

# **Appendix C**

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## Noise Modeling Calculations



# Construction Source Noise Prediction Model

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level ( $L_{eq}$ dBA)	Equipment	Reference Noise Levels ( $L_{max}$ ) at 50 feet <sup>1</sup>	Usage Factor <sup>1</sup>
Multi-Family Residences	250	69.2	Front End Loader	80	0.4
			Backhoe	80	0.4
			Dozer	85	0.4
			Ground Type	hard	
			Source Height	8	
			Receiver Height	5	
			Ground Factor <sup>2</sup>	0.00	
			<b>Predicted Noise Level<sup>3</sup></b>	<b><math>L_{eq}</math> dBA at 50 feet<sup>3</sup></b>	
			Front End Loader	76.0	
			Backhoe	76.0	
			Dozer	81.0	
			<b>Combined Predicted Noise Level (<math>L_{eq}</math> dBA at 50 feet)</b>		
					83.1

Sources:

<sup>1</sup> Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

<sup>2</sup> Based on Table 4-26 from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 86).

<sup>3</sup> Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2018 (pg 176 and 177).

$$L_{eq}(\text{equip}) = E.L. + 10 \cdot \log(U.F.) - 20 \cdot \log(D/50) - 10 \cdot G \cdot \log(D/50)$$

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)
HVAC equipment	70.0	@	50	hard	12	5	0.00	54.4	@	300
							0.66			
							0.66			
							0.66			
							0.66			
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							0.66			
							0.66			
							0.66			

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

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](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: March 5, 2020.

# Traffic Noise Spreadsheet Calculator



**Project:** Natomas Town Center

Number	Segment Description and Location			Existing Conditions	Existing + Project Conditions	Δ Existing – Existing + Project
	Name	From	To			
<b>Summary of Net Changes</b>						
1	I-5 Southbound Ramp	Del Paso Rd	I-5 Southbound	67.1	67.2	0.1
2	Del Paso Rd	I-5 Southbound Ramp	El Centro Rd	70.5	70.6	0.1
3	Del Paso Rd	I-5 Southbound Ramp	I-5 Northbound Ramp	70.9	71.0	0.1
4	I-5 Northbound Ramp	Del Paso Rd	I-5 Northbound	67.3	67.5	0.2
5	Del Paso Rd	I-5 Northbound Ramp	E Commerce Way	71.4	71.6	0.2
6	E Commerce Way	Del Paso Rd	New Market Dr	69.8	69.8	0.0
7	E Commerce Way	Del Paso Rd	Advantage Way	69.4	69.5	0.1
8	Del Paso Rd	E Commerce Way	Town Center Drive	70.1	70.4	0.3
9	Town Center Drive	Del Paso Rd	Natomas Town Center	58.2	59.9	1.8
10	Sports Parkway	Del Paso Rd	End of Sports Parkway	60.2	60.3	0.2
11	Town Center Drive	Natomas Town Center	New Market Dr	57.2	57.4	0.2
12	Natomas Town Center	Town Center Drive	E Commerce Way	51.0	51.1	0.1
13	New Market Drive	Town Center Drive	E Commerce Way	60.3	60.5	0.2
14	Town Center Drive	New Market Drive	End of Town Center Drive	49.9	50.1	0.2
15	Del Paso Rd	Town Center Drive	Project driveway	70.2	70.3	0.1
16	Project driveway	Town Center Drive	Project site	N/A	51.2	N/A
17	Del Paso Rd	Project driveway	Via Ingoglia	70.2	70.4	0.2
18	Via Ingoglia	Del Paso Rd	Library-ARC Driveway	61.3	61.6	0.3
19	Del Paso Rd	Via Ingoglia	Five Star Way	70.3	70.6	0.3
20	Library-ARC Driveway	Via Ingoglia	Del Paso Rd	49.2	49.6	0.4
21	Via Ingoglia	Library-ARC Driveway	New Market Dr	60.9	61.0	0.1
22	Via Ingoglia	New Market Drive	North Natomas Ball Park	51.1	51.1	0.0
23	New Market Drive	Via Ingoglia	Natomas Blvd	58.2	58.3	0.1
24	Del Paso Rd	Five Star Way	Natomas Blvd	70.0	70.4	0.4
25	Natomas Blvd	Del Paso Rd	Park Place Dr	71.4	71.5	0.1
26	Del Paso Rd	Natomas Blvd	Park Place Dr	68.5	68.8	0.3
27	Truxel Rd	Del Paso Rd	Terracina Dr	67.9	68.0	0.1

\*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: Natomas Town Center

Noise Level Descriptor: Ldn  
 Site Conditions: Hard  
 Traffic Input: Peak  
 Traffic K-Factor: 9.76

Segment Description and Location				Input											Output					
Number	Name	From	To	Peak Hour Volume	Speed (mph)	Distance to Directional Centerline, (feet) <sub>4</sub>		Traffic Distribution Characteristics					Ldn, (dBA) <sub>5,6,7</sub>	Distance to Contour, (feet) <sub>3</sub>						
						Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve		% Night	70 dBA	65 dBA	60 dBA	55 dBA		
<b>Existing Conditions</b>																				
1	I-5 Southbound Ramp	Del Paso Rd	I-5 Southbound	1,425	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67	25	80	254	803		
2	Del Paso Rd	I-5 Southbound Ramp	El Centro Rd	3,175	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	57	179	565	1788		
3	Del Paso Rd	I-5 Southbound Ramp	I-5 Northbound Ramp	3,419	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	61	193	609	1926		
4	I-5 Northbound Ramp	Del Paso Rd	I-5 Northbound	1,511	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67	27	85	269	851		
5	Del Paso Rd	I-5 Northbound Ramp	E Commerce Way	3,863	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	69	218	688	2176		
6	E Commerce Way	Del Paso Rd	New Market Dr	1,902	45	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	47	150	474	1499		
7	E Commerce Way	Del Paso Rd	Advantage Way	1,752	45	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69	44	138	437	1381		
8	Del Paso Rd	E Commerce Way	Town Center Drive	2,896	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	52	163	516	1631		
9	Town Center Drive	Del Paso Rd	Natomas Town Center	773	20	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58.2	3	10	33	104		
10	Sports Parkway	Del Paso Rd	End of Sports Parkway	614	30	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60	5	16	52	164		
11	Town Center Drive	Natomas Town Center	New Market Dr	617	20	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	57	3	8	26	83		
12	Natomas Town Center	Town Center Drive	E Commerce Way	164	15	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51	1	2	6	20		
13	New Market Drive	Town Center Drive	E Commerce Way	639	30	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60	5	17	54	170		
14	Town Center Drive	New Market Drive	End of Town Center Drive	115	20	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	50		2	5	15		
15	Del Paso Rd	Town Center Drive	Project driveway	2,940	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	52	166	524	1656		
16	Project driveway	Town Center Drive	Project site	N/A	15	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!		
17	Del Paso Rd	Project driveway	Via Ingoglia	2,947	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	52	166	525	1660		
18	Via Ingoglia	Del Paso Rd	Library-ARC Driveway	540	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61	7	21	67	211		
19	Del Paso Rd	Via Ingoglia	Five Star Way	3,039	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	54	171	541	1712		
20	Library-ARC Driveway	Via Ingoglia	Del Paso Rd	109	15	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	49		1	4	13		
21	Via Ingoglia	Library-ARC Driveway	New Market Dr	501	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61	6	20	62	196		
22	Via Ingoglia	New Market Drive	North Natomas Ball Park	52	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51	1	2	6	20		
23	New Market Drive	Via Ingoglia	Natomas Blvd	391	30	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58	3	10	33	104		
24	Del Paso Rd	Five Star Way	Natomas Blvd	2,828	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	50	159	504	1593		
25	Natomas Blvd	Del Paso Rd	Park Place Dr	2,749	45	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	69	217	685	2167		
26	Del Paso Rd	Natomas Blvd	Park Place Dr	1,986	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	68	35	112	354	1119		
27	Truxel Rd	Del Paso Rd	Terracina Dr	2,489	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	68	31	97	308	975		

Traffic Noise Spreadsheet Calculator



Project: Natomas Town Center

Noise Level Descriptor: Ldn  
 Site Conditions: Hard  
 Traffic Input: Peak  
 Traffic K-Factor: 9.76

Segment Description and Location			Input											Output				
Number	Name	From	To	Peak Hour Volume	Speed (mph)	Distance to Directional Centerline, (feet) <sub>4</sub>		Traffic Distribution Characteristics					Ldn, (dBA) <sub>5,6,7</sub>	Distance to Contour, (feet) <sub>3</sub>				
						Near	Far	% Auto	% Medium	% Heavy	% Day	% Eve		% Night	70 dBA	65 dBA	60 dBA	55 dBA
<b>Existing Conditions</b>																		
1	I-5 Southbound Ramp	Del Paso Rd	I-5 Southbound	1,475	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67	26	83	263	831
2	Del Paso Rd	I-5 Southbound Ramp	El Centro Rd	3,213	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	57	181	572	1810
3	Del Paso Rd	I-5 Southbound Ramp	I-5 Northbound Ramp	3,507	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	62	198	625	1975
4	I-5 Northbound Ramp	Del Paso Rd	I-5 Northbound	1,574	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	67	28	89	280	886
5	Del Paso Rd	I-5 Northbound Ramp	E Commerce Way	4,022	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	72	72	227	716	2265
6	E Commerce Way	Del Paso Rd	New Market Dr	1,917	45	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	48	151	478	1511
7	E Commerce Way	Del Paso Rd	Advantage Way	1,775	45	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69	44	140	442	1399
8	Del Paso Rd	E Commerce Way	Town Center Drive	3,092	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	55	174	551	1741
9	Town Center Drive	Del Paso Rd	Natomas Town Center	1,159	20	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60	5	16	49	156
10	Sports Parkway	Del Paso Rd	End of Sports Parkway	637	30	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60	5	17	54	170
11	Town Center Drive	Natomas Town Center	New Market Dr	647	20	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	57	3	9	28	87
12	Natomas Town Center	Town Center Drive	E Commerce Way	169	15	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51	1	2	6	20
13	New Market Drive	Town Center Drive	E Commerce Way	664	30	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	60	6	18	56	177
14	Town Center Drive	New Market Drive	End of Town Center Drive	120	20	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	50	1	2	5	16
15	Del Paso Rd	Town Center Drive	Project driveway	3,002	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	53	169	535	1691
16	Project driveway	Town Center Drive	Project site	172	15	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51	1	2	7	21
17	Del Paso Rd	Project driveway	Via Ingoglia	3,093	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	55	174	551	1742
18	Via Ingoglia	Del Paso Rd	Library-ARC Driveway	578	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	62	7	23	72	226
19	Del Paso Rd	Via Ingoglia	Five Star Way	3,223	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	57	182	574	1815
20	Library-ARC Driveway	Via Ingoglia	Del Paso Rd	120	15	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	50		1	5	14
21	Via Ingoglia	Library-ARC Driveway	New Market Dr	511	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	61	6	20	63	200
22	Via Ingoglia	New Market Drive	North Natomas Ball Park	52	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	51	1	2	6	20
23	New Market Drive	Via Ingoglia	Natomas Blvd	402	30	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	58	3	11	34	107
24	Del Paso Rd	Five Star Way	Natomas Blvd	3,079	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	70	55	173	548	1734
25	Natomas Blvd	Del Paso Rd	Park Place Dr	2,820	45	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	71	70	222	703	2223
26	Del Paso Rd	Natomas Blvd	Park Place Dr	2,120	40	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	69	38	119	378	1194
27	Truxel Rd	Del Paso Rd	Terracina Dr	2,554	35	50	50	97.0%	2.0%	1.0%	80.0%	15.0%	5.0%	68	32	100	316	1000

Citation # Citations

- |    |  |  |
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| 13 | Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (16), Pg 67 |  |
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