Appendix D

Noise Modeling

Construction Source Noise Prediction Model (Grading)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
SR4	650	55.3

Equipment	Reference Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Grader	85	0.4
Scraper	85	0.4
Backhoe	80	0.4

Ground Type	soft
Source Height	8
Receiver Height	5
Ground Factor[2]	0.63

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Grader	81.0
Scraper	81.0
Backhoe	76.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
84.7

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Table 4-26 from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 86).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 176 and 177).

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 2018: pg 86); and

D = Distance from source to receiver.

Construction Source Noise Prediction Model (Grading + Pile Driving)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
SR1	370	69.0

Equipment	Reference Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Grader	85	0.4
Scraper	85	0.4
Backhoe	80	0.4
Impact Pile Driver	95	0.4

Ground Type	soft
Source Height	8
Receiver Height	5
Ground Factor[2]	0.63

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Grader	81.0
Scraper	81.0
Backhoe	76.0
Impact Pile Driver	91.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
91.9

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Table 4-26 from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 86).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 176 and 177).

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 2018: pg 86); and

D = Distance from source to receiver.

Alternative	Site	Construction activity	Activity	Equipment
1,2,3,4	SR 89	CS1	Grading and Pile Driving	Grader,scaper, backhoe, pile driver
3	North Campground	CS2	Grading	Grader,scaper, backhoe
1,2,3,4	South Campground	CS3	Grading	Grader,scaper, backhoe
1,2,3,4	Parking North of Marina	CS4	Grading	Grader,scaper, backhoe
1	Boat Pier	CS5	Grading and Pile Driving	Grader,scaper, backhoe, pile driver
3,4	Parking at south end	CS6	Grading	Grader,scaper, backhoe
3	South end ADA Parking	CS7	Grading	Grader,scaper, backhoe

Construction Site	Construction details
CS1	State Route 89 Bridge
CS2	Campground at the North side of the Project
CS3	Campground at the South side of the Project
CS4	Parking North of Marina
CS5	Boat Pier
CS6	Parking at South-West end of the project site
CS7	ADA Parking at South-East end of the project site

Sensitive Receptors points	
SR1	Sensitive Receptor 1
SR2	Sensitive Receptor 2
SR3	Sensitive Receptor 3
SR4	Sensitive Receptor 4

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	104	@	25	72.0	@	292

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	0.644	@	25	0.197	@	55

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. 185 of FTA 2018. 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.

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123. Washington, D.C. Accessed: December 20, 2020. Page Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

Long-Term Noise Measurement Summary

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).

Measurement Site:	Proposed site of Edgewood hotel complex
Measurement Date:	5/24/2022
Project Name:	Meeks Bay CNEL Calc

Hour of Day (military time)	Sound Level Leq (dBA)	Sound Power =10*Log(dBA/10)	Computation of CNEL: Period of 24-Hour Day (1=included, 0=not) Day	Evening	Night	Sound Power Breakdown by Period of Day Day	Evening	Night
0:00	85.0	316,227,766	0	0	1	0	0	316,227,766
1:00	85.0	316,227,766	0	0	1	0	0	316,227,766
2:00	85.0	316,227,766	0	0	1	0	0	316,227,766
3:00	85.0	316,227,766	0	0	1	0	0	316,227,766
4:00	85.0	316,227,766	0	0	1	0	0	316,227,766
5:00	85.0	316,227,766	0	0	1	0	0	316,227,766
6:00	85.0	316,227,766	0	0	1	0	0	316,227,766
7:00	85.0	316,227,766	1	0	0	316,227,766	0	0
8:00	85.0	316,227,766	1	0	0	316,227,766	0	0
9:00	85.0	316,227,766	1	0	0	316,227,766	0	0
10:00	85.0	316,227,766	1	0	0	316,227,766	0	0
11:00	85.0	316,227,766	1	0	0	316,227,766	0	0
12:00	85.0	316,227,766	1	0	0	316,227,766	0	0
13:00	85.0	316,227,766	1	0	0	316,227,766	0	0
14:00	85.0	316,227,766	1	0	0	316,227,766	0	0
15:00	85.0	316,227,766	1	0	0	316,227,766	0	0
16:00	85.0	316,227,766	1	0	0	316,227,766	0	0
17:00	85.0	316,227,766	1	0	0	316,227,766	0	0
18:00	85.0	316,227,766	1	0	0	316,227,766	0	0
19:00	85.0	316,227,766	0	1	0	0	316,227,766	0
20:00	85.0	316,227,766	0	1	0	0	316,227,766	0
21:00	85.0	316,227,766	0	1	0	0	316,227,766	0
22:00	85.0	316,227,766	0	0	1	0	0	316,227,766
23:00	85.0	316,227,766	0	0	1	0	0	316,227,766
		Sum of Sound Power during Period wo/penalty				3,794,733,192	948,683,298	2,846,049,894
		Log Factor for CNEL Penalty (i.e., 10*log(x))				1	3	10
		Sound Power during Period with penalty				3,794,733,192	2,846,049,894	28,460,498,942

Total Daily Sound Power, with penalties	###########
Hours per Day	24
Average Hourly Sound Power, with penalties	1,462,553,418
CNEL	91.7

Ldn computation on next page.

Notes:

Computation of the CNEL based on 1-hour Leq measurements for each hour of a day are based on equation 2-27 on pg. 2-57 of Caltrans 2009.

Computation of the Ldn based on 1-hour Leq measurements for each hour of a day are based on equation 2-26 on pg. 2-56 of Caltrans 2009.

Log factors for the Ldn and CNEL penalties are provided in Table 2-12 on pg. 2-52 of Caltrans 2009.

Source:

California Deaprtment of Transportation (Caltrans), Divisiong of Environmental Analysis. 2009 (November). *2009 Technical Noise Supplement* . Sacramento, CA. Available: <http://www.dot.ca.gov/hq/env/noise/>. Accessed September 24, 2010.

Long-Term Noise Measurement Summary

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).

Measurement Site: Meeks Bay CNEL Calc
Measurement Date: 5/24/2022
Project Name: Meeks Bay CNEL Calc

Hour of Day (military time)	Sound Level Leq (dBA)	Sound Power =10*Log(dBA/10)	Computation of CNEL: Period of 24-Hour Day (1=included, 0=not) Day	Evening	Night	Sound Power Breakdown by Period of Day: Day	Evening	Night
0:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
1:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
2:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
3:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
4:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
5:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
6:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
7:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
8:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
9:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
10:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
11:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
12:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
13:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
14:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
15:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
16:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
17:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
18:00	92.0	1,584,893,192	1	0	0	1,584,893,192	0	0
19:00	92.0	1,584,893,192	0	1	0	0	1,584,893,192	0
20:00	92.0	1,584,893,192	0	1	0	0	1,584,893,192	0
21:00	92.0	1,584,893,192	0	1	0	0	1,584,893,192	0
22:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192
23:00	92.0	1,584,893,192	0	0	1	0	0	1,584,893,192

	Day	Evening	Night
Sum of Sound Power during Period wo/penalty	19,018,718,310	4,754,679,577	14,264,038,732
Log Factor for CNEL Penalty (i.e., 10*log(x))	1	3	10
Sound Power during Period with penalty	19,018,718,310	14,264,038,732	142,640,387,322

Total Daily Sound Power, with penalties	175,923,144,363
Hours per Day	24
Average Hourly Sound Power, with penalties	7,330,131,015
CNEL	98.7

Ldn computation on next page.

Notes:

Computation of the CNEL based on 1-hour Leq measurements for each hour of a day are based on equation 2-27 on pg. 2-57 of Caltrans 2009.

Computation of the Ldn based on 1-hour Leq measurements for each hour of a day are based on equation 2-26 on pg. 2-56 of Caltrans 2009.

Log factors for the Ldn and CNEL penalties are provided in Table 2-12 on pg. 2-52 of Caltrans 2009.

Source:

California Deaprtment of Transportation (Caltrans), Divisiong of Environmental Analysis. 2009 (November). *2009 Technical Noise Supplement* . Sacramento, CA. Available: <http://www.dot.ca.gov/hq/env/noise/>. Accessed September 24, 2010.