

# Appendix F

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Noise Modeling Data

# Construction Source Noise Prediction Model

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L <sub>eq</sub> dBA)	Equipment	Reference Noise Levels (L <sub>max</sub> ) at 50 feet <sup>1</sup>	Usage Factor <sup>1</sup>
Threshold	856	60.0	Excavator	85	0.4
Leland Stanford Mansion State Historic Park	100	78.6	Excavator	85	0.4
Nearest office buildings	200	72.6	Front End Loader	80	0.4
Braille and Talking Book Library	260	70.3			
California State Library	480	65.0			
Rainbow Day Care	600	63.1			
Franklin D Roosevelt Park	650	62.4			
Discovery Tree School	750	61.1			
Capitol Towers Apartments	780	60.8			
			Ground Type	hard	
			Source Height	8	
			Receiver Height	5	
			Ground Factor <sup>2</sup>	0.00	
			Predicted Noise Level <sup>3</sup>	L <sub>eq</sub> dBA at 50 feet <sup>3</sup>	
			Excavator	81.0	
			Excavator	81.0	
			Front End Loader	76.0	
<b>Combined Predicted Noise Level (L<sub>eq</sub> dBA at 50 feet)</b>					
84.7					

Sources:

<sup>1</sup> Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

<sup>2</sup> Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

<sup>3</sup> Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

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

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.



## Construction Source Noise Prediction Model

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L <sub>max</sub> dBA)	Equipment	Reference Emission Noise Levels (L <sub>max</sub> ) at 50 feet <sup>1</sup>	Usage Factor <sup>1</sup>
Threshold	241	75.0	Excavator	85	1
Leland Stanford Mansion State Historic Park	100	82.6	Excavator	85	1
Nearest office buildings	200	76.6	Front End Loader	80	1
Braille and Talking Book Library	260	74.3			
California State Library	480	69.0			
Rainbow Day Care	600	67.1			
Franklin D Roosevelt State Park	650	66.4			
Discovery Tree School	750	65.1			
Capitol Towers Apartments	780	64.8			
			Ground Type	HARD	
			Source Height	8	
			Receiver Height	5	
			Ground Factor <sup>2</sup>	0.00	
			<b>Predicted Noise Level<sup>3</sup></b>	<b>L<sub>eq</sub> dBA at 50 feet<sup>3</sup></b>	
			Excavator	85.0	
			Excavator	85.0	
			Front End Loader	80.0	
			<b>Combined Predicted Noise Level (L<sub>max</sub> dBA at 50 feet)</b>		
					88.6

Sources:

<sup>1</sup> Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

<sup>2</sup> Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

<sup>3</sup> Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

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

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 si	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 Nozzle	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
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

Source:

FHWA Roadway Construction Noise Model, January 2006. Table 1  
U.S. Department of Transportation  
CA/T Construction Spec. 721.560

# Distance Propagation Calculations for Stationary Sources of Ground Vibration



**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.

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

Noise Source/ID	Reference Noise Level		
	vibration level (VdB)	@	distance (ft)

## STEP 3A: Select the distance to the receiver.

Attenuated Noise Level at Receptor		
vibration level (VdB)	@	distance (ft)

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

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

Noise Source/ID	Reference Noise Level		
	vibration level (PPV)	@	distance (ft)
Pile drilling	0.089	@	25
Pile drilling	0.089	@	25

## STEP 3B: Select the distance to the receiver.

Attenuated Noise Level at Receptor		
vibration level (PPV)	@	distance (ft)
0.19	@	15
0.08		27

### Notes:

Computation of propagated vibration levels is based on the equations presented on pg. 12-11 of FTA 2006. 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.

### Sources:

Federal Transit Association (FTA). 2006 (May). Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. Washington, D.C. Available: <[http://www.fta.dot.gov/documents/FTA\\_Noise\\_and\\_Vibration\\_Manual.pdf](http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf)>. Accessed: September 24, 2010.

Traffic Noise Spreadsheet Calculator



Project: #REF!

Noise Level Descriptor: CNEL  
 Site Conditions: Hard  
 Traffic Input: Peak  
 Traffic K-Factor: 9.76

Segment Description and Location				Input										Output					
Number	Name	From	To	Peak Hour Volume	Speed (mph)	Distance to Directional Centerline, (feet) <sub>4</sub>		Traffic Distribution Characteristics					CNEL, (dBA) <sub>5,6,7</sub>	Distance to Contour, (feet) <sub>3</sub>					
						Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve		% Night	70 dBA	65 dBA	60 dBA	55 dBA	
#REF!																			
1	N Street	7th Street	8th Street	570	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.3	9	27	85	269	
2	N Street	8th Street	9th Street	560	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.2	8	26	84	265	
3	N Street	9th Street	10th Street	686	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.1	10	32	103	324	
4	N Street	10th Street	11th Street	820	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.9	12	39	123	387	
5	O Street	7th Street	8th Street	52	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51.9	1	2	8	25	
6	O Street	8th Street	9th Street	78	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	53.7	1	4	12	37	
7	P Street	2nd Street	3rd Street	2,644	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69.0	40	125	395	1249	
8	P Street	3rd Street	5th Street	1,971	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.7	29	93	295	931	
9	P Street	7th Street	8th Street	1,264	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.8	19	60	189	597	
10	P Street	8th Street	9th Street	1,226	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.6	18	58	183	579	
11	P Street	9th Street	10th Street	1,233	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.7	18	58	184	583	
12	P Street	10th Street	11th Street	1,183	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.5	18	56	177	559	
13	Q Street	2nd Street	3rd Street	2,879	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69.3	43	136	430	1360	
14	Q Street	3rd Street	4th Street	2,710	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69.1	40	128	405	1281	
15	Q Street	6th Street	7th Street	1,302	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.9	19	62	195	615	
16	Q Street	7th Street	8th Street	1,229	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.7	18	58	184	581	
17	Q Street	8th Street	9th Street	1,044	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.9	16	49	156	493	
18	Q Street	9th Street	10th Street	1,099	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.2	16	52	164	519	
19	Q Street	10th Street	11th Street	887	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.2	13	42	133	419	
20	W Street	10th Street	11th Street	1,660	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.0	25	78	248	784	
21	W Street	11th Street	12th Street	1,644	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	66.9	25	78	246	777	
22	W Street	14th Street	15th Street	948	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.5	14	45	142	448	
23	W Street	15th Street	16th Street	1,616	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	66.8	24	76	241	764	
24	W Street	16th Street	17th Street	1,141	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.3	17	54	171	539	
25	X Street	14th Street	15th Street	747	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.5	11	35	112	353	
26	X Street	15th Street	16th Street	1,952	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.7	29	92	292	922	

Traffic Noise Spreadsheet Calculator



Project: #REF!

Noise Level Descriptor: CNEL  
 Site Conditions: Hard  
 Traffic Input: Peak  
 Traffic K-Factor: 9.76

				Input										Output				
Number	Name	Segment Description and Location		Peak Hour Volume	Speed (mph)	Distance to Directional Centerline, (feet) <sub>4</sub>		Traffic Distribution Characteristics					CNEL, (dBA) <sub>5,6,7</sub>	Distance to Contour, (feet) <sub>3</sub>				
		From	To			Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve		% Night	70 dBA	65 dBA	60 dBA	55 dBA
#REF!																		
1	N Street	7th Street	8th Street	570	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.3	9	27	85	269
2	N Street	8th Street	9th Street	561	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.2	8	27	84	265
3	N Street	9th Street	10th Street	686	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.1	10	32	103	324
4	N Street	10th Street	11th Street	826	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.9	12	39	123	390
5	O Street	7th Street	8th Street	52	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51.9	1	2	8	25
6	O Street	8th Street	9th Street	78	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	53.7	1	4	12	37
7	P Street	2nd Street	3rd Street	2,649	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69.0	40	125	396	1252
8	P Street	3rd Street	5th Street	1,976	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.7	30	93	295	934
9	P Street	7th Street	8th Street	1,266	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.8	19	60	189	598
10	P Street	8th Street	9th Street	1,228	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.6	18	58	184	580
11	P Street	9th Street	10th Street	1,233	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.7	18	58	184	583
12	P Street	10th Street	11th Street	1,184	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.5	18	56	177	560
13	Q Street	2nd Street	3rd Street	2,892	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69.4	43	137	432	1367
14	Q Street	3rd Street	4th Street	2,723	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69.1	41	129	407	1287
15	Q Street	6th Street	7th Street	1,312	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.9	20	62	196	620
16	Q Street	7th Street	8th Street	1,239	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.7	19	59	185	585
17	Q Street	8th Street	9th Street	1,053	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.0	16	50	157	498
18	Q Street	9th Street	10th Street	1,109	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.2	17	52	166	524
19	Q Street	10th Street	11th Street	892	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.3	13	42	133	422
20	W Street	10th Street	11th Street	1,674	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.0	25	79	250	791
21	W Street	11th Street	12th Street	1,658	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.0	25	78	248	784
22	W Street	14th Street	15th Street	948	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.5	14	45	142	448
23	W Street	15th Street	16th Street	1,616	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	66.8	24	76	241	764
24	W Street	16th Street	17th Street	1,141	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.3	17	54	171	539
25	X Street	14th Street	15th Street	747	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.5	11	35	112	353
26	X Street	15th Street	16th Street	1,953	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.7	29	92	292	923

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	
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