Appendix F

Noise Analysis Calculations

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)
Music amphitheater (Leq) on W Taron	75.0	@	50	soft	20	5	0.53	52.7	@	380.0
Music amphitheater (Lmax)	80.0	@	50	soft	20	5	0.53	57.7	@	380.0
Music amphitheater (Leq) on Ruddy Duck	75.0	@	50	soft	20	5	0.53	49.1	@	530.0
Music amphitheater (Lmax)	80.0	@	50	soft	20	5	0.53	54.1	@	530.0

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.

A "soft" ground type is used in these noise attenuation estimates to account for the fact that many trees would be retained on site, new parking lots would be 50 percent shaded with canopy shade trees, and cars would likely be in the parking lot during amphitheater events.

FICAN's Dose-Repsonse Curve for Predicting Awakening

Awakenings = 0.0087/100 * (SENEL-30)^1.79

SENEL (dBA)	Awakenings
100	17%
95	15%
90	13%
85	11%
81	10%
75	8%
70	6%
65	5%
60	4%

Awakening is expressed as the percentage of sleep ing people who experience an awakeing while exposed to single event noise exposure levels (SENELs).

Source of dose-repsonse curve for predicting awakening:
Federal Interagency Committee on Aviation Noise. 1997 (June). *Effects of Aviation Noise on Awakenings from Sleep*. Available: https://www.nps.gov/subjects/sound/upload/findings_awakenings_1997.pdf. Accessed January 10, 2020.

Calculations performed by Ascent Environmental, 2020.

Demolition of Building G in Phase 2

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Threshold	304	69.0
West Taron Way	575	63.5
Church	360	67.5
Ruddy Duck Way	855	60.0

Equipment	Reference Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Excavator	85	0.4
Excavator	85	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]
Excavator	81.0
Excavator	81.0
Front End Loader	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.

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)
County's daytime Lmax standard	86.1	@	50	hard	10	5	0.00	80.1	@	100
County's nighttime Lmax standard	86.1	@	50	hard	10	5	0.00	75.2	@	175
truck with trailer at 10 mph	68.4	@	50	hard	10	5	0.00	63.8	@	85
truck with trailer at 10 mph	68.4	@	50	hard	10	5	0.00	78.9	@	15
truck releasing breaks	86.1	@	50	hard	10	5	0.00	81.5	@	85
truck releasing breaks	86.1	@	50	hard	10	5	0.00	96.6	@	15

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. 176 and 177 of FTA 2018.

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).

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-

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)
HVAC units	70.0	@	50	hard	10	5	0.00	55.0	@	280
HVAC units	70.0		50	hard	10	5	0.00	45.1		875

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. 176 and 177 of FTA 2018.

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).

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-

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)
Activity at 1st Closest Parking Lot	52.6	@	50	hard	5	5	0.00	41.6	@	100	5
Activity at 1st Closest Parking Structure	53.7	@	50	hard	5	5	0.00	41.5	@	115	5
Activity at 2nd Closest Parking Structure	53.7	@	50	hard	5	5	0.00	36.7	@	200	5
							0.66				
							0.66				
							0.66				

Combined level of noise exposure at receptor from all noise sources (dBA): **45.2**

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-0123_0.pdf>Accessed:

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.

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) Towards South End of the Project Site During Daytime 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)
Activity at 1st Closest Parking Lot	52.6	@	50	hard	5	5	0.00	41.6	@	100	5
Activity at Parking Structure	53.7	@	50	hard	5	5	0.00	41.9	@	110	5
Activity at Sport Courts	55.6	@	155	hard	50	5	0.00	57.8	@	120	0
							0.66				
							0.66				
							0.66				

Combined level of noise exposure at receptor from all noise sources (dBA): **58.0**

Notes:

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).

Summation of noise levels from different stationary noise sources at the same receptor is based on the equation presented on page 2-3 of FTA 2006.

Reference noise levels for surface parking lots were calculated based on the number of parking spots in the lot.

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.

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) Towards South End of the Project Site During 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)
Activity at 1st Closest Parking Lot	52.6	@	50	hard	5	5	0.00		41.6	@	100	5
Activity at Parking Structure	53.7	@	50	hard	5	5	0.00		41.9	@	110	5
							0.66					
							0.66					
							0.66					
							0.66					

Combined level of noise exposure at receptor from all noise sources (dBA): **44.7**

Notes:

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).

Summation of noise levels from different stationary noise sources at the same receptor is based on the equation presented on page 2-3 of FTA 2006.

Reference noise levels for surface parking lots were calculated based on the number of parking spots in the lot.

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.

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 North Side of Ruddy Duck Way (back yards) During Daytime 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)
Activity at 1st Closest Parking Lot	44.2	@	50	hard	5	5	0.00	45.2	@	25	5
Activity at 2nd Closest Parking Lot	45.4	@	50	hard	5	5	0.00	36.9	@	75	5
Activity at Parking Structure	53.7	@	50	hard	5	5	0.00	45.2	@	75	5
Activity at Sport Courts	55.6	@	155	hard	50	5	0.00	60.3	@	90	0
							0.66				
							0.66				

Combined level of noise exposure at receptor from all noise sources (dBA): **60.6**

Notes:

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).

Summation of noise levels from different stationary noise sources at the same receptor is based on the equation presented on page 2-3 of FTA 2006.

Reference noise levels for surface parking lots were calculated based on the number of parking spots in the lot.

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.

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 North Side of Ruddy Duck Way (back yards) During 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)
Activity at 1st Closest Parking Lot	44.2	@	50	hard	5	5	0.00		45.2	@	25	5
Activity at 2nd Closest Parking Lot	45.4	@	50	hard	5	5	0.00		36.9	@	75	5
Activity at Parking Structure	53.7	@	50	hard	5	5	0.00		45.2	@	75	5
							0.66					
							0.66					
							0.66					

Combined level of noise exposure at receptor from all noise sources (dBA): **48.5**

Notes:

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).

Summation of noise levels from different stationary noise sources at the same receptor is based on the equation presented on page 2-3 of FTA 2006.

Reference noise levels for surface parking lots were calculated based on the number of parking spots in the lot.

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.

Parking Lot Noise Calculation

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

Number of automobiles per hour		15
Number of buses per hour		0
Distance to sensitive receptor (feet)		25
Leq @	50	**44.2**
Leq @	25	**50.2**

Source

Federal Transit Administration 2006 (May). Transit Noise and Vibration Impact Assessment. Chapter 5-General Noise Assessment, Table 5-6. Office of Planning and Environment.

Parking Lot Noise Calculation

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

Number of automobiles per hour		20
Number of buses per hour		0
Distance to sensitive receptor (feet)		75
Leq @	50	**45.4**
Leq @	25	**51.4**

Source

Federal Transit Administration 2006 (May). Transit Noise and Vibration Impact Assessment. Chapter 5-General Noise Assessment, Table 5-6. Office of Planning and Environment.

Parking Lot Noise Calculation

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

Number of automobiles per hour		105
Number of buses per hour		0
Distance to sensitive receptor (feet)		100
Leq @	50	**52.6**
Leq @	25	**58.6**

Source

Federal Transit Administration. 2018 (September). Transit Noise and Vibration Impact Assessment. Washington, D.C. 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. Accessed February 4, 2019. See pages 45–47, including Equation 4-14.

Existing Noise Combined with Parking Lot Noise

Hourly Leq Noise Level by Noise Source	Existing Measured Noise Levels	Parking Lot Noise Levels	Combined Hourly Leq
Hour of Day			
0:00	52.4	0.0	52.4
1:00	50.6	0.0	50.6
2:00	49.2	0.0	49.2
3:00	46.5	0.0	46.5
4:00	48.5	0.0	48.5
5:00	56.2	44.2	56.5
6:00	63.6	44.2	63.6
7:00	64.0	44.2	64.0
8:00	63.8	44.2	63.8
9:00	63.0	44.2	63.1
10:00	63.1	44.2	63.2
11:00	63.3	44.2	63.4
12:00	63.2	44.2	63.3
13:00	63.4	44.2	63.5
14:00	63.9	44.2	63.9
15:00	64.2	44.2	64.2
16:00	64.0	44.2	64.0
17:00	64.4	44.2	64.4
18:00	62.9	44.2	63.0
19:00	61.7	44.2	61.8
20:00	58.9	44.2	59.0
21:00	58.1	0.0	58.1
22:00	56.7	0.0	56.7
23:00	55.8	0.0	55.8

Notes

Parking activity is assumed to occur during summer daylight hours only (i.e., 5 AM- 9 PM)

Existing Noise level values are shown in Appendix X, Long-term Noise Measurement Summary worksheet

Parking Lot CNEL Calculation

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: North Demo Northern Terminus near Tunnel Creek Road
Measurement Date: 8/23/2011
Project Name: North Demo

Computation of CNEL

Hour of Day (military time)	Sound Level Leq (dBA)	Sound Power =10*Log(dB A/10)	Period of 24-Hour Day (1=included, 0=not) Day	Evening	Night	Sound Power Breakdown by Period of Day Day	Evening	Night
0:00	52.4	173,781	0	0	1	0	0	173,781
1:00	50.6	114,816	0	0	1	0	0	114,816
2:00	49.2	83,177	0	0	1	0	0	83,177
3:00	46.5	44,669	0	0	1	0	0	44,669
4:00	48.5	70,796	0	0	1	0	0	70,796
5:00	56.5	442,875	0	0	1	0	0	442,875
6:00	63.6	2,316,873	0	0	1	0	0	2,316,873
7:00	64.0	2,537,892	1	0	0	2,537,892	0	0
8:00	63.8	2,424,838	1	0	0	2,424,838	0	0
9:00	63.1	2,021,268	1	0	0	2,021,268	0	0
10:00	63.2	2,067,743	1	0	0	2,067,743	0	0
11:00	63.4	2,163,967	1	0	0	2,163,967	0	0
12:00	63.3	2,115,301	1	0	0	2,115,301	0	0
13:00	63.5	2,213,767	1	0	0	2,213,767	0	0
14:00	63.9	2,480,714	1	0	0	2,480,714	0	0
15:00	64.2	2,656,273	1	0	0	2,656,273	0	0
16:00	64.0	2,537,892	1	0	0	2,537,892	0	0
17:00	64.4	2,780,234	1	0	0	2,780,234	0	0
18:00	63.0	1,975,850	1	0	0	1,975,850	0	0
19:00	61.8	1,505,114	0	1	0	0	1,505,114	0
20:00	59.0	802,252	0	1	0	0	802,252	0
21:00	58.1	645,655	0	1	0	0	645,655	0
22:00	56.7	467,736	0	0	1	0	0	467,736
23:00	55.8	380,190	0	0	1	0	0	380,190

Sum of Sound Power during Period wo/penalty	27,975,739	2,953,021	4,094,914
Log Factor for CNEL Penalty (i.e., 10*log(x))	1	3	10
Sound Power during Period with penalty	27,975,739	8,859,064	40,949,139

Total Daily Sound Power, with penalties	77,783,942
Hours per Day	24
Average Hourly Sound Power, with penalties	3,240,998
CNEL	65.1

Ldn computation on next page.

Computation of Ldn

Period of 24-Hour Day (1=included, 0=not) Day	Night	Sound Power Breakdown by Period of Day Day	Night
0	1	0	173,781
0	1	0	114,816
0	1	0	83,177
0	1	0	44,669
0	1	0	70,796
0	1	0	442,875
0	1	0	2,316,873
1	0	2,537,892	0
1	0	2,424,838	0
1	0	2,021,268	0
1	0	2,067,743	0
1	0	2,163,967	0
1	0	2,115,301	0
1	0	2,213,767	0
1	0	2,480,714	0
1	0	2,656,273	0
1	0	2,537,892	0
1	0	2,780,234	0
1	0	1,975,850	0
1	0	1,505,114	0
1	0	802,252	0
1	0	645,655	0
0	1	0	467,736
0	1	0	380,190

Sum of Sound Power during Period wo/penalty	30,928,761	4,094,914
Log Factor for Penalty (i.e., 10*log(x))	1	10
Sound Power during Period with penalty	30,928,761	40,949,139

Total Daily Sound Power, with penalties	71,877,899
Hours per Day	24
Average Hourly Sound Power, with penalties	2,994,912
Ldn	64.8

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.

Traffic Noise Spreadsheet Calculator

Project: Elk Grove CNU Hospital **Noise Level Descriptor:** Ldn

Number	Name	Segment Description and Location: From	To	Existing Conditions	Existing + Project Conditions (Phase 1)	Existing + Project Conditions (Buildout)	Δ Existing – Existing + Project (Phase 1)	Δ Existing – Existing + Project (Buildout)	Cumulative Conditions	Cumulative +Project Conditions (Phase 1)	Cumulative +Project Conditions (Buildout)	Δ Cumulative – Cumulative + Project (Phase 1)	Δ Cumulative – Cumulative + Project (Buildout)	Existing - Cumulative + Project (Phase 1)	Existing - Cumulative + Project (Buildout)
Summary of Net Changes															
1	I-5	Hood Franklin Road	Elk Grove Boulevard	66.3	66.3	66.4	0.0	0.1	68.0	68.0	68.0	0.0	0.0	1.7	1.7
2	I-5	Elk Grove Boulevard	Laguna Boulevard	67.0	67.1	67.3	0.1	0.2	68.6	68.7	68.8	0.1	0.1	1.6	1.7
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	59.5	59.8	60.4	0.3	0.8	60.8	61.0	61.4	0.2	0.6	1.5	1.9
4	Elk Grove Boulevard	West Taron Drive/Harbour Point Drive	Franklin Boulevard	61.5	62.0	62.6	0.5	1.1	62.3	62.7	63.2	0.4	0.9	1.2	1.7
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	62.2	62.6	62.9	0.3	0.7	63.0	63.3	63.6	0.3	0.6	1.1	1.4
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	63.7	63.8	63.8	0.1	0.1	65.0	65.0	65.1	0.0	0.1	1.3	1.4
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	63.4	66.3	69.0	2.9	5.6	64.7	67.0	69.4	2.3	4.7	3.6	6.0
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	54.4	54.6	54.7	0.1	0.2	54.4	54.6	54.7	0.1	0.2	0.1	0.2
9	Riparian Drive	West Taron Drive	Waterfowl Drive	49.8	51.1	52.3	1.3	2.5	51.1	52.1	53.1	1.0	1.9	2.3	3.3
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	59.8	60.0	60.3	0.2	0.5	61.7	61.8	62.0	0.1	0.3	2.0	2.2
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	56.4	56.7	57.0	0.2	0.6	58.3	58.5	58.7	0.1	0.4	2.0	2.3

Note: Some calculations may vary +/- 0.1 dB from the incremental increase noise levels listed in Table 3.11-15 due to rounding in the modeling.

Traffic Noise Spreadsheet Calculator

Project: Elk Grove CNU Hospital

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor:

		Segment Description and Location		Input										Output	
						Distance to Directional Centerline, (feet)[4]		Traffic Distribution Characteristics							
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night	Ldn, $(dBA)_{5,6,7}$	Ldn Including Applicable Attenuation
Existing Conditions															
1	I-5	Hood Franklin Road	Elk Grove Boulevard	77,000	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	71.3	66.3
2	I-5	Elk Grove Boulevard	Laguna Boulevard	91,000	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	72.0	67.0
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	26,400	45	100	110	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	64.5	59.5
4	Elk Grove Boulevard	West Taron Drive/Harbour Pc	Franklin Boulevard	40,900	45	100	110	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	66.5	61.5
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	35,200	45	80	90	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.2	62.2
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	13,300	40	60	65	98.0%	1.3%	0.7%	80.0%	15.0%	5.0%	63.7	63.7
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	7,300	35	30	35	98.9%	0.7%	0.4%	80.0%	15.0%	5.0%	63.4	63.4
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	4,000	35	40	40	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	59.4	54.4
9	Riparian Drive	West Taron Drive	Waterfowl Drive	1,700	35	45	45	99.2%	0.5%	0.3%	80.0%	15.0%	5.0%	54.8	49.8
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	20,900	45	80	95	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	64.8	59.8
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	22,100	45	150	150	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	61.4	56.4

Traffic Noise Spreadsheet Calculator

Project:

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor:

		Segment Description and Location		Input										Output	
						Distance to Directional Centerline, (feet)[4]		Traffic Distribution Characteristics							
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night	Ldn, $(dBA)_{5,6,7}$	Ldn Including Applicable Attenuation
Existing Plus Project (Phase 1)															
1	I-5	Hood Franklin Road	Elk Grove Boulevard	77,200	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	71.3	66.3
2	I-5	Elk Grove Boulevard	Laguna Boulevard	92,600	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	72.1	67.1
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	28,200	45	100	110	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	64.8	59.8
4	Elk Grove Boulevard	West Taron Drive/Harbour Pc	Franklin Boulevard	46,100	45	100	110	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.0	62.0
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	38,100	45	80	90	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.6	62.6
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	13,500	40	60	65	98.0%	1.3%	0.7%	80.0%	15.0%	5.0%	63.8	63.8
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	14,300	35	30	35	98.9%	0.7%	0.4%	80.0%	15.0%	5.0%	66.3	66.3
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	4,100	35	40	40	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	59.6	54.6
9	Riparian Drive	West Taron Drive	Waterfowl Drive	2,300	35	45	45	99.2%	0.5%	0.3%	80.0%	15.0%	5.0%	56.1	51.1
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	22,000	45	80	95	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	65.0	60.0
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	23,300	45	150	150	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	61.7	56.7

Traffic Noise Spreadsheet Calculator

Project: Buildout

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor:

		Segment Description and Location		Input										Output	
						Distance to Directional Centerline, (feet)[4]		Traffic Distribution Characteristics							
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night	Ldn, $(dBA)_{5,6,7}$	Ldn Including Applicable Attenuation
Existing Plus Project (Buildout)															
1	I-5	Hood Franklin Road	Elk Grove Boulevard	78,100	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	71.4	66.4
2	I-5	Elk Grove Boulevard	Laguna Boulevard	95,400	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	72.3	67.3
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	31,900	45	100	110	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	65.4	60.4
4	Elk Grove Boulevard	West Taron Drive/Harbour Pc	Franklin Boulevard	52,500	45	100	110	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.6	62.6
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	41,300	45	80	90	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.9	62.9
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	13,700	40	60	65	98.0%	1.3%	0.7%	80.0%	15.0%	5.0%	63.8	63.8
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	26,500	35	30	35	98.9%	0.7%	0.4%	80.0%	15.0%	5.0%	69.0	69.0
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	4,200	35	40	40	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	59.7	54.7
9	Riparian Drive	West Taron Drive	Waterfowl Drive	3,000	35	45	45	99.2%	0.5%	0.3%	80.0%	15.0%	5.0%	57.3	52.3
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	23,400	45	80	95	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	65.3	60.3
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	25,100	45	150	150	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	62.0	57.0

Traffic Noise Spreadsheet Calculator

Project: Elk Grove CNU Hospital

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor:

		Segment Description and Location		Input										Output	
						Distance to Directional Centerline, (feet)[4]		Traffic Distribution Characteristics							
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night	Ldn, $(dBA)_{5,6,7}$	Ldn Including Applicable Attenuation
Cumulative Conditions															
1	I-5	Hood Franklin Road	Elk Grove Boulevard	113,200	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	73.0	68.0
2	I-5	Elk Grove Boulevard	Laguna Boulevard	130,700	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	73.6	68.6
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	35,400	45	100	110	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	65.8	60.8
4	Elk Grove Boulevard	West Taron Drive/Harbour Pc	Franklin Boulevard	49,200	45	100	110	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.3	62.3
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	42,400	45	80	90	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	68.0	63.0
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	17,900	40	60	65	98.0%	1.3%	0.7%	80.0%	15.0%	5.0%	65.0	65.0
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	9,800	35	30	35	98.9%	0.7%	0.4%	80.0%	15.0%	5.0%	64.7	64.7
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	4,000	35	40	40	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	59.4	54.4
9	Riparian Drive	West Taron Drive	Waterfowl Drive	2,300	35	45	45	99.2%	0.5%	0.3%	80.0%	15.0%	5.0%	56.1	51.1
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	31,900	45	80	95	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	66.7	61.7
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	34,200	45	150	150	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	63.3	58.3

Traffic Noise Spreadsheet Calculator

Project: Phase 1

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor:

Number	Segment Description and Location: Name	From	To	Input: ADT	Speed (mph)	Distance to Directional Centerline, (feet)$_4$: Near	Far	Traffic Distribution Characteristics: % Auto	% Medium	% Heavy	% Day	% Eve	% Night	Output: Ldn, (dBA)$_{5,6,7}$	Ldn Including Applicable Attenuation
Cumulative Plus Project (Phase 1)															
1	I-5	Hood Franklin Road	Elk Grove Boulevard	113,400	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	73.0	68.0
2	I-5	Elk Grove Boulevard	Laguna Boulevard	132,300	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%	73.7	68.7
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	37,200	45	100	110	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	66.0	61.0
4	Elk Grove Boulevard	West Taron Drive/Harbour Pc	Franklin Boulevard	54,400	45	100	110	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	67.7	62.7
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	45,300	45	80	90	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	68.3	63.3
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	18,100	40	60	65	98.0%	1.3%	0.7%	80.0%	15.0%	5.0%	65.0	65.0
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	16,800	35	30	35	98.9%	0.7%	0.4%	80.0%	15.0%	5.0%	67.0	67.0
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	4,100	35	40	40	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	59.6	54.6
9	Riparian Drive	West Taron Drive	Waterfowl Drive	2,900	35	45	45	99.2%	0.5%	0.3%	80.0%	15.0%	5.0%	57.1	52.1
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	33,000	45	80	95	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%	66.8	61.8
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	35,400	45	150	150	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%	63.5	58.5

Traffic Noise Spreadsheet Calculator

Project: Buildout

Noise Level Descriptor: Ldn
Site Conditions: Soft
Traffic Input: ADT
Traffic K-Factor:

		Segment Description and Location		Input											Output	
						Distance to Directional Centerline, (feet)[4]		Traffic Distribution Characteristics								
Number	Name	From	To	ADT	Speed (mph)	Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve	% Night		Ldn, $(dBA)_{5,6,7}$	Ldn Including Applicable Attenuation
Cumulative Plus Project (Buildout)																
1	I-5	Hood Franklin Road	Elk Grove Boulevard	114,300	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%		73.0	68.0
2	I-5	Elk Grove Boulevard	Laguna Boulevard	135,100	65	190	265	84.6%	10.3%	5.1%	80.0%	15.0%	5.0%		73.8	68.8
3	Elk Grove Boulevard	I-5	West Taron Drive/Harbour Point Drive	40,900	45	100	110	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%		66.4	61.4
4	Elk Grove Boulevard	West Taron Drive/Harbour Pc	Franklin Boulevard	60,800	45	100	110	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%		68.2	63.2
5	Elk Grove Boulevard	Franklin Boulevard	Bruceville Road	48,500	45	80	90	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%		68.6	63.6
6	Harbour Point Drive	Elk Grove Boulevard	Laguna Boulevard	18,300	40	60	65	98.0%	1.3%	0.7%	80.0%	15.0%	5.0%		65.1	65.1
7	West Taron Drive	Riparian Drive	Elk Grove Boulevard	29,000	35	30	35	98.9%	0.7%	0.4%	80.0%	15.0%	5.0%		69.4	69.4
8	West Taron Drive	Ruddy Duck Way	Riparian Drive	4,200	35	40	40	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%		59.7	54.7
9	Riparian Drive	West Taron Drive	Waterfowl Drive	3,600	35	45	45	99.2%	0.5%	0.3%	80.0%	15.0%	5.0%		58.1	53.1
10	Franklin Boulevard	Elk Grove Boulevard	Laguna Boulevard	34,400	45	80	95	98.8%	0.8%	0.4%	80.0%	15.0%	5.0%		67.0	62.0
11	Franklin Boulevard	Laguna Boulevard	Whitelock Parkway	37,200	45	150	150	99.0%	0.7%	0.3%	80.0%	15.0%	5.0%		63.7	58.7