Appendix D

Noise Measurement Data and
Noise Modeling Calculations

Traffic Noise Spreadsheet Calculator

Project:

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

		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	CNEL, (dBA)[5,6,7]	75 dBA	70 dBA	65 dBA	60 dBA
Existing Conditions																		
1	Donner Pass Road	Western Town Limit	South Shore Drive	1,760	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	54.1	1	3	8	26
2	Donner Pass Road	South Shore Drive	Cold Stream Road	9,730	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61.5	4	14	45	142
3	Northwood Boulevard	Donner Pass Road	Lamplighter Way	14,240	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.2	7	21	66	208
4	Northwoods Boulevard	Lamplighter Way	Northwoods Boulevard	11,340	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.2	5	17	52	165
5	Donner Pass Road	SR 89 South	Cold Stream Road	15,140	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.4	7	22	70	221
6	Deerfield Drive	SR 89 South	Dolomite Way	10,060	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.4	2	7	22	68
7	West River Street	SR 89 South	McIver Crossing	7,850	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.6	7	23	73	231
8	SR 89 South	West River Street	Southern Town Limit	17,460	40	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.6	12	37	116	366
9	SR 89 South	West River Street	Central I-80 Interchange	18,430	40	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.9	12	39	122	387
10	Donner Pass Road	SR 89 South	Central I-80 Interchange	15,140	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60.1	3	10	33	103
11	McIver Crossing	West River Street	High Street	6,250	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	56.3	1	4	13	43
12	Bridge Street	So East River Street	East River Street	22,410	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61.8	5	15	48	153
13	Donner Pass Road	Bridge Street	Spring Street	13,560	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	59.7	3	9	29	92
14	West River Street	Bridge Street	McIver Crossing	12,700	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	59.4	3	9	27	86
15	Brockway Road	Palisades Road	Reynold Way	17,070	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.0	16	50	159	501
16	Glenshire Drive	Truckee Way	Highland Avenue	9,790	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.6	9	29	91	287
17	Glenshire Drive	Martis Peak Road	Eastern Town Limit	380	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	44.1			1	3
18	Truckee Way	Pioneer Trail	SR 89	16,680	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60.6	4	11	36	114
19	Pioneer Trail	Truckee Way	Comstock Drive	10,100	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.4	2	7	22	69
20	SR 89 North	Northern Town Limit	Alder Creek Road	4,460	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.1	2	7	21	65
21	SR 89 North	Alder Drive	Truckee Way	13,980	30	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61.4	4	14	44	139
22	SR 267	I-80	Brockway Road	22,880	55	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70.8	38	122	385	1216
23	SR 267	Brockway Road	Airport Road	28,570	55	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71.8	48	152	480	1518
24	SR 267	Airport Road	Northstar Drive	24,650	55	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71.2	41	131	414	1310
25	Alder Creek Road	SR 89	Schussing Way	2,290	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.3	2	7	21	67
26	Brockway Road	Reynold Way	SR 267	13,970	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	66.1	13	41	130	410
27	Airport Road	SR 267	Chandelle Way	5,240	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61.9	5	15	49	154
28	Schaffer Mill Road	SR 267	Lodge Trail Drive	8,550	30	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	59.3	3	8	27	85

*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 2-5
6	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-27), Pg 2-57.	Caltrans Technical Noise Supplement. 2013 (September). Equation (2-24), Pg 2-5
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	

References

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

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	210	75.0
Threshold 4-7 days	374	70.0
Threshold 1-2 weeks	665	65.0
Threshold 2-8 weeks	1,183	60.0
Threshold over 8 weeks	2,104	55.0
Center	50	87.5
Staging Area	100	81.5

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Dozer	85	0.4
Grader	85	0.4
Dump Truck	84	0.4
Excavator	85	0.4
Backhoe	80	0.4
Front End Loader	80	0.4

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Dozer	81.0
Grader	81.0
Dump Truck	80.0
Excavator	81.0
Backhoe	76.0
Front End Loader	76.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
87.5

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	333	75.0
Threshold 4-7 days	592	70.0
Threshold 1-2 weeks	1,052	65.0
Threshold 2-8 weeks	1,871	60.0
Threshold over 8 weeks	3,327	55.0
Center	50	91.5
Staging Area	100	85.4

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Dozer	85	1
Grader	85	1
Dump Truck	84	1
Excavator	85	1
Backhoe	80	1
Front End Loader	80	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Dozer	85.0
Grader	85.0
Dump Truck	84.0
Excavator	85.0
Backhoe	80.0
Front End Loader	80.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
91.5

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	182	75.0
Threshold 4-7 days	324	70.0
Threshold 1-2 weeks	577	65.0
Threshold 2-8 weeks	1,026	60.0
Threshold over 8 weeks	1,824	55.0
Center	50	86.2
Staging Area	100	80.2

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Compactor (ground)	80	0.4
Generator	82	0.4
Crane	85	0.16
Dump Truck	84	0.4
Front End Loader	80	0.4
Man Lift	85	0.4

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Compactor (ground)	76.0
Generator	78.0
Crane	77.0
Dump Truck	80.0
Front End Loader	76.0
Man Lift	81.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
86.2

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;

Representative Construction Equipment and Levels (Lmax)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{max} dBA)
Sensitive Receptors	313	75.0
Commercial Uses	99	85.0
Center	50	90.9
Staging Area	100	84.9

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Compactor (ground)	80	1
Generator	82	1
Crane	85	1
Dump Truck	84	1
Front End Loader	80	1
Man Lift	85	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Compactor (ground)	80.0
Generator	82.0
Crane	85.0
Dump Truck	84.0
Front End Loader	80.0
Man Lift	85.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
90.9

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	299	75.0
Threshold 4-7 days	532	70.0
Threshold 1-2 weeks	947	65.0
Threshold 2-8 weeks	1,683	60.0
Threshold over 8 weeks	2,993	55.0
Center	50	90.5
Staging Area	100	84.5

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Compactor (ground)	80	0.4
Generator	82	0.4
Crane	85	0.16
Dump Truck	84	0.4
Compressor (air)	80	0.4
Front End Loader	80	0.4
Backhoe	80	0.4
Man Lift	85	0.4
Impact Pile Driver	95	0.2

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Compactor (ground)	76.0
Generator	78.0
Crane	77.0
Dump Truck	80.0
Compressor (air)	76.0
Front End Loader	76.0
Backhoe	76.0
Man Lift	81.0
Impact Pile Driver	88.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
90.5

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;

Representative Construction Equipment and Levels (Lmax)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (Lmax dBA)
Sensitive Receptors	603	75.0
Commercial Uses	191	85.0
Center	50	96.6
Staging Area	100	90.6

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Compactor (ground)	80	1
Generator	82	1
Crane	85	1
Dump Truck	84	1
Compressor (air)	80	1
Front End Loader	80	1
Backhoe	80	1
Man Lift	85	1
Impact Pile Driver	95	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Compactor (ground)	80.0
Generator	82.0
Crane	85.0
Dump Truck	84.0
Compressor (air)	80.0
Front End Loader	80.0
Man Lift	85.0
Impact Pile Driver	95.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
96.6

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	203	75.0
Threshold 4-7 days	641	65.0
Threshold 1-2 weeks	2,027	55.0
Threshold 2-8 weeks	3,605	50.0
Threshold over 8 weeks	6,411	45.0
Center	50	87.2
Staging Area	100	81.1

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Paver	85	0.4
Roller	85	0.4
Concrete Mixer Truck	85	0.4
Front End Loader	80	0.4
Flat Bed Truck	84	0.4

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Paver	81.0
Roller	81.0
Concrete Mixer Truck	81.0
Front End Loader	76.0
Flat Bed Truck	80.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
87.2

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	321	75.0
Threshold 4-7 days	1,014	65.0
Threshold 1-2 weeks	3,206	55.0
Threshold 2-8 weeks	5,701	50.0
Threshold over 8 weeks	10,137	45.0
Center	50	91.1
Staging Area	100	85.1

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Paver	85	1
Roller	85	1
Concrete Mixer Truck	85	1
Front End Loader	80	1
Flat Bed Truck	84	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Paver	85.0
Roller	85.0
Concrete Mixer Truck	85.0
Front End Loader	80.0
Flat Bed Truck	84.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
91.1

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	226	75.0
Threshold 4-7 days	715	65.0
Threshold 1-2 weeks	2,261	55.0
Threshold 2-8 weeks	4,020	50.0
Threshold over 8 weeks	7,149	45.0
Center	50	88.1
Staging Area	100	82.1

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Man Lift	85	0.4
Crane	85	0.4
Flat Bed Truck	84	0.4
Front End Loader	80	0.4
Auger Drill Rig	85	0.4
Excavator	85	0.4

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Man Lift	81.0
Crane	81.0
Flat Bed Truck	80.0
Front End Loader	76.0
Auger Drill Rig	81.0
Excavator	81.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
88.1

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold 0-3 days	357	75.0
Threshold 4-7 days	1,130	65.0
Threshold 1-2 weeks	3,574	55.0
Threshold 2-8 weeks	6,356	50.0
Threshold over 8 weeks	11,303	45.0
Center	50	92.1
Staging Area	100	86.1

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Man Lift	85	1
Crane	85	1
Flat Bed Truck	84	1
Front End Loader	80	1
Auger Drill Rig	85	1
Excavator	85	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Man Lift	85.0
Crane	85.0
Flat Bed Truck	84.0
Front End Loader	80.0
Auger Drill Rig	85.0
Excavator	85.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
92.1

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;

Representative Construction Equipment and Levels (LEQ)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Commercial Uses	973	60.0
Sensitive Receptors	3,077	50.0
Center	50	85.8
Staging Area	100	79.8

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Concrete Mixer Truck	85	0.4
Concrete Mixer Truck	85	0.4
Concrete Pump Truck	82	0.16
Tractor	84	0.4

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Concrete Mixer Truck	81.0
Concrete Mixer Truck	81.0
Concrete Pump Truck	74.0
Tractor	80.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
85.8

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;

Representative Construction Equipment and Levels (Lmax)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Commercial Uses	161	80.0
Sensitive Receptors	510	70.0
Center	50	90.2
Staging Area	100	84.2

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Concrete Mixer Truck	85	1
Concrete Mixer Truck	85	1
Concrete Pump Truck	82	1
Tractor	84	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Concrete Mixer Truck	85.0
Concrete Mixer Truck	85.0
Concrete Pump Truck	82.0
Tractor	84.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
90.2

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;

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
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 9.1
U.S. Department of Transportation
CA/T Construction Spec. 721.560

Traffic Noise Spreadsheet Calculator

Project:

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

Number	Name	Segment Description and Location: From	To	Input: ADT	Speed (mph)	Distance to Directional Centerline, (feet)[4] Near	Far	Traffic Distribution Characteristics: % Auto	% Medium	% Heavy	% Day	% Eve	% Night	Output: CNEL, (dBA)[5,6,7]	Distance to Contour, (feet)[3] 75 dBA	70 dBA	65 dBA	60 dBA
Existing Conditions																		
1	Donner Pass Road	Western Town Limit	South Shore Drive	4,980	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.6	2	7	23	73
2	Donner Pass Road	South Shore Drive	Cold Stream Road	11,880	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.4	5	17	55	173
3	Northwood Boulevard	Donner Pass Road	Lamplighter Way	13,810	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	63.0	6	20	64	201
4	Northwoods Boulevard	Lamplighter Way	Northwoods Boulevard	18,990	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.4	9	28	88	277
5	Donner Pass Road	SR 89 South	Cold Stream Road	18,390	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.3	8	27	85	268
6	Deerfield Drive	SR 89 South	Dolomite Way	13,680	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	59.7	3	9	29	93
7	West River Street	SR 89 South	McIver Crossing	9,320	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	64.4	9	27	87	274
8	SR 89 South	West River Street	Southern Town Limit	19,980	40	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	66.2	13	42	133	419
9	SR 89 South	West River Street	Central I-80 Interchange	21,070	40	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	66.5	14	44	140	442
10	Donner Pass Road	SR 89 South	Central I-80 Interchange	19,490	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61.2	4	13	42	133
11	McIver Crossing	West River Street	High Street	10,440	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.5	2	7	22	71
12	Bridge Street	So East River Street	East River Street	27,420	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.7	6	19	59	187
13	Donner Pass Road	Bridge Street	Spring Street	14,620	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60.0	3	10	31	100
14	West River Street	Bridge Street	McIver Crossing	14,890	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60.1	3	10	32	101
15	Brockway Road	Palisades Road	Reynold Way	19,880	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.7	18	58	185	584
16	Glenshire Drive	Truckee Way	Highland Avenue	11,390	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	65.2	11	33	106	334
17	Glenshire Drive	Martis Peak Road	Eastern Town Limit	810	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	47.4		1	2	6
18	Truckee Way	Pioneer Trail	SR 89	26,800	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.6	6	18	58	182
19	Pioneer Trail	Truckee Way	Comstock Drive	17,960	25	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60.9	4	12	39	122
20	SR 89 North	Northern Town Limit	Alder Creek Road	3,840	35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	57.5	2	6	18	56
21	SR 89 North	Alder Drive	Truckee Way	17,270	30	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62.3	5	17	54	172
22	SR 267	I-80	Brockway Road	34,850	55	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	72.7	59	185	586	1852
23	SR 267	Brockway Road	Airport Road	33,160	55	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	72.5	56	176	557	1762
24	SR 267	Airport Road	Northstar Drive	28,530	55	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71.8	48	152	480	1516
25	Alder Creek Road	SR 89	Schussing Way	1,580	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	56.7	1	5	15	46
26	Brockway Road	Reynold Way	SR 267	20,840	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67.9	19	61	194	612
27	Airport Road	SR 267	Chandelle Way	4,280	45	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61.0	4	13	40	126
28	Schaffer Mill Road	SR 267	Lodge Trail Drive	8,620	30	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	59.3	3	9	27	86

*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 2-5
6	Caltrans Technical Noise Supplement. 2009 (November). Equation (2-27), Pg 2-57.	Caltrans Technical Noise Supplement. 2013 (September). Equation (2-24), Pg 2-5
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	

References

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

Addition of Noise Levels from Multiple Sources at a Discrete Receptor

OBJECTIVE: This work sheet is designed to estiamte the combined level of noise exposure at a single discrete receptor from multiple point 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).

Receptor Name: **Houses on East Side of West Taron Drive (back yards) Close to Riparian Court During Daytime and Nighttime Hours**

STEP 1: Identify the noise sources and enter the reference noise levels (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 receptor and the reduction provided by any intervening barrier.

Step 1. Step 2. Step 3.

Noise Source	Reference Noise Level			Attenuation Characteristics				Attenuated Noise Level at Receptor			
	Reference Noise Level (dBA)	@	Reference Distance (ft)	Ground Type (soft/hard)	Source Height (ft)	Receiver Height (ft)	Ground Factor	Noise Level (dBA)	@	Distance to Receptor (ft)	Reduction Provided by Barrier, if any (dBA)
Railroad Noise	76.0	@	100	hard	8	5	0.00	75.0	@	112	
Railroad Noise	76.0	@	100	hard	8	5	0.00	70.0	@	200	
Railroad Noise	76.0	@	100	hard	8	5	0.00	65.0	@	355	
Railroad Noise	76.0	@	100	hard	8	5	0.00	60.0	@	630	
							0.66				

Notes:

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

2 - 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).

3 - Summation of noise levels from different stationary noise sources at the same receptor is based on the equation presented on page 201 of FTA 2018.

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-

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>. Accessed: March 5, 2020.

Ground Type
hard
soft

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.

STEP 3A: Select the distance to the receiver.

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

Noise Source/ID	Reference Noise Level			Attenuated Noise Level at Receptor		
	vibration level (VdB)	@	distance (ft)	vibration level (VdB)	@	distance (ft)
Impact pile driver	112	@	25	65.0	@	919
blasting	109	@	25	80.0	@	232
large bull dozer	87.0	@	25	79.9	@	43

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			Attenuated Noise Level at Receptor		
	vibration level (PPV)	@	distance (ft)	vibration level (PPV)	@	distance (ft)
Impact pile driver	1.518	@	25	0.190	@	100
blasting	1.130	@	25	0.197	@	80
large bull dozer	0.089	@	25	0.191	@	15

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. 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>. Accessed: September 24, 2010.

Ground Type
hard
soft