
Appendix I2

Construction Noise Modeling Data

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at occupied building, per FTA = allowable hours over which Leq is to be averaged FTA =

Construction Activity	Equipment	Total Equipment Qty	AEP % from FTA (RCM)	Reference Line @ 50 ft from FTA (RCM)	Client Equipment Description, Data Source and/or Notes	Source to MR Distance (ft)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance Adjusted Leq	Allowable Operation Time (Hours)	Predicted 5-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Bar. ("A") Horiz. (ft)	Bar. to Bar. ("B") Horiz. (ft)	Source to Receptor ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. ("P") (ft)	Absn (dB)	ILBarr (dB)	Notes
Site Preparation	Excavator	3	40	81		4000	0.0		352	2	480	36	4	0	0	392	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Tractor	4	40	84		4000	0.0		372	8	480	39	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
Total for Site Preparation Phase												40.9												
Grading	Excavator	2	40	81		4000	0.0		342	8	480	33	5	0	0	337	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Tractor	1	40	88		4000	0.0		382	8	480	34	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Tractor	1	40	88		4000	0.0		382	8	480	31	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Tractor	2	40	84		4000	0.0		372	8	480	36	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
Building Construction	Crane	1	16	81		4000	0.0		342	8	420	26	5	0	0	337	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	3	20	79		4000	0.0		282	8	480	26	5	0	0	287	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	1	50	79		4000	0.0		282	8	480	22	5	0	0	287	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	3	40	84		4000	0.0		372	8	480	38	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
Paving	Generator	1	40	79		4000	0.0		282	8	420	22	5	0	0	287	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	1	40	79		4000	0.0		282	8	420	22	5	0	0	287	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	1	40	79		4000	0.0		282	8	420	22	5	0	0	287	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	1	40	79		4000	0.0		282	8	420	22	5	0	0	287	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
Total for Building Construction Phase												41.6												
Paving	Generator	2	50	79		4000	0.0		302	8	480	30	5	0	0	307	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Generator	2	50	88		4000	0.0		382	8	480	32	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	All Other Equipment + SIP	2	50	88		4000	0.0		382	8	480	38	5	0	0	387	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
Total for Paving Phase												38.3												
Architectural Coating	Compressor (air)	4	40	79		4000	0.0		312	8	360	32	5	0	0	317	4000	11.2	3990.0	4000.0	0.00	0.1	0.0	
	Total for Architectural Coating Phase												32.8											

To User: bordered cells are inputs, unbordered cells have formulae

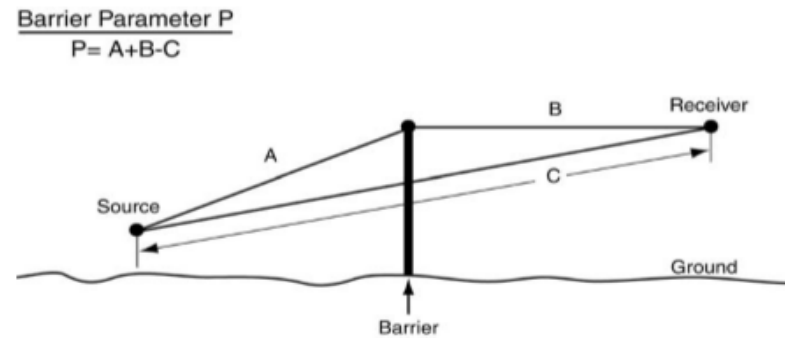
noise level limit for construction phase at occupied building, per San Diego County (36.409) = 36
 allowable hours over which Leq is to be averaged (example: 8 per SD County 36.409) = 8

Construction Activity	Equipment	Total Equipment Qty	AEP % from FRIIA RCNM	Reference Lines @ 50 ft from FRIIA RCNM	Client Equipment Description, Data Source and/or Notes	Source to Receiver Distance (ft)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance Adjusted Leq	Allowable Operation Time (Hours)	Predicted 5-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Bar. ("A") Horiz. (ft)	Bar. to Bar. ("B") Horiz. (ft)	Source to Rev. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Calc. ("P") (ft)	Absn (dB)	ILbar (dB)	Notes
Site Preparation	Excavator	3	40	81		5000	0.0		32.2	8	480	33	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Tractor	4	40	84		5000	0.0		34.2	8	480	36	3	0	0	10	4980	11.2	4990.0	3000.0	0.00	0.1	0.0	
Total for Site Preparation Phase																								
												38.8												
Grading	Excavator	2	40	81		5000	0.0		31.2	8	480	30	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Excavator	1	40	88		5000	0.0		35.2	8	480	31	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Tractor	1	40	84		5000	0.0		32.2	8	480	28	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Tractor	2	40	84		5000	0.0		34.2	8	480	33	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Tractor	2	40	84		5000	0.0		34.2	8	480	33	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
Total for Grading Phase																								
												38.6												
Building Construction	Crane	1	16	81		5000	0.0		31.8	8	420	23	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Hoist/Lift	3	20	79		5000	0.0		25.2	8	480	23	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Generator	1	50	79		5000	0.0		22.2	8	480	19	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Tractor	3	40	84		5000	0.0		34.2	8	480	35	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Welder / Torch	1	40	79		5000	0.0		23.2	8	420	19	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
Total for Building Construction Phase																								
												35.7												
Paving	Paver	2	50	79		5000	0.0		27.2	8	480	27	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Roller	2	30	88		5000	0.0		30.2	8	480	26	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	All Other Equipment + SIP	2	50	88		5000	0.0		35.2	8	480	35	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
Total for Paving Phase																								
												36.3												
Architectural Coating	Compressor (air)	4	40	79		5000	0.0		26.2	8	360	25	3	0	0	10	4990	11.2	4990.0	3000.0	0.00	0.1	0.0	
	Total for Architectural Coating Phase																							
												28.8												

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Lesser of or available Lmax	Spec. 721 Lmax	Measured L _{max} @50ft (dBA, slow)
All Other Equipment > 5 HP	No	50	85	85	-- N/A --
Auger Drill Rig	No	20	84	85	84
Backhoe	No	40	78	80	78
Bar Bender	No	20	80	80	-- N/A --
Blasting	Yes	-- N/A --	94	94	-- N/A --
Boring Jack Power Unit	No	50	80	80	83
Chain Saw	No	20	84	85	84
Clam Shovel (dropping)	Yes	20	87	93	87
Compactor (ground)	No	20	80	80	83
Compressor (air)	No	40	78	80	78
Concrete Batch Plant	No	15	83	83	-- N/A --
Concrete Mixer Truck	No	40	79	85	79
Concrete Pump Truck	No	20	81	82	81
Concrete Saw	No	20	90	90	90
Crane	No	16	81	85	81
Dozer	No	40	82	85	82
Drill Rig Truck	No	20	79	84	79
Drum Mixer	No	50	80	80	80
Dump Truck	No	40	76	84	76
Excavator	No	40	81	85	81
Flat Bed Truck	No	40	74	84	74
Front End Loader	No	40	79	80	79
Generator	No	50	72	72	81
Generator (<25KVA, VMS signs)	No	50	70	70	73
Gradall	No	40	83	85	83
Grader	No	40	85	85	-- N/A --
Grapple (on backhoe)	No	40	85	85	87
Horizontal Boring Hydr. Jack	No	25	80	80	82
Hydra Break Ram	Yes	10	90	90	-- N/A --
Impact Pile Driver	Yes	20	95	95	101
Jackhammer	Yes	20	85	85	89
Man Lift	No	20	75	85	75
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	90
Pavement Scarifier	No	20	85	85	90
Paver	No	50	77	85	77
Pickup Truck	No	40	55	55	75
Pneumatic Tools	No	50	85	85	85
Pumps	No	50	77	77	81
Refrigerator Unit	No	100	73	82	73
Rivit Buster/chipping gun	Yes	20	79	85	79
Rock Drill	No	20	81	85	81
Roller	No	20	80	85	80
Sand Blasting (Single Nozzle)	No	20	85	85	96
Scraper	No	40	84	85	84
Shears (on backhoe)	No	40	85	85	96
Slurry Plant	No	100	78	78	78
Slurry Trenching Machine	No	50	80	82	80
Soil Mix Drill Rig	No	50	80	80	-- N/A --
Tractor	No	40	84	84	-- N/A --
Vacuum Excavator (Vac-truck)	No	40	85	85	85
Vacuum Street Sweeper	No	10	80	80	82
Ventilation Fan	No	100	79	85	79
Vibrating Hopper	No	50	85	85	87
Vibratory Concrete Mixer	No	20	80	80	80
Vibratory Pile Driver	No	20	95	95	101
Warning Horn	No	5	83	85	83
Welder / Torch	No	40	73	73	74

Source _{elev}	5.0	A _{horiz}	24.0	A	25.0
Receiver _{elev}	10.0	B _{horiz}	38.0	B	38.1
C	62.2	C _{horiz}	62.0		
P	0.85				
Barrier _{elev}	12				
A _{barr}	12.3				

The above calculations, referring to inputs from the figure at right, helps a user estimate what barrier attenuation (A_{barr}) to expect (i.e., up to 15 per formula to right) based upon source height (above grade), barrier height, and receiver height, and the horizontal distances between the source and receiver to the barrier. The FTA-based formula in the grid_barr_IL_X worksheets use these path length (P) and A_{barr} values to determine the barrier's insertion loss for each barrier element with respect to the ID'd source-to-receptor path it occludes.



For all other barriers, and for protrusion of terrain above the line of sight:	$A_{barrier} = \min \left\{ 15 \text{ or } \left[20 \times \log \left(\frac{2.51\sqrt{P}}{\tanh[4.46\sqrt{P}]} \right) + 5 \right] \right\}$
Barrier Insertion Loss	$IL_{barrier} = \max \left\{ 0 \text{ or } \left[A_{barrier} - 10(G_{NB} - G_B) \log \left(\frac{D}{50} \right) \right] \right\}$
<p>D = <u>closest</u> distance between the receiver and the source, in feet</p> <p>P = path length difference, in feet (see figure below)</p> <p>G_{NB} = Ground factor G computed <i>without barrier</i> (see Figure 6-5)</p> <p>G_B = Ground factor G computed <i>with barrier</i> (see Figure 6-5)</p> <p>† The term "tanh(variable)" stands for hyperbolic tangent, available on many scientific calculators. If "tanh" is not available, then compute E = exp(variable), and set tanh(variable) = (E - 1/E) / (E + 1/E), where exp(variable) is the "exponential" function, also written as e^x on calculator keypads.</p>	

Sources: Transit Noise & Vibration Impact Assessment (FTA 2006)

05/09/21, MCS: This model now considers effect of up to two barriers ("nearest" and "farthest" w.r.t. the receiver) so that "B" is still distance between Receiver and the nearest barrier, while "A" may be distance from Source to top edge of the farthest barrier. In such a situation, the path length difference calculation will include the horizontal distance between the two barriers. If it's a single barrier, this difference equals zero. If there are more than two intervening barriers, only the nearest and farthest will be considered. Hence, good practice should avoid more than two barriers, especially if "middle" barriers are much taller than the nearest or farthest.