Draft Environmental Impact Report

Appendix

Noise

Pacheco Reservoir Expansion Project

November 2021

Attachments

Attachment A

Noise Measurement Data

Long-Term Noise Measurement Summary

KEY: Orange cells are for input.
Grey cells are intermediate calculations performed by the model.
Green cells are data to present in a written analysis (output).

Measurement Site: near dam construction site
Measurement Date: 2/3/2021
Project Name: Pacheco Reservoir

Computation of CNEL

Hour of Day (military time)	Sound Level Leq (dBA)	Sound Power =10*Log(dBA /10)	Period of 24-Hour Day (1=included, 0=not) Day	Evening	Night	Sound Power Breakdown by Period of Day Day	Evening	Night	
0:00	39.4	8,710	0	0	1	0	0	8,710	
1:00	38.9	7,762	0	0	1	0	0	7,762	
2:00	38.7	7,413	0	0	1	0	0	7,413	
3:00	46.3	42,658	0	0	1	0	0	42,658	
4:00	43.2	20,893	0	0	1	0	0	20,893	
5:00	43.2	20,893	0	0	1	0	0	20,893	
6:00	44.7	29,512	0	0	1	0	0	29,512	
7:00	44.5	28,184	1	0	0	28,184	0	0	
8:00	42.0	15,849	1	0	0	15,849	0	0	
9:00	44.7	29,512	1	0	0	29,512	0	0	
10:00	41.4	13,804	1	0	0	13,804	0	0	
11:00	42.1	16,218	1	0	0	16,218	0	0	
12:00	45.2	33,113	1	0	0	33,113	0	0	
13:00	46.9	48,978	1	0	0	48,978	0	0	
14:00	46.7	46,774	1	0	0	46,774	0	0	
15:00	46.1	40,738	1	0	0	40,738	0	0	start time
16:00	47.4	54,954	1	0	0	54,954	0	0	
17:00	45.2	33,113	1	0	0	33,113	0	0	
18:00	45.9	38,905	1	0	0	38,905	0	0	
19:00	45.9	38,905	0	1	0	0	38,905	0	
20:00	44.9	30,903	0	1	0	0	30,903	0	
21:00	43.7	23,442	0	1	0	0	23,442	0	
22:00	40.7	11,749	0	0	1	0	0	11,749	
23:00	41.9	15,488	0	0	1	0	0	15,488	

	Day	Evening	Night
Sum of Sound Power during Period wo/penalty	400,141	93,250	165,078
Log Factor for CNEL Penalty (i.e., 10*log(x))	1	3	10
Sound Power during Period with penalty	400,141	279,749	1,650,783

Total Daily Sound Power, with penalties	2,330,673
Hours per Day	24
Average Hourly Sound Power, with penalties	97,111
CNEL	49.9

Ldn computation on next page.

Computation of Ldn

Period of 24-Hour Day (1=included, 0=not)		Sound Power Breakdown by Period of Day	
Day	Night	Day	Night
0	1	0	8,710
0	1	0	7,762
0	1	0	7,413
0	1	0	42,658
0	1	0	20,893
0	1	0	20,893
0	1	0	29,512
1	0	28,184	0
1	0	15,849	0
1	0	29,512	0
1	0	13,804	0
1	0	16,218	0
1	0	33,113	0
1	0	48,978	0
1	0	46,774	0
1	0	40,738	0
1	0	54,954	0
1	0	33,113	0
1	0	38,905	0
1	0	38,905	0
1	0	30,903	0
1	0	23,442	0
0	1	0	11,749
0	1	0	15,488

Sum of Sound Power during Period wo/penalty	493,391	165,078
Log Factor for Penalty (i.e., 10*log(x))	1	10
Sound Power during Period with penalty	493,391	1,650,783

Total Daily Sound Power, with penalties	2,144,174
Hours per Day	24
Average Hourly Sound Power, with penalties	89,341
Ldn	49.5

Notes:

Computation of the CNEL based on 1-hour Leq measurements for each hour of a day are based on equation 2-27 on pg. 2-57 of Caltrans 2009.

Computation of the Ldn based on 1-hour Leq measurements for each hour of a day are based on equation 2-26 on pg. 2-56 of Caltrans 2009.

Log factors for the Ldn and CNEL penalties are provided in Table 2-12 on pg. 2-52 of Caltrans 2009.

Source:

California Deaprtment of Transportation (Caltrans), Divisiong of Environmental Analysis. 2009 (November). *2009 Technical Noise Supplement* . Sacramento, CA. Available: <http://www.dot.ca.gov/hq/env/noise/>. Accessed September 24, 2010.

Summary- ST 1

File Name on Meter	LxT_Data.056.s			
File Name on PC	LxT_0003285-20210203 153220-LxT_Data.056.ldbi			
Serial Number	0003285			
Model	SoundTrack LxT®			
Firmware Version	2.302			
User				
Location				
Job Description				
Note				

Measurement

Description				
Start	2021-02-03 15:32:20			
Stop	2021-02-03 15:47:23			
Duration	00:15:02.3			
Run Time	00:15:02.3			
Pause	00:00:00.0			
Pre-Calibration	2021-02-03 15:31:06			
Post-Calibration	None			
Calibration Deviation	---			

Overall Settings

RMS Weight	A Weighting			
Peak Weight	A Weighting			
Detector	Slow			
Preamplifier	PRMLxT1L			
Microphone Correction	Off			
Integration Method	Linear			
Overload	121.8	dB		
	A		**C**	**Z**
Under Range Peak	**78.1**		75.1	80.1
Under Range Limit	**26.1**		25.9	31.0
Noise Floor	16.5		16.7	21.9

Results

LAeq	51.9			
LAE	81.4			
EA	15.399	µPa²h		
EA8	491.517	µPa²h		
EA40	2.458	mPa²h		
LApeak (max)	2021-02-03 15:33:38		81.3	dB
LASmax	2021-02-03 15:40:54		62.1	dB
LASmin	2021-02-03 15:32:43		37.4	dB
SEA	-99.94	dB		

LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LApeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LApeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LApeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s

LCeq	65.1 dB
LAeq	51.9 dB
LCeq - LAeq	13.2 dB
LAIeq	53.0 dB
LAeq	51.9 dB
LAIeq - LAeq	1.1 dB

	A		
	dB	**Time Stamp**	**dB**
Leq	51.9		65.1
LS(max)	62.1	2021/02/03 15:40:54	
LS(min)	37.4	2021/02/03 15:32:43	
LPeak(max)	81.3	2021/02/03 15:33:38	

Overload Count	0
Overload Duration	0.0 s

Dose Settings

Dose Name	OSHA-1	OSHA-2
Exchange Rate	5	3 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h

Results

Dose	0.01	0.00 %
Projected Dose	0.47	0.02 %
TWA (Projected)	51.4	51.9 dB
TWA (t)	26.4	36.8 dB
Lep (t)	36.8	36.8 dB

Statistics

LAI5.00	55.3 dB
LAI10.00	53.9 dB
LAI33.30	52.0 dB
LAI50.00	50.9 dB
LAI66.60	49.7 dB
LAI90.00	46.9 dB

Calibration History

Preamp	**Date**	**dB re. 1V/Pa**
PRMLxT1L	2021-02-03 15:31:03	-28.14

PRMLxT1L	2020-04-23 12:50:26	-27.93
PRMLxT1L	2020-02-27 05:51:17	-28.11
PRMLxT1L	2020-02-26 09:44:36	-28.09
PRMLxT1L	2020-02-26 09:05:52	-27.97
PRMLxT1L	2020-02-12 14:56:47	-28.14
PRMLxT1L	2020-02-12 14:35:25	-28.06
PRMLxT1L	2020-02-12 14:22:03	-28.08
PRMLxT1L	2020-01-31 10:37:34	-28.15
PRMLxT1L	2020-01-29 09:40:48	-28.13
PRMLxT1L	2020-01-15 11:51:04	-28.02

Summary- ST 2			
File Name on Meter	LxT_Data.057.s		
File Name on PC	LxT_0003285-20210204 122000-LxT_Data.057.ldbi		
Serial Number	0003285		
Model	SoundTrack LxT®		
Firmware Version	2.302		
User			
Location			
Job Description			
Note			

Measurement	
Description	
Start	2021-02-04 12:20:00
Stop	2021-02-04 12:35:00
Duration	00:15:00.7
Run Time	00:15:00.7
Pause	00:00:00.0
Pre-Calibration	2021-02-04 12:16:45
Post-Calibration	None
Calibration Deviation	---

Overall Settings				
RMS Weight	A Weighting			
Peak Weight	A Weighting			
Detector	Slow			
Preamplifier	PRMLxT1L			
Microphone Correction	Off			
Integration Method	Linear			
Overload	121.8	dB		
	A		**C**	**Z**
Under Range Peak	**78.1**		75.1	80.1
Under Range Limit	**26.1**		25.8	31.0
Noise Floor	16.4		16.7	21.8

Results				
LAeq	69.6			
LAE	99.2			
EA	915.036	μPa²h		
EA8	29.258	mPa²h		
EA40	146.292	mPa²h		
LApeak (max)	2021-02-04 12:29:31		91.9	dB
LASmax	2021-02-04 12:22:46		79.0	dB
LASmin	2021-02-04 12:30:29		51.4	dB
SEA	-99.94	dB		

LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LApeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LApeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LApeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s

LCeq	76.0 dB
LAeq	69.6 dB
LCeq - LAeq	6.3 dB
LAIeq	71.4 dB
LAeq	69.6 dB
LAIeq - LAeq	1.8 dB

	A		
	dB	**Time Stamp**	**dB**
Leq	69.6		76.0
LS(max)	79.0	2021/02/04 12:22:46	
LS(min)	51.4	2021/02/04 12:30:29	
LPeak(max)	91.9	2021/02/04 12:29:31	

Overload Count	0
Overload Duration	0.0 s

Dose Settings

Dose Name	OSHA-1	OSHA-2
Exchange Rate	5	3 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h

Results

Dose	0.16	0.03 %
Projected Dose	5.24	0.91 %
TWA (Projected)	68.7	69.6 dB
TWA (t)	43.7	54.6 dB
Lep (t)	54.6	54.6 dB

Statistics

LAI5.00	74.8 dB
LAI10.00	73.7 dB
LAI33.30	69.5 dB
LAI50.00	67.4 dB
LAI66.60	65.4 dB
LAI90.00	60.4 dB

Calibration History

Preamp	**Date**	**dB re. 1V/Pa**
PRMLxT1L	2021-02-04 12:16:45	-28.10

PRMLxT1L	2021-02-03 15:31:03	-28.14
PRMLxT1L	2020-04-23 12:50:26	-27.93
PRMLxT1L	2020-02-27 05:51:17	-28.11
PRMLxT1L	2020-02-26 09:44:36	-28.09
PRMLxT1L	2020-02-26 09:05:52	-27.97
PRMLxT1L	2020-02-12 14:56:47	-28.14
PRMLxT1L	2020-02-12 14:35:25	-28.06
PRMLxT1L	2020-02-12 14:22:03	-28.08
PRMLxT1L	2020-01-31 10:37:34	-28.15
PRMLxT1L	2020-01-29 09:40:48	-28.13

Attachment B

Noise Propagation Calculations

Construction Source Noise Prediction Model

	Distance in feet	Combined Predicted Noise Level (L_{eq} dBA)
Daytime threshold	619	60.0
Nighttime threshold	1,554	50.0

Equipment	Reference Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Front End Loader	80	0.4
Excavator	85	0.4
Dozer	85	0.4
Generator	82	0.5
Backhoe	80	0.4
Excavator	85	0.4

Ground Type	soft
Source Height	8
Receiver Height	5
Ground Factor[2]	0.63

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Front End Loader	76.0
Excavator	81.0
Dozer	81.0
Generator	79.0
Backhoe	76.0
Excavator	81.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
87.3

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Table 4-26 from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 86).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 176 and 177).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2018: pg 86); and

D = Distance from source to receiver.

Construction Source Noise Prediction Model

	Distance in feet	Combined Predicted Noise Level (L_{eq} dBA)
Daytime threshold	288	75.0

Equipment	Reference Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Blasting	94	1

Ground Type	soft
Source Height	8
Receiver Height	5
Ground Factor[2]	0.63

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Blasting	94.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
94.0

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Table 4-26 from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 86).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 176 and 177).

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2018: pg 86); and

D = Distance from source to receiver.

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Auger Drill Rig	20	85	84	36	79.0	72.0	100	78.0	71.0
Backhoe	40	80	78	372	74.0	70.0	100	72.0	68.0
Bar Bender	20	80	na	0	74.0	67.0	100		
Blasting	na	94	na	0	88.0		100		
Boring Jack Power Unit	50	80	83	1	74.0	71.0	100	77.0	74.0
Chain Saw	20	85	84	46	79.0	72.0	100	78.0	71.0
Clam Shovel (dropping)	20	93	87	4	87.0	80.0	100	81.0	74.0
Compactor (ground)	20	80	83	57	74.0	67.0	100	77.0	70.0
Compressor (air)	40	80	78	18	74.0	70.0	100	72.0	68.0
Concrete Batch Plant	15	83	na	0	77.0	68.7	100		
Concrete Mixer Truck	40	85	79	40	79.0	75.0	100	73.0	69.0
Concrete Pump Truck	20	82	81	30	76.0	69.0	100	75.0	68.0
Concrete Saw	20	90	90	55	84.0	77.0	100	84.0	77.0
Crane	16	85	81	405	79.0	71.0	100	75.0	67.0
Dozer	40	85	82	55	79.0	75.0	100	76.0	72.0
Drill Rig Truck	20	84	79	22	78.0	71.0	100	73.0	66.0
Drum Mixer	50	80	80	1	74.0	71.0	100	74.0	71.0
Dump Truck	40	84	76	31	78.0	74.0	100	70.0	66.0
Excavator	40	85	81	170	79.0	75.0	100	75.0	71.0
Flat Bed Truck	40	84	74	4	78.0	74.0	100	68.0	64.0
Front End Loader	40	80	79	96	74.0	70.0	100	73.0	69.0
Generator	50	82	81	19	76.0	73.0	100	75.0	72.0
Generator (<25KVA, VMS s	50	70	73	74	64.0	61.0	100	67.0	64.0
Gradall	40	85	83	70	79.0	75.0	100	77.0	73.0
Grader	40	85	na	0	79.0	75.0	100		
Grapple (on Backhoe)	40	85	87	1	79.0	75.0	100	81.0	77.0
Horizontal Boring Hydr. Jac	25	80	82	6	74.0	68.0	100	76.0	70.0
Hydra Break Ram	10	90	na	0	84.0	74.0	100		
Impact Pile Driver	20	95	101	11	89.0	82.0	100	95.0	88.0
Jackhammer	20	85	89	133	79.0	72.0	100	83.0	76.0
Man Lift	20	85	75	23	79.0	72.0	100	69.0	62.0
Mounted Impact Hammer	20	90	90	212	84.0	77.0	100	84.0	77.0
Pavement Scarafier	20	85	90	2	79.0	72.0	100	84.0	77.0
Paver	50	85	77	9	79.0	76.0	100	71.0	68.0
Pickup Truck	40	55	75	1	49.0	45.0	100	69.0	65.0
Pneumatic Tools	50	85	85	90	79.0	76.0	100	79.0	76.0
Pumps	50	77	81	17	71.0	68.0	100	75.0	72.0
Refrigerator Unit	100	82	73	3	76.0	76.0	100	67.0	67.0
Rivit Buster/chipping gun	20	85	79	19	79.0	72.0	100	73.0	66.0
Rock Drill	20	85	81	3	79.0	72.0	100	75.0	68.0
Roller	20	85	80	16	79.0	72.0	100	74.0	67.0
Sand Blasting (Single Nozzl	20	85	96	9	79.0	72.0	100	90.0	83.0
Scraper	40	85	84	12	79.0	75.0	100	78.0	74.0
Shears (on backhoe)	40	85	96	5	79.0	75.0	100	90.0	86.0
Slurry Plant	100	78	78	1	72.0	72.0	100	72.0	72.0
Slurry Trenching Machine	50	82	80	75	76.0	73.0	100	74.0	71.0
Soil Mix Drill Rig	50	80	na	0	74.0	71.0	100		
Tractor	40	84	na	0	78.0	74.0	100		
Vacuum Excavator (Vac-tru	40	85	85	149	79.0	75.0	100	79.0	75.0
Vacuum Street Sweeper	10	80	82	19	74.0	64.0	100	76.0	66.0

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Ventilation Fan	100	85	79	13	79.0	79.0	100	73.0	73.0
Vibrating Hopper	50	85	87	1	79.0	76.0	100	81.0	78.0
Vibratory Concrete Mixer	20	80	80	1	74.0	67.0	100	74.0	67.0
Vibratory Pile Driver	20	95	101	44	89.0	82.0	100	95.0	88.0
Warning Horn	5	85	83	12	79.0	66.0	100	77.0	64.0
Welder / Torch	40	73	74	5	67.0	63.0	100	68.0	64.0
Helicopter		98							

Source:
FHWA Roadway Construction Noise Model, January 2006. Table 9.1
U.S. Department of Transportation
CA/T Construction Spec. 721.560

Pump Station Noise

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	1,375	45.0
SF Res	620	52.2
Residence 2		#NUM!

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Pumps	77	0.5
Pumps	77	0.5
Pumps	77	0.5
Pumps	77	0.5
Pumps	77	0.5
Pumps	77	0.5
Pumps	77	0.5

Ground Type	soft
Source Height	8
Receiver Height	5
Ground Factor[2]	0.63

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Pumps	74.0
Pumps	74.0
Pumps	74.0
Pumps	74.0
Pumps	74.0
Pumps	74.0
Pumps	74.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
81

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Auger Drill Rig	20	85	84	36	79.0	72.0	100	78.0	71.0
Backhoe	40	80	78	372	74.0	70.0	100	72.0	68.0
Bar Bender	20	80	na	0	74.0	67.0	100		
Blasting	na	94	na	0	88.0		100		
Boring Jack Power Unit	50	80	83	1	74.0	71.0	100	77.0	74.0
Chain Saw	20	85	84	46	79.0	72.0	100	78.0	71.0
Clam Shovel (dropping)	20	93	87	4	87.0	80.0	100	81.0	74.0
Compactor (ground)	20	80	83	57	74.0	67.0	100	77.0	70.0
Compressor (air)	40	80	78	18	74.0	70.0	100	72.0	68.0
Concrete Batch Plant	15	83	na	0	77.0	68.7	100		
Concrete Mixer Truck	40	85	79	40	79.0	75.0	100	73.0	69.0
Concrete Pump Truck	20	82	81	30	76.0	69.0	100	75.0	68.0
Concrete Saw	20	90	90	55	84.0	77.0	100	84.0	77.0
Crane	16	85	81	405	79.0	71.0	100	75.0	67.0
Dozer	40	85	82	55	79.0	75.0	100	76.0	72.0
Drill Rig Truck	20	84	79	22	78.0	71.0	100	73.0	66.0
Drum Mixer	50	80	80	1	74.0	71.0	100	74.0	71.0
Dump Truck	40	84	76	31	78.0	74.0	100	70.0	66.0
Excavator	40	85	81	170	79.0	75.0	100	75.0	71.0
Flat Bed Truck	40	84	74	4	78.0	74.0	100	68.0	64.0
Front End Loader	40	80	79	96	74.0	70.0	100	73.0	69.0
Generator	50	82	81	19	76.0	73.0	100	75.0	72.0
Generator (<25KVA, VMS s	50	70	73	74	64.0	61.0	100	67.0	64.0
Gradall	40	85	83	70	79.0	75.0	100	77.0	73.0
Grader	40	85	na	0	79.0	75.0	100		
Grapple (on Backhoe)	40	85	87	1	79.0	75.0	100	81.0	77.0
Horizontal Boring Hydr. Ja	25	80	82	6	74.0	68.0	100	76.0	70.0
Hydra Break Ram	10	90	na	0	84.0	74.0	100		
Impact Pile Driver	20	95	101	11	89.0	82.0	100	95.0	88.0
Jackhammer	20	85	89	133	79.0	72.0	100	83.0	76.0
Man Lift	20	85	75	23	79.0	72.0	100	69.0	62.0
Mounted Impact Hammer	20	90	90	212	84.0	77.0	100	84.0	77.0
Pavement Scarafier	20	85	90	2	79.0	72.0	100	84.0	77.0
Paver	50	85	77	9	79.0	76.0	100	71.0	68.0
Pickup Truck	40	55	75	1	49.0	45.0	100	69.0	65.0
Pneumatic Tools	50	85	85	90	79.0	76.0	100	79.0	76.0
Pumps	50	77	81	17	71.0	68.0	100	75.0	72.0
Refrigerator Unit	100	82	73	3	76.0	76.0	100	67.0	67.0
Rivit Buster/chipping gun	20	85	79	19	79.0	72.0	100	73.0	66.0
Rock Drill	20	85	81	3	79.0	72.0	100	75.0	68.0
Roller	20	85	80	16	79.0	72.0	100	74.0	67.0
Sand Blasting (Single Nozzl	20	85	96	9	79.0	72.0	100	90.0	83.0
Scraper	40	85	84	12	79.0	75.0	100	78.0	74.0
Shears (on backhoe)	40	85	96	5	79.0	75.0	100	90.0	86.0
Slurry Plant	100	78	78	1	72.0	72.0	100	72.0	72.0
Slurry Trenching Machine	50	82	80	75	76.0	73.0	100	74.0	71.0
Soil Mix Drill Rig	50	80	na	0	74.0	71.0	100		
Tractor	40	84	na	0	78.0	74.0	100		
Vacuum Excavator (Vac-tr	40	85	85	149	79.0	75.0	100	79.0	75.0
Vacuum Street Sweeper	10	80	82	19	74.0	64.0	100	76.0	66.0
Ventilation Fan	100	85	79	13	79.0	79.0	100	73.0	73.0
Vibrating Hopper	50	85	87	1	79.0	76.0	100	81.0	78.0
Vibratory Concrete Mixer	20	80	80	1	74.0	67.0	100	74.0	67.0

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Vibratory Pile Driver	20	95	101	44	89.0	82.0	100	95.0	88.0
Warning Horn	5	85	83	12	79.0	66.0	100	77.0	64.0
Welder / Torch	40	73	74	5	67.0	63.0	100	68.0	64.0
chipper		75							

Source:
FHWA Roadway Construction Noise Model, January 2006. Table 9.1
U.S. Department of Transportation
CA/T Construction Spec. 721.560

Distance Propagation Calculations for Stationary Sources of Ground Vibration

ASCENT ENVIRONMENTAL

KEY: Orange cells are for input.

Grey cells are intermediate calculations performed by the model.

Green cells are data to present in a written analysis (output).

STEP 1: Determine units in which to perform calculation.

— If vibration decibels (VdB), then use Table A and proceed to Steps 2A and 3A.

— If peak particle velocity (PPV), then use Table B and proceed to Steps 2B and 3B.

STEP 2A: Identify the vibration source and enter the reference vibration level (VdB) and distance.

STEP 3A: Select the distance to the receiver.

Table A. Propagation of vibration decibels (VdB) with distance

Noise Source/ID	Reference Noise Level vibration level (VdB)	@	distance (ft)	Attenuated Noise Level at Receptor vibration level (VdB)	@	distance (ft)
Impact Pile Driver	112	@	25	79.8	@	295
Blasting	109	@	25	79.8	@	235
Vibratory Roller	94	@	25	79.7	@	75
Large Bulldozer	87	@	25	79.3	@	45
Caisson Drilling	87	@	25	79.3	@	45
Loaded Truck	86	@	25	79.9	@	40
Jackhammer	79	@	25	79.0	@	25
Small Bulldozer	58	@	25	79.0	@	5

The Lv metric (VdB) is used to assess the likelihood for vibration to result in human annoyance.

STEP 2B: Identify the vibration source and enter the reference peak particle velocity (PPV) and distance.

STEP 3B: Select the distance to the receiver.

Table B. Propagation of peak particle velocity (PPV) with distance

Noise Source/ID	Reference Noise Level vibration level (PPV)	@	distance (ft)	Attenuated Noise Level at Receptor vibration level (PPV)	@	distance (ft)
Impact Pile Driver	1.518	@	25	0.49	@	53
Blasting	1.130	@	25	0.50	@	43
Vibratory Roller	0.210	@	25	0.50	@	14
Large Bulldozer	0.089	@	25	0.49	@	8
Caisson Drilling	0.089	@	25	0.49	@	8
Loaded Truck	0.076	@	25	0.51	@	7
Jackhammer	0.035	@	25	0.39	@	5
Small Bulldozer	0.003	@	25	0.13	@	2

The PPV metric (in/sec) is used for assessing the likelihood for the potential of structural damage.

Notes:

Computation of propagated vibration levels is based on the equations presented on pg. 185 of FTA 2018. Estimates of attenuated vibration levels do not account for reductions from intervening underground barriers or other underground structures of any type, or changes in soil type.

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123. Washington, D.C. Accessed: December 20, 2020. Page Available:

https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

Attenuation Calculations for Stationary Noise Sources

KEY: Orange cells are for input.

Grey cells are intermediate calculations performed by the model.

Green cells are data to present in a written analysis (output).

STEP 1: Identify the noise source and enter the reference noise level (dBA and distance).

STEP 2: Select the ground type (hard or soft), and enter the source and receiver heights.

STEP 3: Select the distance to the receiver.

Noise Source/ID	Reference Noise Level			Attenuation Characteristics				Attenuated Noise Level at Receptor		
	noise level (dBA)	@	distance (ft)	Ground Type (soft/hard)	Source Height (ft)	Receiver Height (ft)	Ground Factor	noise level (dBA)	@	distance (ft)
Kaman K-1200 helicopter	83.0	@	492	hard	6	5	0.00	99.8	@	71
Kaman K-1200 helicopter	83.0	@	492	hard	6	5	0.00	79.9	@	700

Notes:

Estimates of attenuated noise levels do not account for reductions from intervening barriers, including walls, trees, vegetation, or structures of any type.

Computation of the attenuated noise level is based on the equation presented on pg. 176 and 177 of FTA 2018.

Computation of the ground factor is based on the equation presentd in Table 4-26 on pg. 86 of FTA 2018, where the distance of the reference noise leve can be adjusted and the usage factor is not applied (i.e., the usage factor is equal to 1).

Sources:

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment. Washington, D.C. Available: <http://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf>Accessed: March 5, 2020.

Traffic Noise Spreadsheet Calculator

Project Genereated Truck Trip Noise

Project: **Pacheco Reservoir Expansion Project**

Noise Level Descriptor: Leq
Site Conditions: Soft
Traffic Input: Peak
Traffic K-Factor:

			Input											Output				
		Segment Description and Location			Distance to Directional Centerline, (feet)4		Traffic Distribution Characteristics								Distance to Contour, (feet)3			
Number	Name	Road Segmetn	Peak Hour Volume	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night	Leq, (dBA)5,6,7		65 dBA	60 dBA	55 dBA	50 dBA
PP	Access Roads	Kaiser Aetna Road/SR 152	146	30	92	108	84.0%	2.0%	14.0%	60.0%	25.0%	15.0%	55.5		23	50	108	232
Alt A	Access Roads	Kaiser Aetna Road/SR 152	307	30	92	108	90.0%	2.0%	8.0%	60.0%	25.0%	15.0%	57.0		29	63	136	294
Alt B	Access Roads	Kaiser Aetna Road/SR 152	194	30	92	108	90.0%	2.0%	8.0%	60.0%	25.0%	15.0%	55.1		22	47	101	217
Alt C	Access Roads	Kaiser Aetna Road/SR 152	147	30	92	108	83.0%	2.0%	15.0%	60.0%	25.0%	15.0%	55.8		24	52	112	241
Alt D	Access Roads	Kaiser Aetna Road/SR 152	225	30	92	108	90.0%	2.0%	8.0%	60.0%	25.0%	15.0%	55.7		24	51	111	239

Access Road analysis assumes all trucks at one intersection, thus volumes and project-generated noise at other intersections would be lower

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Traffic Noise Spreadsheet Calculator
SR 152 Existing Traffic Noise Levels

Project: **Pacheco Reservoir Expansion Project**

Noise Level Descriptor: Leq
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 10

Segment Description and Location				Input											Output				
						Distance to Directional Centerline, (feet)4		Traffic Distribution Characteristics							Leq,	Distance to Contour, (feet)3			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night		(dBA)5,6,7	70 dBA	65 dBA	60 dBA	55 dBA
1	State Route 152	Casa De Fruta	Santa Clara/Merced County Line	41,800	65	70	130	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%		75.1	208	448	965	2078

Peak hour assumes 2 hours of the day so total trips/2

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Traffic Noise Spreadsheet Calculator
SR 152 With Project Truck Noise

Project: **Pacheco Reservoir Expansion Project**

Noise Level Descriptor: Leq
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor: 10

Segment Description and Location				Input											Output				
						Distance to Directional Centerline, (feet)4		Traffic Distribution Characteristics								Distance to Contour, (feet)3			
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night	Leq, (dBA)5,6,7	70 dBA	65 dBA	60 dBA	55 dBA
PP	State Route 152	Casa De Fruta	Santa Clara/Merced County Line	41,946	65	70	130	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	75.1	208	449	967	2083
Alt A	State Route 152	Casa De Fruta	Santa Clara/Merced County Line	42,021	65	70	130	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	75.1	209	449	968	2086
Alt B	State Route 152	Casa De Fruta	Santa Clara/Merced County Line	41,994	65	70	130	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	75.1	208	449	968	2085
Alt C	State Route 152	Casa De Fruta	Santa Clara/Merced County Line	41,947	65	70	130	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	75.1	208	449	967	2083
Alt D	State Route 152	Casa De Fruta	Santa Clara/Merced County Line	42,025	65	70	130	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	75.1	209	449	968	2086

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

Citation #	Citations	
1	Caltrans Technical Noise Supplement. 2009 (November). Table (5-11), Pg 5-60.	Caltrans Technical Noise Supplement. 2013 (September). Table (4-2), Pg 4-17.
2	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-26), Pg 5-60.	Caltrans Technical Noise Supplement. 2013 (September). Equation (4-5), Pg 4-17.
3	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-16), Pg 2-32.	FHWA 2004 TNM Version 2.5
4	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-11), Pg 5-47, 48.	FHWA 2004 TNM Version 2.5
5	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-26), Pg 2-55, 56.	Caltrans Technical Noise Supplement. 2013 (September). Equation (2-23), Pg 2-51, 52.
6	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-27), Pg 2-57.	Caltrans Technical Noise Supplement. 2013 (September). Equation (2-24), Pg 2-53.
7	Caltrans Technical Noise Supplement. 2009 (November). Pg 2-53.	Caltrans Technical Noise Supplement. 2013 (September). Pg 2-57.
8	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-7), Pg 5-45.	FHWA 2004 TNM Version 2.5
9	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-8), Pg 5-45.	FHWA 2004 TNM Version 2.5
10	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-9), Pg 5-45.	FHWA 2004 TNM Version 2.5
11	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-13), Pg 5-49.	FHWA 2004 TNM Version 2.5
12	Caltrans Technical Noise Supplement. 2009 (November). Equation (5-14), Pg 5-49.	FHWA 2004 TNM Version 2.5
13	Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (16), Pg 67	
14	Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (20), Pg 69	
15	Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (18), Pg 69	

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California Department of Transportation (Caltrans). 2009 (November). Technical Noise Supplement. Available: http://www.dot.ca.gov/hq/env/noise/pub/tens_complete.pdf. Accessed August 17, 2017.

California Department of Transportation (Caltrans). 2013 (September). Technical Noise Supplement. Available: http://www.dot.ca.gov/hq/env/noise/pub/TeNS_Sept_2013A.pdf. Accessed August 17, 2017.

Federal Highway Administration. 2004. Traffic Noise Model Version 2.5. Available: https://www.fhwa.dot.gov/environment/noise/traffic_noise_model/tnm_v25/. Accessed August 17, 2017.