B.F. Sisk Dam Safety of Dam Modification Project Environmental Impact Statement / Environmental Impact Report

Appendix F: Construction Noise Calculations

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Construction Noise - Equipment
Enlarged Reservoir Alternative - Without Shear Key Option

Table F-1. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)- Without Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	5	7	88	84
	Dump Truck	Dump Truck	40%	76	72	1	0	76	72
	Grader	Grader	40%	85	81	4	6	91	87
	Loaders	Dozer	40%	82	78	6	8	90	86
	Scrapers	Scraper	40%	84	80	2	3	87	83
	Crane	Crane	16%	81	73	5	7	88	80
	Pumps	Pumps	50%	81	78	3	5	86	83
	Concrete/Industrial Saw	Concrete Saw	20%	90	83	1	0	90	83
	Off-Highway Water Trucks	Dump Truck	40%	76	72	19	13	89	85
	On-Highway Light Duty Truck	Flat Bed Truck	40%	74	70	24	14	88	84
	Crawler Tractor	Tractor	40%	84	80	6	8	92	88
	Rollers	Roller	20%	80	73	6	8	88	81
	Generator Sets	Generator	50%	81	78	1	0	81	78
	Tampers/ Rammers	Jackhammer	20%	89	82	1	0	89	82
	On-Highway Water Truck	Dump Truck	40%	76	72	5	7	83	79
	Blasting	Blasting	1%	115	95	4	6	121	101
							Peak Hour Total	**121**	**102**

Table F-2. 1-Hour Nighttime Construction Noise Level at 50 Feet (dBA)- Without Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	2	3	84	80
	Dump Truck	Dump Truck	40%	76	72	8	9	85	81
	Loaders	Dozer	40%	82	78	2	3	85	81
	On-Highway Light Duty Trucks	Flat Bed Truck	40%	74	70	13	11	85	81
	Compactor	Compactor (ground)	20%	83	76	2	3	86	79
							Peak Hour Total	**92**	**88**

Table F-3. 1-Hour Daytime Construction Noise Level at the Receptor (dBA)- Without Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	102	102	102
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	38	56	51
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	42	57	51
Daytime Increase Over Existing (dBA)	2	17	11
Significant?	No	Yes	Yes

Table F-4. 1-Hour Nighttime Construction Noise Level at the Receptor (dBA)- Without Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	88	88	88
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	24	42	36
Nighttime Unmitigated Leq (Construction Noise + Existing) (dBA)	31	42	37
Nighttime Increase Over Existing (dBA)	1	12	7
Significant?	No	Yes	Yes

County
Merced

Significance Level
10 dBA (daytime increase over existing noise levels)
5 dBA (nighttime increase over existing noise levels)

Existing Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	40
Nighttime Background Noise (dBA)	30

Sensitive Receptor Locations:

Residence on Harper Lane	16,400	feet
Subdivision off SR 152	8,250	feet
San Luis Creek Use Area	5,600	feet

Construction Noise - Equipment
Enlarged Reservoir Alternative - With Shear Key Option

Table F-5. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)- With Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	6	8	89	85
	Dump Truck	Dump Truck	40%	76	72	2	3	79	75
	Grader	Grader	40%	85	81	4	6	91	87
	Loaders	Dozer	40%	82	78	5	7	89	85
	Scrapers	Scraper	40%	84	80	2	3	87	83
	Crane	Crane	16%	81	73	5	7	88	80
	Pumps	Pumps	50%	81	78	3	5	86	83
	Concrete/Industrial Saw	Concrete Saw	20%	90	83	1	0	90	83
	Off-Highway Trucks	Dump Truck	40%	76	72	33	15	91	87
	On-Highway Light-Duty Truck	Flat Bed Truck	40%	74	70	24	14	88	84
	Crawler Tractor	Tractor	40%	84	80	7	8	92	88
	Generator Sets	Generator	50%	81	78	1	0	81	78
	Tampers/ Rammers	Jackhammer	20%	89	82	1	0	89	82
	Rollers	Roller	20%	80	73	9	10	90	83
	On-Highway Water Truck	Dump Truck	40%	76	72	5	7	83	79
	Blasting	Blasting	1%	115	95	4	6	121	101
							Peak Hour Total	**121**	**102**

Table F-6. 1-Hour Nighttime Construction Noise Level at 50 Feet (dBA)- With Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	3	5	86	82
	Dump Truck	Dump Truck	40%	76	72	2	3	79	75
	Loaders	Dozer	40%	82	78	2	3	85	81
	Off-Highway Trucks	Dump Truck	40%	76	72	15	12	88	84
	On-Highway Light Duty Truck	Flat Bed Truck	40%	74	70	15	12	86	82
	Compactor	Compactor (ground)	20%	83	76	6	8	91	84
	Crawler Tractor	Tractor	40%	84	80	4	6	90	86
							Peak Hour Total	**96**	**91**

Table F-7. 1-Hour Daytime Construction Noise Level at the Receptor (dBA)- With Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	102	102	102
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	38	57	51
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	42	57	51
Daytime Increase Over Existing (dBA)	2	17	11
Significant?	No	Yes	Yes

Table F-8. 1-Hour Nighttime Construction Noise Level at the Receptor (dBA)- With Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	91	91	91
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	27	46	40
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	32	46	41
Daytime Increase Over Existing (dBA)	2	16	11
Significant?	No	Yes	Yes

County
Merced

Significance Level
10 dBA (daytime increase over existing noise levels)
5 dBA (nighttime increase over existing noise levels)

Existing Noise Levels
Land Use Type Rural Residential
Daytime Background Noise (dBA) 40
Nighttime Background Noise (dBA) 30

Sensitive Receptor Locations:

Residence on Harper Lane 16,400 feet

Subdivision off SR 152 8,250 feet

San Luis Creek Use Area 5,600 feet

Table F-9. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)- Without Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	5	7	88	84
	Dump Truck	Dump Truck	40%	76	72	1	0	76	72
	Grader	Grader	40%	85	81	4	6	91	87
	Loaders	Dozer	40%	82	78	6	8	90	86
	Scrapers	Scraper	40%	84	80	2	3	87	83
	Crane	Crane	16%	81	73	5	7	88	80
	Pumps	Pumps	50%	81	78	3	5	86	83
	Concrete/Industrial Saw	Concrete Saw	20%	90	83	1	0	90	83
	Off-Highway Water Trucks	Dump Truck	40%	76	72	19	13	89	85
	On-Highway Light Duty Truck	Flat Bed Truck	40%	74	70	24	14	88	84
	Crawler Tractor	Tractor	40%	84	80	6	8	92	88
	Rollers	Roller	20%	80	73	6	8	88	81
	Generator Sets	Generator	50%	81	78	1	0	81	78
	Tampers/ Rammers	Jackhammer	20%	89	82	1	0	89	82
	On-Highway Water Truck	Dump Truck	40%	76	72	5	7	83	79
	Conveyor	Conveyor	100%	90	90	1	0	90	90
	Blasting	Blasting	1%	115	95	4	6	121	101
							Peak Hour Total	**121**	**102**

Table F-10. 1-Hour Nighttime Construction Noise Level at 50 Feet (dBA)- Without Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	2	3	84	80
	Dump Truck	Dump Truck	40%	76	72	8	9	85	81
	Loaders	Dozer	40%	82	78	2	3	85	81
	On-Highway Light Duty Trucks	Flat Bed Truck	40%	74	70	13	11	85	81
	Compactor	Compactor (grou	20%	83	76	2	3	86	79
	Conveyor	Conveyor	100%	90	90	1	0	90	90
							Peak Hour Total	**94**	**92**

Table F-11. 1-Hour Daytime Construction Noise Level at the Receptor (dBA)- Without Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	102	102	102
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	39	57	51
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	42	57	51
Daytime Increase Over Existing (dBA)	2	17	11
Significant?	No	Yes	Yes

Table F-12. 1-Hour Nighttime Construction Noise Level at the Receptor (dBA)- Without Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	92	92	92
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	28	46	41
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	32	46	41
Daytime Increase Over Existing (dBA)	2	16	11
Significant?	No	Yes	Yes

County	Significance Level	
Merced	10 dBA	(daytime increase over existing noise levels)
	5 dBA	(nighttime increase over existing noise levels)

Existing Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	40
Nighttime Background Noise (dBA)	30

Sensitive Receptor Locations:

Residence on Harper Lane	16,400 feet
Subdivision off SR 152	8,250 feet
San Luis Creek Use Area	5,600 feet

Table F-13. 1-Hour Daytime Construction Noise Level at 50 Feet (dBA)- With Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	6	8	89	85
	Dump Truck	Dump Truck	40%	76	72	2	3	79	75
	Grader	Grader	40%	85	81	4	6	91	87
	Loaders	Dozer	40%	82	78	5	7	89	85
	Scrapers	Scraper	40%	84	80	2	3	87	83
	Crane	Crane	16%	81	73	5	7	88	80
	Pumps	Pumps	50%	81	78	3	5	86	83
	Concrete/Industrial Saw	Concrete Saw	20%	90	83	1	0	90	83
	Off-Highway Trucks	Dump Truck	40%	76	72	33	15	91	87
	Compactor	Compactor (grou	20%	83	76	7	8	91	84
	On-Highway Light-Duty Truck	Flat Bed Truck	40%	74	70	24	14	88	84
	Crawler Tractor	Tractor	40%	84	80	7	8	92	88
	Generator Sets	Generator	50%	81	78	1	0	81	78
	Tampers/ Rammers	Jackhammer	20%	89	82	1	0	89	82
	Rollers	Roller	20%	80	73	9	10	90	83
	On-Highway Water Truck	Dump Truck	40%	76	72	5	7	83	79
	Conveyor	Conveyor	100%	90	90	1	0	90	90
	Blasting	Blasting	1%	115	95	4	6	121	101
							Peak Hour Total	**121**	**102**

Table F-14. 1-Hour Nighttime Construction Noise Level at 50 Feet (dBA)- With Shear Key Option

Phase	Equipment Description	RCNM Equipment Types	Usage Factor	Equipment Lmax @ 50'	Equipment Leq(h) @ 50'	Number of Equipment	Add to Single Source Level (dBA)	Total Lmax @ 50'	Total Leq(h) @ 50'
Peak Hour	Excavator	Excavator	40%	81	77	3	5	86	82
	Dump Truck	Dump Truck	40%	76	72	2	3	79	75
	Loaders	Dozer	40%	82	78	2	3	85	81
	Off-Highway Trucks	Dump Truck	40%	76	72	15	12	88	84
	On-Highway Light Duty Truck	Flat Bed Truck	40%	74	70	15	12	86	82
	Compactor	Compactor (grou	20%	83	76	6	8	91	84
	Crawler Tractor	Tractor	40%	84	80	4	6	90	86
	Conveyor	Conveyor	100%	90	90	1	0	90	90
							Peak Hour Total	**97**	**94**

Table F-15. 1-Hour Daytime Construction Noise Level at the Receptor (dBA)- With Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	102	102	102
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	39	57	51
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	42	57	52
Daytime Increase Over Existing (dBA)	2	17	12
Significant?	No	Yes	Yes

Table F-16. 1-Hour Nighttime Construction Noise Level at the Receptor (dBA)- With Shear Key Option

Location	Residence on Harper Lane	San Luis Creek Use Area	Subdivision off SR 152
Distance from the Center of Construction Activity to a Receptor (ft)	16,400	5,600	8,250
1-Hour Construction Noise Level at 50 ft (dBA)	94	94	94
Distance Divergence (dBA)	50.3	41.0	44.3
Atmospheric Attenuation (dBA)	13.50	4.61	6.79
1-Hour Construction Noise Level at the Receptor (dBA)	30	48	43
Daytime Unmitigated Leq (Construction Noise + Existing) (dBA)	33	48	43
Daytime Increase Over Existing (dBA)	3	18	13
Significant?	No	Yes	Yes

County

Merced

Significance Level

10 dBA (daytime increase over existing noise levels)

5 dBA (nighttime increase over existing noise levels)

Existing Noise Levels

Land Use Type	Rural Residential
Daytime Background Noise (dBA)	40
Nighttime Background Noise (dBA)	30

Sensitive Receptor Locations:

Residence on Harper Lane	16,400 feet
Subdivision off SR 152	8,250 feet
San Luis Creek Use Area	5,600 feet

Construction Noise - Traffic
Enlarged Reservoir Alternative

Table F-17. Construction Vehicles - Equivalent Noise Levels-Without Shear Key Option

Type	Roadway	Existing 2015 AADT	Maximum Daily Truck Hauling Trips	Maximum Daily Worker Trips	Speed (mph)	Equivalency Factor for Heavy-Duty Vehicles	Equivalent Vehicles	Total With Project	Increase Ratio
Interstate	I-5 at junction with SR-152	32,800	45	26	55	10.4	494	33,294	1.02
State Route	SR-152 at junction with I-5	28,700	28	24	55	10.4	315	29,015	1.01
State Route	SR-152 at junction with SR-33	28,700	118	76	55	10.4	1,303	30,003	1.05
State Route	SR-33 at junction with I-5	14,600	45	26	55	10.4	494	15,094	1.03
Local	Basalt Rd	191	118	100	35	19.1	2,354	2,545	**13.32**

Note:
Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

Maximum 13.32
Significant? Yes

Doubling of the noise source produces only a 3 dB increase, which is a barely perceptible change; therefore, there would be no audible change in traffic noise.
FHWA. 2011. Highway Traffic Noise: Analysis and Abatement Guidance.

Table F-18. Construction Vehicles - Equivalent Noise Levels-With Shear Key Option

Type	Roadway	Existing 2015 AADT	Maximum Daily Truck Hauling Trips	Maximum Daily Worker Trips	Speed (mph)	Equivalency Factor for Heavy-Duty Vehicles	Equivalent Vehicles	Total With Project	Increase Ratio
Interstate	I-5 at junction with SR-152	32,800	45	34	55	10.4	502	33,302	1.02
State Route	SR-152 at junction with I-5	28,700	28	32	55	10.4	323	29,023	1.01
State Route	SR-152 at junction with SR-33	28,700	118	100	55	10.4	1,327	30,027	1.05
State Route	SR-33 at junction with I-5	14,600	45	34	55	10.4	502	15,102	1.03
Local	Basalt Rd	191	118	132	35	19.1	2,386	2,577	**13.49**

Note:
Impacts would be significant if equivalent traffic volume increases by nine times (10 dBA increase).

Maximum 13.49
Significant? Yes

Table F-19. Atmospheric Attenuation

Assumptions	**Merced**
Ambient pressure (kPa)	101.3
Temperature (F)	68
Relative humidity (%)	90
Frequency of noise source (Hz)	500
Air Attenuation Coefficient (α, dB/km)	2.7
(dB/ft)	0.0008

$A_{air} = \alpha d$

Conversion:
0.3048 m/ft
1000 m/km

Weather in Merced County
Average temperature 62.9 °F
Average relative humidity 79.48 %

Weather in Santa Clara County
Average temperature 59.7 °F
Average relative humidity 81.51 %

Reference:
Harris, Cyril M. 1998. Handbook of Acoustical Measurements and Noise Control. 3rd ed. - Chapter 3 Calculation of Attenuation
http://www.usa.com/santa-clara-county-ca-weather.htm; http://www.usa.com/merced-county-ca-weather.htm

Table F-20. Equipment noise emissions and acoustical usage factors database

Equipment Description	Impact Device?	Acoustical Use Factor	Spec 721.560 Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50 ft (dBA, slow)
All Other Equipment > 5 hp	No	50%	85	N/A
Auger Drill Rig	No	20%	85	84
Backhoe	No	40%	80	78
Bar Bender	No	20%	80	N/A
Blasting	Yes	1%	94	115
Boring Jack Power Unit	No	50%	80	83
Chain Saw	No	20%	85	84
Clam Shovel (dropping)	Yes	20%	93	87
Compactor (ground)	No	20%	80	83
Compressor (air)	No	40%	80	78
Concrete Batch Plant	No	15%	83	N/A
Concrete Mixer Truck	No	40%	85	79
Concrete Pump Truck	No	20%	82	81
Concrete Saw	No	20%	90	90
Conveyor	No	100%	90	90
Crane	No	16%	85	81
Dozer	No	40%	85	82
Drill Rig Truck	No	20%	84	79
Drum Mixer	No	50%	80	80
Dump Truck	No	40%	84	76
Excavator	No	40%	85	81
Flat Bed Truck	No	40%	84	74
Front End Loader	No	40%	80	79
Generator	No	50%	82	81
Generator (<25KVA, VMS signs)	No	50%	70	73
Gradall	No	40%	85	83
Grader	No	40%	85	N/A
Grapple (on backhoe)	No	40%	85	87
Horizontal Boring Hydr. Jack	No	25%	80	82
Hydra Break Ram	Yes	10%	90	N/A
Impact Pile Driver	Yes	20%	95	101
Jackhammer	Yes	20%	85	89
Man Lift	No	20%	85	75
Mounted Impact Hammer (hoe ram)	Yes	20%	90	90
Pavement Scarifier	No	20%	85	90
Paver	No	50%	85	77
Pickup Truck	No	40%	55	75
Pneumatic Tools	No	50%	85	85
Pumps	No	50%	77	81
Refrigerator Unit	No	100%	82	73
Rivit Buster/Chipping Gun	Yes	20%	85	79
Rock Drill	No	20%	85	81
Roller	No	20%	85	80
Sand Blasting (Single Nozzle)	No	20%	85	96
Scraper	No	40%	85	84
Shears (on backhoe)	No	40%	85	96
Slurry Plant	No	100%	78	78
Slurry Trenching Machine	No	50%	82	80
Soil Mix Drill Rig	No	50%	80	N/A
Tractor	No	40%	84	N/A
Vacuum Excavator (vac-truck)	No	40%	85	85
Vacuum Street Sweeper	No	10%	80	82
Ventilation Fan	No	100%	85	79
Vibrating Hopper	No	50%	85	87
Vibratory Concrete Mixer	No	20%	80	80
Vibratory Pile Driver	No	20%	95	101
Warning Horn	No	5%	85	83
Welder/Torch	No	40%	73	74

Usage factor is the percentage of time during a construction noise operation that a piece of construction equipment is operating at full power. In case of construction blasting, the equipment gives a very short duration blast and can be quantified by using a 1% usage factor in the RCNM to allow for some prediction.

FHWA. RCNM User's Guide - Table 1. CA/T equipment noise emissions and acoustical usage factors database.

Table F-21. Average Ambient Noise Levels for Various Land Uses

Land Use Description	Average Ldn (dBA)	Daytime Leq (dBA)	Nighttime Leq (dBA)
Wilderness	35	35	25
Rural Residential	40	40	30
Quiet Suburban Residential	50	50	40
Normal Suburban Residential	55	55	45
Urban Residential	60	60	50
Noisy Urban Residential	65	65	55
Very Noisy Urban Residential	70	70	60

Source: U.S. EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974.

Table F-22. Noise Reductions from Mitigation Measures

Mitigation Type	Reduction (dBA)
Noise barrier or other obstruction just barely breaks the line-of-sight between the noise source and the receptor	3
Noise source completely enclosed or completely shielded with solid barrier located close to the source	8
Enclosure and/or barrier with some gaps	5
Noise source completely enclosed and completely shielded with a solid barrier located close to the source	10
Noise source enclosed or shielded with heavy vinyl noise curtain material	5

Source: FHWA. RCNM User's Guide Appendix A Best Practices for Calculating Estimated Shielding for Use in the RCNM

Table F-23. Number of Equivalent Vehicles as a Function of Vehicle Type and Speed Based on TNM Reference Energy Mean Emission Levels

Speed (km/h [mph])		Equivalent Vehicles		
		1 Heavy Truck	1 Medium Truck	1 Auto
56	(35)	19.1	7.1	1
64	(40)	15.1	5.8	1
72	(45)	12.9	5	1
80	(50)	11.5	4.5	1
88.5	(55)	10.4	4.1	1
97	(60)	9.6	3.7	1
105	(65)	7.9	3.5	1
113	(70)	8.3	3.2	1

Source: Caltrans. 2009. Technical Noise Supplement. Prepared by ICF Jones & Stokes. November.

Construction Vibration - Equipment
Crest Raise Alternative

Table F-24. Construction Vibration- Without Shear Key Option

Phase	Equipment Description	Equivalent Equipment Types	Distance (ft): / Number of Equipment	At Source 25 PPV (in/sec)	Residence on Harper Lane 16,400 PPV (in/sec)	San Luis Creek Use 5,600 PPV (in/sec)	Subdivision off SR 152 8,250 PPV (in/sec)
Peak Day	Excavator	n/a	2	n/a	n/a		n/a
	Dump Truck	Loaded Trucks	1	0.076	0.000005	0.000023	0.000013
	Grader	Small bulldozer	2	0.006	0.000000	0.000002	0.000001
	Loaders	Small bulldozer	4	0.012	0.000001	0.000004	0.000002
	Scrapers	Large Bulldozer	2	0.178	0.000011	0.000053	0.000030
	Crane	n/a	5	n/a	n/a	n/a	n/a
	Pumps	n/a	2	n/a	n/a	n/a	n/a
	Concrete/Industrial Saw	n/a	1	n/a	n/a	n/a	n/a
	Rubber Tired Loaders	Small bulldozer	3	0.009	0.000001	0.000003	0.000002
	Crawler Tractor	Large Bulldozer	4	0.356	0.000021	0.000106	0.000059
	Rollers	Vibratory Roller	4	0.840	0.000050	0.000251	0.000140
	On-Highway Water Truck	Loaded Trucks	4	0.304	0.000018	0.000091	0.000051
	Tampers/Rammers	Jackhammer	1	0.035	0.000002	0.000010	0.000006
	Generator Sets	n/a	1	n/a	n/a	n/a	n/a
	Skid Steer Loaders	Small bulldozer	1	0.003	0.000000	0.000001	0.000001
	Off-Highway Trucks	Loaded Trucks	12	0.912	0.000054	0.000272	0.000152
	Blasting	n/a	4	0.050	0.002976	0.014914	0.008341
			Peak Day Total	**N/A**	**0.003138**	**0.015729**	**0.008796**
			Significant?	**n/a**	**No**	**No**	**No**

Note: Reference distance for blasting is 2,500 feet.

Table F-25. Construction Vibration- With Shear Key Option

Phase	Equipment Description	Equivalent Equipment Types	Number of Equipment	At Source Distance (ft): 25 PPV (in/sec)	Residence on Harper Lane 16,400 PPV (in/sec)	San Luis Creek Use 5,600 PPV (in/sec)	Subdivision off SR 152 8,250 PPV (in/sec)
Peak Day	Excavator	n/a	3	n/a	n/a	n/a	n/a
	Dump Truck	Loaded Trucks	1	0.076	0.000005	0.000023	0.000013
	Grader	Small bulldozer	3	0.009	0.000001	0.000003	0.000002
	Loaders	Small bulldozer	4	0.012	0.000001	0.000004	0.000002
	Scrapers	Small bulldozer	2	0.006	0.000000	0.000002	0.000001
	Crane	n/a	5	n/a	n/a	n/a	n/a
	Pumps	n/a	2	n/a	n/a	n/a	n/a
	Concrete/Industrial Saw	n/a	1	n/a	n/a	n/a	n/a
	Rubber Tired Loaders	Small bulldozer	3	0.009	0.000001	0.000003	0.000002
	Crawler Tractor	Large Bulldozer	5	0.445	0.000026	0.000133	0.000074
	Rollers	Vibratory Roller	5	1.050	0.000062	0.000313	0.000175
	On-Highway Water Truck	Loaded Trucks	4	0.304	0.000018	0.000091	0.000051
	Tampers/Rammers	Jackhammer	1	0.035	0.000002	0.000010	0.000006
	Generator Sets	n/a	1	n/a	n/a	n/a	n/a
	Skid Steer Loaders	Small bulldozer	1	0.003	0.000000	0.000001	0.000001
	Off-Highway Trucks	Loaded Trucks	15	1.140	0.000068	0.000340	0.000190
	Blasting	n/a	4	0.050	0.002976	0.014914	0.008341
			Peak Day Total	**N/A**	**0.003160**	**0.015836**	**0.008856**
			Significant?	**n/a**	**No**	**No**	**No**

Note: Reference distance for blasting is 2,500 feet.

Significance Threshold

0.3 in/sec

Table F-26. Vibration Source Levels for Construction Equipment

Equipment	PPV at 25 ft (in/sec)	Approximate Lv† at 25 ft
Pile Driver (impact)	0.644	104
Pile Driver (sonic)	0.17	93
Clam shovel drop (slurry wall)	0.202	94
Hydromill (slurry wall) - in soil	0.008	66
Hydromill (slurry wall) - in rock	0.017	75
Vibratory Roller	0.21	94
Hoe Ram	0.089	87
Large Bulldozer	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: Federal Transit Administration. 2006. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. May.

Note:

Values for pile drivers are based on the typical vibration source levels.

† RMS velocity in decibels (VdB) re 1 micro-inch/second