct.

One caution on barrier heights is that when the base elevation for a residence is below the grade of the highway, the barrier height is relative to the highway. When the base elevation for a residence is above the grade of the highway, the barrier height is relative to the base elevation of the residence, so barrier heights (and areas) could be greater than those shown on Table 11.

During the public outreach for the project, owners of "benefited receptors" (those getting a 5-dBA attenuation from the barrier) will have the opportunity to comment on the proposed barriers. If more than 50% of the owners of receptors that are benefited by the barrier construction are opposed to it, the barrier will not be constructed.

CEQA Impacts

When determining whether a noise impact is significant under CEQA, comparison is made between the no-build noise level and the build noise level. The CEQA noise analysis is completely independent of the NEPA-23 CFR 772 analysis, which is centered on noise abatement criteria. Under CEQA, the assessment entails looking at the setting of the noise impact and then how large or perceptible any noise increase would be in the given area. Key considerations include the uniqueness of the setting; the sensitive nature of the noise receptors; the magnitude of the noise increase over existing conditions; the number of residences affected, and the absolute (construction year) noise level. See Section 3 of the Protocol.

The only time a noise abatement criterion applies under CEQA is when classrooms could be affected by the proposed project. If noise levels in public or private elementary or secondary school classrooms would exceed 52-dBA as a result of a freeway project, Caltrans would provide noise abatement to reduce classroom noise to 52 dBA or less. If the classroom noise exceeds the criteria of 52 dBA before and after the project, Caltrans would provide noise abatement to reduce classroom noise to the pre-project noise levels. See Section 1.3.2 of the Protocol.

At no location in the project area does a substantial permanent impact occur, where noise levels increase by 12 decibels over existing noise levels. No schools appear to be impacted by project construction. No impacts under CEQA are anticipated from the proposed project.

Noise Abatement Decision Report (NADR)

When noise barriers are recommended on a project, it is necessary for the Design Department to complete a Noise Abatement Decision Report (NADR). This document summarizes the conclusions of the Noise Study Report and presents the Engineer's cost estimate, the preliminary noise abatement decision, and explains the secondary effects of noise barrier construction, including impacts to biologic or scenic resources and to hazardous waste sites.

Short-term (Construction) Impacts

It is inevitable that local noise levels in the vicinity of the construction will be increased due to construction activities. Some nighttime construction is expected during this project, so

there is a potential for impacts on neighboring areas due to construction activity. The construction period is anticipated to be 900 working days (4.1 years).

The amount of the increased noise will vary with the types and models of equipment used. Caltrans policy (CATNAP Section 1.4.5) states that normal construction operations shall not generate greater than 86-dBA at 50 feet from the source. Extraordinary construction methods including pavement breaking and pile driving can generate peak noise levels of 110-dBA at 50-feet. This noise level decreases at a rate of 6 to 7.5-dBA per distance doubled away from the (point) source of construction noise. This means 6 to 7.5-dBA less at 100-feet, 12 to 15-dBA less at 200-feet, 18 to 22.5-dBA less at 400 feet, and so on (see Table 2). At this rate, residences up to 1600 feet from the construction activity could experience noise levels above the noise abatement criteria level (NAC) during periods of pile driving activity.

The loudest construction operation is expected to be the installation of cast in steel shell (CISS) piles. Noise from this operation can reach peak noise levels of 110-decibels at 50 feet. CISS piles will be installed at three locations (the two overcrossings and the new Carpinteria Creek Bridge) with Alternatives 2 and 3, and at four locations (the previously mentioned locations plus the northbound Franklin Creek bridge) with Alternatives 1 and 4. Pile driving activities are expected to take place over a two-week period at each location, up to a total of 70 days. During this period, noise levels at residences and businesses near the pile driving locations will be higher than normal. There is also a potential for annoying vibrations to occur (see draft project vibration report dated August 14, 2008). Pavement-breaking operations are nearly as noisy as pile driving. This activity would occur on Route 101 between about 1000 feet south of Carpinteria Creek and the Casitas Pass Overcrossing, and would include the existing northbound off-ramp to Casitas Pass Road. Pavement-breaking is expected to take place independent of the pile driving, and would occur over a period of 5 working days.

Minimization

Caltrans Standard Specifications (May 2007, Chapter 7-101I Noise Control) that are applicable on all state highway construction projects require: "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 shall be operated on the job site without the muffler." California Health and Safety Code requires the contractor to prevent visible dust from leaving the construction site.

Several methods are proposed in the United States Department of Transportation, Federal Highway Administration Highway Noise manual for dealing with construction noise. Methods that could be applicable to this project include:

Advanced Notice—The Resident Engineer will notify the District 5 Public Information office to place notice of the proposed project in local news media in advance of construction. The notice will give estimated dates of project, and mention potential noise impacts. Since some night work will take place, Resident Engineer will try to have noisier operations scheduled earlier in the evening. If complaints are received, temporary barriers will be considered.

To minimize "impacts" from pile driving and pavement breaking, residents will be notified through the local news media a week before pile driving or pavement breaking at each location. Notification should include the dates, times and locations of pile driving activities. Residents within 100 feet of each activity might what to secure loose items that could be vibrated off tables and shelves.

Construction Schedule—Whenever possible, schedule the noisiest operations duri8ng the daylight or early evening hours.

Early Construction of Sound Barriers—In cases where sound barriers are required to be installed with a project, and where the barriers would not interfere with construction, Environmental Engineering recommends construction of the barriers before the project construction begins. This is because of the additional noise protection benefit that will accrue to the local residents during the construction phase.

Public Relations—On some projects where construction noise is expected to be a problem, special telephones have been installed in the resident engineer's office to receive noise complaints. The telephone numbers were well publicized in local newspapers, and by letter to residences near the construction area. Studies show the public is more tolerant of short-term noise if construction schedules are publicized well in advance. This way, the public is able to adjust their schedules in advance for a few noisy nights. It is also recommended to keep the public advised of noisier operations through the media.

Temporary Sound Barriers—When applicable, temporary noise barriers may be effective in mitigating construction noise, dust, glare and visual impacts. These barriers can be quickly constructed from safety shape and plywood panels. When constructed within 15 feet of the edge of the traveled way (ETW), noise barriers must be placed on concrete barrier (Type 50).

Pile Driving—When pile driving or pavement breaking will take place at night (after 9:00 p.m.) within 100 feet of residences, the Resident Engineer should offer motel accommodations to the affected residents.

References

Caltrans. 1998. Technical Noise Supplement. October. Sacramento, CA: Environmental Program, Noise, Air Quality, and Hazardous Waste Management Office. Sacramento, CA. Available: (http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf).

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Federal Highway Administration. 1979. Highway Noise—Highway Construction Noise: Measurement, Prediction and Mitigation. U.S. Department of Transportation. Washington DC.

_____. 2004. FHWA Traffic Noise Model, Version 2.5 User's Guide. April. FHWA-PD-96-009. Washington D.C.

_____. 2006. Roadway Construction Noise Model. February, 15, 2006. Available: <http://www.rcnm.us/>.

Appendix 1

- **Instrumentation, manufacturer(s), model, type, serial numbers, calibration**
  1999 Studies were conducted with a 2221 Bruel and Kjaer sound level meter (Serial Number 1210555) that was calibrated before and after each reading with a 4230 Bruel and Kjaer sound level calibrator (Serial Number 1206367).
  2008 noise levels were recorded with a 2238 Bruel and Kjaer sound level meter (Serial Number 2163495) and a 4230 Bruel and Kjaer sound level calibrator (Serial Number 1206367) that was calibrated in May 2007.
- Sound level readings were taken for 10 to 20-minutes at each location with the instrument microphone covered with a standard windscreen. Instrument was mounted on a tripod at a height of 5 feet as recommended in the Protocol.
- Traffic data was counted as noise levels were being measured, and was input into the Traffic Noise Model for the calibration run.

Table A1— Model Calibration January 2008

Receiver I.D. Number	Date (Time)	Traffic (Autos/ Med. Tr./HD Tr.)	Measured Noise Level, Leq(h), dBA	Predicted Noise Level, Leq(h), dBA	Calibration Constant, K (Measured-Predicted), dBA
R7	1/31/08 (1006-1026)	NB-443/20/21 SB- 423/27/25	70.0	69.8	NA
R9b[1]	1/31/08 (1128/1138)	NB- 275/12/18 SB- 253/26/18	68.1	68.5	NA

[1] Receptor 9b is located on the highway side of the barrier that protects Receptor 9

Simultaneous noise readings and traffic counts were made at one receptor north of Route 101 (Receptor 9b), and 1 receptor south of Route 101 (Receptor 7). Predictions were made using Traffic Noise Model for the same locations using the traffic volumes counted during the measurements. The results of the predictions were within 1-decibel of the measured reading. The calibration is considered successful.

After the TNM model predicted noise levels within 1-dBA of the noise measured during the calibration runs, existing and future year traffic was input, and all locations were modeled for the current year and for the future (2036) build and no build peak-hour traffic noise hour conditions.