Appendix D

Noise Modeling

Construction Source Noise Prediction Model-Leq Boca

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	3,521	50.0
State Hospital Bound.	1,200	59.4
Nearest St. Hosp Build.	1,300	58.7

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Grader	85	0.4
Scraper	85	0.4
Generator	82	0.5
Dump Truck	84	0.4
Jackhammer	85	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]
Grader	81.0
Scraper	81.0
Generator	79.0
Dump Truck	80.0
Jackhammer	78.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
87.0

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.

Construction Source Noise Prediction Model-Lmax Boca

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	5,827	50.0
State Hospital Bound.	1,200	63.7
Nearest St. Hosp Build.	1,300	63.0

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Grader	85	1
Scraper	85	1
Generator	82	1
Dump Truck	84	1
Jackhammer	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]
Grader	85.0
Scraper	85.0
Generator	82.0
Dump Truck	84.0
Jackhammer	85.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
91.3

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.

Construction Source Noise Prediction Model-Leq Pacific Coast

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	3,521	50.0
State Hospital Bound.	1,220	59.2
Nearest St. Hosp Build.	1,330	58.5

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Grader	85	0.4
Scraper	85	0.4
Generator	82	0.5
Dump Truck	84	0.4
Jackhammer	85	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]
Grader	81.0
Scraper	81.0
Generator	79.0
Dump Truck	80.0
Jackhammer	78.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
87.0

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.

Construction Source Noise Prediction Model-Lmax Pacific Coast

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	5,827	50.0
State Hospital Bound.	1,220	63.6
Nearest St. Hosp Build.	1,330	62.8

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Grader	85	1
Scraper	85	1
Generator	82	1
Dump Truck	84	1
Jackhammer	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]
Grader	85.0
Scraper	85.0
Generator	82.0
Dump Truck	84.0
Jackhammer	85.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
91.3

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.

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)
large bull dozer	87	@	25	36.6	@	1,200
loaded truck	86	@	25	35.6	@	1,200

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)
large bull dozer	0.089	@	25	0.0003	@	1,200
loaded truck	0.076	@	25	0.0002	@	1,200

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.

Traffic Noise Spreadsheet Calculator

Project: Napa Jail

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]	70 dBA	65 dBA	60 dBA	55 dBA
Segment Description and Location																		
1	SR 221 at Basalt Road			27,000	65	100	100	94.0%	2.5%	3.5%	80.0%	15.0%	5.0%	74.5	282	893	2824	8929
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					
					35	100	100	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%					

*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

Project: **Napa Jail**

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

				Input										Output				
		Segment Description and Location				Distance to Directional Centerline, (feet)[4]		Traffic Distribution Characteristics						CNEL,	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
Segment Description and Location																		
1	SR 221			27,554	65	100	100	94.0%	2.5%	3.5%	80.0%	15.0%	5.0%	74.6	288	911	2882	9112

*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.

Vehicl Fleet Calculation for Traffic Noise Model

SR 221 Trucks

AADT Total	# Medium	#Heavy	
1601	659	251	3 axle
		96	4 axle
		595	5+ axle
		942	Total Heavy
	41%	59%	
Truck % AADT	% Medium		
6.04	2.4764	3.5636	

Ref: Caltrans 2011. Annual Average Daily Truck Traffic on the California State Highway System. Available: http://traffic-counts.dot.ca.gov/truck2011final.pdf

Blast Air Overpressure and Ground Vibration

KEY: Orange cells are for input.
Grey cells are default values
Green cells are data to present in a written analysis (output).

STEP 1: Enter charge weights and distance to nearest sensitive receptor

STEP 2: Either use the range of default K values or if the K value is known input that in the "Actual K" column.

STEP 3: Choose appropriate unit for results. Note that calculated PSI values are used to determine Blast Noise (dB). K values for Air overpressures are linked to PSI

			Air Over Pressure K Values			Ground Vibration K Values			Air Over Pressure Outputs						Ground Vibration Outputs		
Blast Events	**Blasting Inputs**		**Blast Noise (dB) K**			**PPV (in/sec) K**			**PSI[1]**			**Blast Noise (dB)[2]**			**PPV (in/sec)[3]**		
	Charge Weight (lbs)	distance (ft)	Lower Bound (K)	Upper Bound (K)	Actual K (If known)	Lower Bound (K)	Upper Bound (K)	Actual (If known K)	Lower Bound	Upper Bound	Actual (If known K)	Lower Bound	Upper Bound	Actual (If known K)	Lower Bound	Upper Bound	Actual (If known K)
Blast 1	332	2,600	0.78	2.5	0	24	242	300	0.0006	0.0020	0.0000	106.8	116.9	#NUM!	0.0086	0.0865	0.1072
Blast 2	700	6,330	0.78	2.5	0	24	242	300	0.0003	0.0009	0.0000	100.1	110.2	#NUM!	0.0038	0.0378	0.0469
Blast 3	300	1,000	0.78	2.5	0	24	242	0	0.0019	0.0061	0.0000	116.4	126.5	#NUM!	0.0365	0.3677	0.0000
Blast 4	300	1,000	0.78	2.5	0	24	242	0	0.0019	0.0061	0.0000	116.4	126.5	#NUM!	0.0365	0.3677	0.0000
Blast 5	300	1,000	0.78	2.5	0	24	242	0	0.0019	0.0061	0.0000	116.4	126.5	#NUM!	0.0365	0.3677	0.0000

Source:
Caltrans (2004). Transportation- and Construction-Induced Vibration Guidance Manual. Noise, Vibration, and Hazardous Waste Management Office. Prepared by: Jones & Stokes.

1. Air Overpressure (PSI) — Caltrans 2004, Eq. 14

psi= K (Ds)^1/3^-1.2
Where:
PSI= pounds per square inch
Ds= cube-root scaled distance (distance to receiver in ft, divided by cube root of charge weight in lbs)

K= the curves representing the normal upper and lower bounds for confined charges, subject to many variables

2. Air Overpressure (dB) — Caltrans 2004, Eq. 15

dB=20Log(psi/2.9*10^-9)

3. Ground Vibration (PPV) — Caltrans 2004, Eq. 13

PPV=L (Ds)^-1.6
Where:
PPV= peak particle velocity (in/sec)
Ds= square-foot scaled distance (distance to receiver in feet divided by square root of charge weight in lbs
K= the curves representing the normal upper and lower bounds for confined charges, subject to many variables

Mining Noise Calculations

Noise Sources

	Noise Level dBA Lmax	Reference Distance (ft)	Mining Pit 1 dBA Lmax at Receptor (2,600 feet)	Mining Pit 2 dBA Lmax at Receptor (6,300 feet)	Asphalt Batch Plant dBA Lmax at receptor (1,170 ft)
Material Truck	88	20	32	22	
Water Truck	97	20	41	31	
Aggregate Crushing	81	150	48	38	57
Aggregate Mining	85	100	47	37	

Noise Levels

	Mining Activities	Pit 1 Activities Noise Level dBA Lmax (2,600 ft from SR)	Pit 2 Activities Noise Level dBA Lmax (6,300 ft from SR)	All Activities Noise Level dBA Lmax (Combined SR)	
1	Crushing + Trucks	49	39	49	
2	Mining + Trucks	48	38	49	49

		Asphalt Batch Plant Noise Level dBA Lmax (1,170 ft from SR)
3	Asphalt Processing	57

		Mining+Crushing+Asphalt dBA Lmax @ SR	Reduction from Wall
4	Combined Activities	58	53

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)
Material Truck	88.0	@	20	soft	6	5	0.65	31.9	@	2600
Water Truck	97.0	@	20	soft	6	5	0.65	40.9	@	2600
Aggregate Crushing	81.0	@	150.00	soft	6	5	0.65	48.1	@	2600
Aggregate Mining	85.0	@	100	soft	6	5	0.65	47.5	@	2600
	0.0		0							
Material Truck	88.0	@	20	soft	6	5	0.65	21.8	@	6300
Water Truck	97.0	@	20	soft	6	5	0.65	30.8	@	6300
Aggregate Crushing	81.0	@	150	soft	6	5	0.65	38.0	@	6300
Aggregate Mining	85.0	@	100	soft	6	5	0.65	37.3	@	6301
Asphalt Batching	81.0	@	150	soft	5	4	0.65	57.4	@	1170

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. 12-3 and 12-4 of FTA 2006.

Computation of the ground factor is based on the equation presentd in Figure 6-23 on pg. 6-23 of FTA 2006, 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). 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.