

APPENDIX E

NOISE CALCULATIONS

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RCNM User's Guide Construction Noise Prediction

Table 1. CA/T equipment noise emissions and acoustical usage factors database.

CA/T Noise Emission Reference Levels and Usage Factors

filename: EQUIPLST.xls

<u>Equipment Description</u>	<u>Impact Device?</u>	<u>Acoustical Use Factor %</u>	<u>Spec 721.560 L_{max} @ 50 ft (dBA, slow)</u>	<u>Actual Measured L_{max} @ 50 ft (dBA, slow)</u>	<u>No. of Actual Data Samples (count)</u>
All Other Equipment > 5 HP	No	50	85	85	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	80	0
Blasting	Yes	-- N/A --	94	94	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	83	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	85	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydr. Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	90	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarafier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/chipping gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (Single Nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Shears (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75

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Table 1. CA/T equipment noise emissions and acoustical usage factors database.

CA/T Noise Emission Reference Levels and Usage Factors

filename: EQUIPLST.xls

<u>Equipment Description</u>	Impact Device?	Acoustical Use Factor %	Spec 721.560 L _{max} @ 50 ft (dBA, slow)	Actual Measured L _{max} @ 50 ft (dBA, slow)	No. of Actual Data Samples (count)
Soil Mix Drill Rig	No	50	80	80	0
Tractor	No	40	84	84	0
Vacuum Excavator (Vac-truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44
Warning Horn	No	5	85	83	12
Welder / Torch	No	40	73	74	5

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase
Demolition	Demolition	9/1/2027	9/29/2027	5.0	20
Site Preparation	Site Preparation	9/30/2027	10/2/2027	5.0	2.0
Grading	Grading	10/3/2027	10/8/2027	5.0	4.0
Building Construction	Building Construction	10/9/2027	7/15/2028	5.0	200
Paving	Paving	10/9/2027	10/22/2027	5.0	10.0
Architectural Coating	Architectural Coating	7/1/2028	7/22/2028	5.0	15

5.2. Off-Road Equipment 5.2.1. Unmitigated

Phase Name	Equipment Type	Number per Day	Hours Per Day	Horsepower	Load Factor
Demolition	Concrete/Industrial Saws	1.00	8.0	33	0.73
Demolition	Rubber Tired Dozers	1.00	8.0	367	0.40
Demolition	Tractors/Loaders/Back hoes	3.0	8.0	84	0.37
Site Preparation	Rubber Tired Dozers	1.00	8.0	367	0.40
Site Preparation	Tractors/Loaders/Back hoes	0.00	8.0	84	0.37
Site Preparation	Crawler Tractors	2.0	8.0	87	0.43
Site Preparation	Graders	1.00	8.0	148	0.41
Site Preparation	Trenchers	1.00	8.0	40	0.50
Site Preparation	Dumpers/Tenders	1.00	8.0	16	0.38
Site Preparation	Excavators	1.00	8.0	36	0.38
Site Preparation	Skid Steer Loaders	1.00	8.0	71	0.37
Site Preparation	Plate Compactors	1.00	8.0	8.0	0.43
Grading	Graders	1.00	8.0	148	0.41
Grading	Rubber Tired Dozers	1.00	8.0	367	0.40
Grading	Tractors/Loaders/Back hoes	0.00	8.0	84	0.37
Grading	Crawler Tractors	3.0	8.0	87	0.43
Building Construction	Cranes	1.00	8.0	367	0.29
Building Construction	Forklifts	1.00	8.0	82	0.20
Building Construction	Generator Sets	1.00	8.0	14	0.74
Building Construction	Tractors/Loaders/Back hoes	3.0	8.0	84	0.37
Building Construction	Welders	3.0	8.0	46	0.45
Paving	Pavers	1.00	8.0	81	0.42
Paving	Paving Equipment	1.00	8.0	89	0.36
Paving	Rollers	1.00	8.0	36	0.38
Paving	Cement and Mortar Mixers	1.00	8.0	10.0	0.56
Paving	Tractors/Loaders/Back hoes	1.00	8.0	84	0.37
Architectural Coating	Air Compressors	1.00	8.0	37	0.48

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	Worker	13	19	LDA,LDT1, LDT2
Demolition	Vendor	—	10.0	HHDT,MHDT
Demolition	Hauling	44	20.0	HHDT
Demolition	Onsite truck	—	—	HHDT

Site Preparation	Worker	23	19	LDA,LDT1, LDT2
Site Preparation	Vendor	—	10	HHDT,MH DT
Site Preparation	Hauling	0.0	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	Worker	13.00	19.0	LDA,LDT1, LDT2
Grading	Vendor	—	10	HHDT,MH DT
Grading	Hauling	31	20	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	Worker	19	19.0	LDA,LDT1, LDT2
Building Construction	Vendor	2.8	10.0	HHDT,MH DT
Building Construction	Hauling	0	20	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	Worker	13.0	19.0	LDA,LDT1, LDT2
Paving	Vendor	—	10.0	HHDT,MH DT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	Worker	3.7	19	LDA,LDT1, LDT2
Architectural Coating	Vendor	—	10.0	HHDT,MH DT
Architectural Coating	Hauling	0	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	1	85	40	50	0.5	85	81
Concrete Saw	1	90	20	50	0.5	90	83
Front End Loader	3	80	40	50	0.5	80	81
Combined at 50 feet						92	86
Combined at Receptor 160 feet						81	76
Combined at Receptor 175 feet						81	76
Combined at Receptor 120 feet						84	79
Combined at Receptor 220 feet						79	74

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	1	85	40	50	0.5	85	81
Tractor	2	84	40	50	0.5	84	83
Grader	1	85	40	50	0.5	85	81
All Other Equipment > 5 HP	1	85	50	50	0.5	85	82
Dump Truck	1	84	40	50	0.5	84	80
Excavator	1	85	40	50	0.5	85	81
Front End Loader	1	80	40	50	0.5	80	76
Compactor (ground)	1	80	20	50	0.5	80	73
Combined at 50 feet						93	90
Combined at Receptor 160 feet						83	79
Combined at Receptor 175 feet						82	79
Combined at Receptor 120 feet						85	82
Combined at Receptor 220 feet						80	77

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Tractor	3	84	40	50	0.5	84	85
Dozer	1	85	40	50	0.5	85	81
Combined at 50 feet						89	87
Combined at Receptor 160 feet						79	77
Combined at Receptor 175 feet						79	77
Combined at Receptor 120 feet						82	80
Combined at Receptor 220 feet						77	75

Phase: Building Construction

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Crane	1	85	16	50	0.5	85	77
Man Lift	1	85	20	50	0.5	85	78
Generator	1	82	50	50	0.5	82	79
Tractor	3	84	40	50	0.5	84	85
Welder / Torch	3	73	40	50	0.5	73	74
Combined at 50 feet						90	87
Combined at Receptor 160 feet						80	77
Combined at Receptor 175 feet						79	76
Combined at Receptor 120 feet						83	80
Combined at Receptor 220 feet						77	74

Phase: Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Paver	1	85	50	50	0.5	85	82
Roller	1	85	20	50	0.5	85	78
All Other Equipment > 5 HP	1	85	50	50	0.5	85	82
Concrete Mixer Truck	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Combined at 50 feet						92	88
Combined at Receptor 160 feet						82	78
Combined at Receptor 175 feet						81	77
Combined at Receptor 120 feet						84	80
Combined at Receptor 220 feet						79	75

Phase: Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Compressor (air)	1	80	40	50	0.5	80	76
Combined at 50 feet						80	76
Combined at Receptor 160 feet						70	66
Combined at Receptor 175 feet						69	65
Combined at Receptor 120 feet						72	68
Combined at Receptor 220 feet						67	63

¹ - Percentage of time that a piece of equipment is operating at full power.

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	1	85	40	50	0.5	85	81
Concrete Saw	1	90	20	50	0.5	90	83
Front End Loader	1	80	40	50	0.5	80	76
Combined at 50 feet						92	86
Combined at Receptor 160 feet						81	76
Combined at Receptor 175 feet						81	75
Combined at Receptor 120 feet						84	78
Combined at Receptor 220 feet						79	73

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Grader	1	85	40	50	0.5	85	81
All Other Equipment > 5 HP	1	85	50	50	0.5	85	82
Dump Truck	1	84	40	50	0.5	84	80
Excavator	1	85	40	50	0.5	85	81
Front End Loader	1	80	40	50	0.5	80	76
Compactor (ground)	1	80	20	50	0.5	80	73
Combined at 50 feet						93	89
Combined at Receptor 160 feet						83	79
Combined at Receptor 175 feet						82	78
Combined at Receptor 120 feet						85	81
Combined at Receptor 220 feet						80	76

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Dozer	1	85	40	50	0.5	85	81
Combined at 50 feet						89	85
Combined at Receptor 160 feet						79	75
Combined at Receptor 175 feet						79	75
Combined at Receptor 120 feet						82	78
Combined at Receptor 220 feet						77	73

Phase: Building Construction

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Crane	1	85	16	50	0.5	85	77
Man Lift	1	85	20	50	0.5	85	78
Generator	1	82	50	50	0.5	82	79
Tractor	1	84	40	50	0.5	84	80
Welder / Torch	1	73	40	50	0.5	73	69
Combined at 50 feet						90	85
Combined at Receptor 160 feet						80	75
Combined at Receptor 175 feet						79	74
Combined at Receptor 120 feet						83	77
Combined at Receptor 220 feet						77	72

Phase: Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Paver	1	85	50	50	0.5	85	82
Roller	1	85	20	50	0.5	85	78
All Other Equipment > 5 HP	1	85	50	50	0.5	85	82
Concrete Mixer Truck	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Combined at 50 feet						92	88
Combined at Receptor 160 feet						82	78
Combined at Receptor 175 feet						81	77
Combined at Receptor 120 feet						84	80
Combined at Receptor 220 feet						79	75

Phase: Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Compressor (air)	1	80	40	50	0.5	80	76
Combined at 50 feet						80	76
Combined at Receptor 160 feet						70	66
Combined at Receptor 175 feet						69	65
Combined at Receptor 120 feet						72	68
Combined at Receptor 220 feet						67	63

¹ - Percentage of time that a piece of equipment is operating at full power.

dBA – A-weighted Decibels

Lmax- Maximum Level

Leq- Equivalent Level

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	1	85	40	50	0.5	85	81
Concrete Saw	1	90	20	50	0.5	90	83
Front End Loader	1	80	40	50	0.5	80	76
Combined at 50 feet						92	86
Combined at Receptor 160 feet						81	76
Combined at Receptor 175 feet						81	75
Combined at Receptor 120 feet						84	78
Combined at Receptor 220 feet						79	73

Phase: Site Preparation

Equipment ²	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Dozer	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Grader	1	85	40	50	0.5	85	81
Dump Truck	1	84	40	50	0.5	84	80
Combined at 50 feet						91	87
Combined at Receptor 160 feet						80	76
Combined at Receptor 175 feet						80	76
Combined at Receptor 120 feet						83	79
Combined at Receptor 220 feet						78	74

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Grader	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Dozer	1	85	40	50	0.5	85	81
Combined at 50 feet						89	85
Combined at Receptor 160 feet						79	75
Combined at Receptor 175 feet						79	75
Combined at Receptor 120 feet						82	78
Combined at Receptor 220 feet						77	73

Phase: Building Construction

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Crane	1	85	16	50	0.5	85	77
Man Lift	1	85	20	50	0.5	85	78
Generator	1	82	50	50	0.5	82	79
Tractor	1	84	40	50	0.5	84	80
Welder / Torch	1	73	40	50	0.5	73	69
Combined at 50 feet						90	85
Combined at Receptor 160 feet						80	75
Combined at Receptor 175 feet						79	74
Combined at Receptor 120 feet						83	77
Combined at Receptor 220 feet						77	72

Phase: Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Paver	1	85	50	50	0.5	85	82
Roller	1	85	20	50	0.5	85	78
Concrete Mixer Truck	1	85	40	50	0.5	85	81
Tractor	1	84	40	50	0.5	84	80
Combined at 50 feet						91	87
Combined at Receptor 160 feet						81	76
Combined at Receptor 175 feet						80	76
Combined at Receptor 120 feet						83	79
Combined at Receptor 220 feet						78	74

Phase: Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor ¹	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA)	
						Lmax	Leq
Compressor (air)	1	80	40	50	0.5	80	76
Combined at 50 feet						80	76
Combined at Receptor 160 feet						70	66
Combined at Receptor 175 feet						69	65
Combined at Receptor 120 feet						72	68
Combined at Receptor 220 feet						67	63

¹- Percentage of time that a piece of equipment is operating at full power.

²- These four pieces of equipment represent a typical condition for this phase.

dBA – A-weighted Decibels

L_{max} – Maximum Level

L_{eq} – Equivalent Level

No.	Land Use	Direction	Construction Equipment	Annoyance		Vibration Level (PPV)	Caltrans (RMS in/sec)
				Reference Vibration Level (VdB)	Average Distance (ft)		
1	Res	North	Large Bulldozers	0.062	19	0.094	0.1
2	Res	North	Pile Driver	0.451	70	0.096	0.1

Human Response	Vibration Level (RMS in/sec)
Barely perceptible	0.01
Distinctly perceptible	0.04
Strongly perceptible	0.1
Severe	0.4

Damage		PL Distance	Vibration Level	Caltrans (PPV
Reference Vibration Level (PPV)		(ft)	(PPV)	in/sec)
0.089		12	0.268	0.3
0.644		42	0.296	0.3

Structure / Condition	PPV (in/sec)
Extremely fragile historic buildings, ruins, ancient monuments	0.08
Fragile buildings	0.1
Historic and some old buildings	0.25
Older residential structures	0.3
New residential structures	0.5
Modern industrial / commercial buildings	0.5

Construction Traffic Noise Calculator

Construction Phase	One-Way Worker Trip/Day	One Way Vendor Trip/Day	One Way Hauling Trip/Day	Total
Demolition	13	0	44	57
Site Preparation	23	0	0	23
Grading	13	0	31	44
Building Construction	19	2.8	0	21.8
Paving	13	0	0	13
Architectural Coating	3.7	0	0	3.7
Maximum	44			

Roadway	Speed	Existing Volume	MT Factor	HT Factor
Russell Avenue	25	3,600	12.6	39.8

	Worker Trip/Day	Vendor Trip/Day	Hauling Trip/Day	Total
Demolition	13	0	1,752	1765
Site Preparation	23	0	0	23
Grading	13	0	1,234	1247
Building Construction	19	74	0	93
Paving	13	0	0	13
Architectural Coating	4	0	0	4

Chosen Phase Demolition
 Total Equivalent Vehicles 1,765
Noise Increase (dBA) 1.73

Phase Number	Phase Name	Number of Days
1	Demolition	20
2	Site Preparation	2
3	Grading	4
4	Building Construction	200
5	Paving	10
6	Architectural Coating	15

Speed (mph)	MT Factor	HT Factor
25	12.6	39.8
30	8.9	26.3
35	7.1	19.1
40	5.8	15.1
45	5	12.9
50	4.5	11.5
55	4.1	10.4
60	3.7	9.6
65	3.5	8.9

Receptor	HVAC	Reference Noise Level	Total Noise Level	Reference Distance (ft)	Distance (ft)	Noise Level	Distance Attenuation
Residential	4	66.5	72.5	5	68	49.8	22.7

Receiver Name	Source	Wall Name	Wall Height	Wall Elevation	Rec. elev.	Rec. Height	Source Elevation	Source Height	Source to Barrier	Rec. to Source dist.	Rec. to Barr. dist.	d1	d2	d3	delta	N	Noise Reduction
Residential (S)	SR-22	South Prop Wall	6	0	0	5	0	5	660	710	50	710	50	660	0.01	0.01	5
Residential (S)	SR-22	South Prop Wall	6	0	0	5	0	5	660	680	20	680	20	660	0.03	0.03	5