APPENDIX C
Noise Calculations

US Army Corps of Engineers
Corte Madera Creek Flood Risk Management Project
October 2018

Noise Calculations

Equipment List

Equipment	Specified L_{max} 50ft (dBA)	Acoustical Usage Factor (%)
Soil Compactor	80	20
Backhoe	80	40
Concrete Pump Truck	82	20
Trenching Machine	82	50
Articulated Hauler, Track Dumper, Tracked Carrier	84	40
Crane (Truck-Mounted, Mobile)	85	16
Asphalt Drum Compactor	85	20
Dozer, Excavator, Plant Remover	85	40
Manual Soil Compactor	85	50
Concrete Cutter/Crusher	90	20
Vibratory Pile Driver	95	20

Equipment for Each Task

Task	ALT A	ALT B	ALT F	ALT G	ALT J	Loudest Equipment
Prepare site	Y	Y	Y	Y	Y	Manual Soil Compactor, Excavator
Construct top of bank floodwalls	Y	Y	N	Y	Y	Vibratory Pile Driver, Manual Soil Compactor
Construct setback floodwalls	Y	Y	Y	Y	N	Manual Soil Compactor, Excavator
Construct parallel culvert bypass/College Ave culverts	Y	Y	Y	Y	Y	Vibratory Pile Driver, Manual Soil Compactor
Remove existing Denil fish ladder	Y	Y	Y	Y	Y	Manual Soil Compactor, Excavator
Widen creek to create benches near	N	Y	Y	Y	N	Manual Soil Compactor, Excavator
Remove concrete channel floor and right bank	N	Y	Y	Y	N	Concrete Cutter, Concrete Crusher
Construct Allen Park riparian corridor	N	N	Y	Y	Y	Excavators, Dozer
Replace and improve bicycle-pedestrian pathway	N	N	Y	Y	N	Manual Soil Compactor, Excavator
Install box culverts under Sir Francis Drake Boulevard at night	N	N	Y	N	Y	Crane, Dozer

L_{eq} Calculation

The L_{eq} for each task was calculated by compounding the noise level from the two loudest pieces of equipment and the measured ambient nosie level of 53.5 dBA. For tasks utilizing a vibratory pile driver, it was assumed that this single piece of equipment would be used alone, as it produces substantially more noise than other equipment.

Equation 1 was used to calculate the L_{eq} for each piece of equipment.

Equation 1 $L_{eq} = L_{max} + 10\log(UF)$

where L_{eq}= equivalent noise level (dBA)
L_{max}=peak noise level, (dBA)
UF=usage factor (%)

Equation 2 was used to calculate the compounded L_{eq} for each task.

Equation 2 $L_{eq,total} = 10\log(10^{Leq,1/10} + 10^{Leq,2/10})$

where $L_{eq,\ total}$= combined total equivalent noise level (dBA)
$L_{eq,1}$= L_{eq} of equipment piece #1, (dBA)
$L_{eq,2}$= L_{eq} of equipment piece #2, (dBA)

	L_{max} (50ft)	L_{max} (25ft)	Usage (%)	L_{eq} (50ft)	L_{eq} (25ft)
Prepare site					
Daytime Noise				53.5	53.5
Manual Soil Compactor	85	91.0	40	81.0	87.0
Excavator	85	91.0	40	81.0	87.0
			Totals:	84.0	90.1
Construct top of bank floodwalls					
Daytime Noise				53.5	53.5
Vibratory Pile Driver	95	101.0	20	88.0	94.0
			Totals:	88.0	94.0
Construct offset floodwalls					
Daytime Noise				53.5	53.5
Manual Soil Compactor	85	91.0	40	81.0	87.0
Excavator	85	91.0	40	81.0	87.0
			Totals:	84.0	90.1
Construct parallel culvert bypass/College Ave culverts					
Daytime Noise				53.5	53.5
Vibratory Pile Driver	95	101.0	20	88.0	94.0
			Totals:	88.0	94.0

	L_{max} (50ft)	L_{max} (25ft)	Usage (%)	L_{eq} (50ft)	L_{eq} (25ft)
Remove existing Denil fish ladder					
Daytime Noise				53.5	53.5
Manual Soil Compactor	85	91.0	40	81.0	87.0
Excavator	85	91.0	40	81.0	87.0
			Totals:	84.0	90.1
Widen creek to create benches near College Ave and construct retaining wall					
Daytime Noise				53.5	53.5
Manual Soil Compactor	85	91.0	40	81.0	87.0
Excavator	85	91.0	40	81.0	87.0
			Totals:	84.0	90.1
Remove concrete channel floor and right bank					
Daytime Noise				53.5	53.5
Concrete Cutter	90	96.0	20	83.0	89.0
Concrete Crusher	90	96.0	20	83.0	89.0
			Totals:	86.0	92.0
Construct Allen Park riparian corridor					
Daytime Noise				53.5	53.5
Dozer	85	91.0	40	81.0	87.0
Excavator	85	91.0	40	81.0	87.0
			Totals:	84.0	90.1
Replace and improve bicycle-pedestrian pathway					
Daytime Noise				53.5	53.5
Manual Soil Compactor	85	91.0	40	81.0	87.0
Excavator	85	91.0	40	81.0	87.0
			Totals:	84.0	90.1
Install Box Culverts under Sir Francis Drake Boulevard at Night					
Daytime Noise (8pm-10pm)				53.5	53.5
Crane	85	91.0	16	77.0	83.1
Dozer	85	91.0	40	81.0	87.0
			Totals:	82.5	88.5
Nighttime Noise (10pm-midnight)				40.0	40.0
Crane	85	91.0	16	77.0	83.1
Dozer	85	91.0	40	81.0	87.0
			Totals:	82.5	88.5

Average L_{eq} for Each Alternative at 50 feet and 25 feet

The average noise level among the construction tasks for each alternative were calculated by averaging noise levels in a linear scale and then converting back to a logarithmic scale (equation 3).

Equation 3

$$L_{eq,average} = 10\log\left(\frac{\sum_{i=1}^{n} 10^{L_i/10}}{n}\right)$$

where $L_{eq,\ average}$= average equivalent noise level (dBA)
L_i = noise level from construction tasks, 1 to n (dBA)
n= number of construction tasks applicable to alternative

Task	ALT A		ALT B		ALT F		ALT G		ALT J	
	50 ft	25 ft	50 ft	25 ft	50 ft	25 ft	50 ft	25 ft	50 ft	25 ft
Prepare site	84.0	90.1	84.0	90.1	84.0	90.1	84.0	90.1	84.0	90.1
Construct top of bank floodwalls	88.0	94.0	88.0	94.0	-	-	88.0	94.0	88.0	94.0
Construct offset floodwalls	84.0	90.1	84.0	90.1	84.0	90.1	84.0	90.1	-	-
Construct parallel culvert bypass/College Ave culverts	88.0	94.0	88.0	94.0	88.0	94.0	88.0	94.0	88.0	94.0
Remove existing Denil fish ladder	84.0	90.1	84.0	90.1	84.0	90.1	84.0	90.1	84.0	90.1
Widen creek to create benches near College Ave and construct retaining wall	-	-	84.0	90.1	84.0	90.1	84.0	90.1	-	-
Remove concrete channel floor and right bank	-	-	86.0	92.0	86.0	92.0	86.0	92.0	-	-
Construct Allen Park riparian corridor	-	-	-	-	84.0	90.1	84.0	90.1	84.0	90.1
Replace and improve bicycle-pedestrian pathway	-	-	-	-	84.0	90.1	84.0	90.1	-	-
Average	**86.1**	**92.1**	**85.8**	**91.8**	**85.0**	**91.1**	**85.5**	**91.5**	**86.1**	**92.1**

L_{dn} Calculation

L_{dn}, the Day-Night Average Noise Level, is a 24-hour average L_{eq} with a 10 dBA penalty during the hours of 10 pm to 7 am to account for noise sensitivity in the evening and nighttime, respectively. Pages C-5 to C-15 present detailed tables used to calcualte L_{dn}, both mitigated and unmitigated for each alternative. L_{dn} was caculated by averaging the hourly noise level over 24 hours (equation 4). Similar to the L_{eq} calculations, the average was calculated in a linear scale and then converted back into a logarithmic scale (decibels). The ambient daytime noise level used was 53.5 dBA, and the nighttime noise level used was 40 dBA. The average L_{eq} for each alternative was used during construction hours. Mitigated L_{dn} considers a 10 dBA reduction in construction noise levels.

For Alternatives F and J L_{dn} was also calculated for the circumstance of nighttime installation of box culverts under Sir Francis Drake Boulevard. Nighttime construction was estimated to occur for 4 hours, from 8 pm to midnight. An excavator was assumed to be the loudest piece of daytime equipment during this construction task.

Equation 4

$$L_{dn} = 10\log\left(\frac{\sum_{i=1}^{24} 10^{L_i/10}}{24}\right)$$

where L_{dn}= average equivalent noise level (dBA)

L_i = weighted noise level each hour of the day (dBA)

Summary

Unmitigated

ALT	L_{dn} 50 ft	L_{dn} 25 ft
A	81.8	87.8
B	81.6	87.6
F	80.8	86.8
G	81.2	87.2
J	81.8	87.8

Mitigated

ALT	L_{dn} 50 ft	L_{dn} 25 ft
A	71.8	77.8
B	71.6	77.6
F	70.8	76.8
G	71.3	77.3
J	71.8	77.8

Night Construction

Alternatives F & J Nighttime Construction on Sir Francis Drake Boulevard

	L_{dn} 50 ft	L_{dn} 25 ft
Unmitigated	83.2	89.2
Mitigated	73.2	79.2

Alternative A

L_{dn} at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	86.1	0	86.1
9:00 AM	86.1	0	86.1
10:00 AM	86.1	0	86.1
11:00 AM	86.1	0	86.1
Noon	86.1	0	86.1
1:00 PM	86.1	0	86.1
2:00 PM	86.1	0	86.1
3:00 PM	86.1	0	86.1
4:00 PM	86.1	0	86.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**81.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**71.8**

Alternative A

L_{dn} at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	92.1	0	92.1
9:00 AM	92.1	0	92.1
10:00 AM	92.1	0	92.1
11:00 AM	92.1	0	92.1
Noon	92.1	0	92.1
1:00 PM	92.1	0	92.1
2:00 PM	92.1	0	92.1
3:00 PM	92.1	0	92.1
4:00 PM	92.1	0	92.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**87.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**77.8**

Alternative B

L_{dn} at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	85.8	0	85.8
9:00 AM	85.8	0	85.8
10:00 AM	85.8	0	85.8
11:00 AM	85.8	0	85.8
Noon	85.8	0	85.8
1:00 PM	85.8	0	85.8
2:00 PM	85.8	0	85.8
3:00 PM	85.8	0	85.8
4:00 PM	85.8	0	85.8
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**81.6**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**71.6**

Alternative B

L_{dn} at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	91.8	0	91.8
9:00 AM	91.8	0	91.8
10:00 AM	91.8	0	91.8
11:00 AM	91.8	0	91.8
Noon	91.8	0	91.8
1:00 PM	91.8	0	91.8
2:00 PM	91.8	0	91.8
3:00 PM	91.8	0	91.8
4:00 PM	91.8	0	91.8
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**87.6**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
91.8	-10	81.85
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**77.6**

Alternative F

L_{dn} at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	85.0	0	85.0
9:00 AM	85.0	0	85.0
10:00 AM	85.0	0	85.0
11:00 AM	85.0	0	85.0
Noon	85.0	0	85.0
1:00 PM	85.0	0	85.0
2:00 PM	85.0	0	85.0
3:00 PM	85.0	0	85.0
4:00 PM	85.0	0	85.0
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**80.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**70.8**

Alternative F

L_{dn} at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	91.1	0	91.1
9:00 AM	91.1	0	91.1
10:00 AM	91.1	0	91.1
11:00 AM	91.1	0	91.1
Noon	91.1	0	91.1
1:00 PM	91.1	0	91.1
2:00 PM	91.1	0	91.1
3:00 PM	91.1	0	91.1
4:00 PM	91.1	0	91.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**86.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**76.8**

Alternative G

L_{dn} at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	85.5	0	85.5
9:00 AM	85.5	0	85.5
10:00 AM	85.5	0	85.5
11:00 AM	85.5	0	85.5
Noon	85.5	0	85.5
1:00 PM	85.5	0	85.5
2:00 PM	85.5	0	85.5
3:00 PM	85.5	0	85.5
4:00 PM	85.5	0	85.5
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**81.2**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**71.3**

Alternative G

L_{dn} at 25 feet

	Unmitigated			Mitigated (Noise Barrier)		
Hour	L_{eq}	Weight	Weighted Noise (L_i)	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50	40	10	50
1:00 AM	40	10	50	40	10	50
2:00 AM	40	10	50	40	10	50
3:00 AM	40	10	50	40	10	50
4:00 AM	40	10	50	40	10	50
5:00 AM	40	10	50	40	10	50
6:00 AM	40	10	50	40	10	50
7:00 AM	53.5	0	53.5	53.5	0	53.5
8:00 AM	91.5	0	91.5	91.5	-10	81.5
9:00 AM	91.5	0	91.5	91.5	-10	81.5
10:00 AM	91.5	0	91.5	91.5	-10	81.5
11:00 AM	91.5	0	91.5	91.5	-10	81.5
Noon	91.5	0	91.5	91.5	-10	81.5
1:00 PM	91.5	0	91.5	91.5	-10	81.5
2:00 PM	91.5	0	91.5	91.5	-10	81.5
3:00 PM	91.5	0	91.5	91.5	-10	81.5
4:00 PM	91.5	0	91.5	91.5	-10	81.5
5:00 PM	53.5	0	53.5	53.5	0	53.5
6:00 PM	53.5	0	53.5	53.5	0	53.5
7:00 PM	53.5	0	53.5	53.5	0	53.5
8:00 PM	53.5	0	53.5	53.5	0	53.5
9:00 PM	53.5	0	53.5	53.5	0	53.5
10:00 PM	40	10	50	40	10	50
11:00 PM	40	10	50	40	10	50
		L_{dn}	**87.2**		**L_{dn}**	**77.3**

Alternative J

L_{dn} at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	86.1	0	86.1
9:00 AM	86.1	0	86.1
10:00 AM	86.1	0	86.1
11:00 AM	86.1	0	86.1
Noon	86.1	0	86.1
1:00 PM	86.1	0	86.1
2:00 PM	86.1	0	86.1
3:00 PM	86.1	0	86.1
4:00 PM	86.1	0	86.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**81.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**71.8**

Alternative J

L_{dn} at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	92.1	0	92.1
9:00 AM	92.1	0	92.1
10:00 AM	92.1	0	92.1
11:00 AM	92.1	0	92.1
Noon	92.1	0	92.1
1:00 PM	92.1	0	92.1
2:00 PM	92.1	0	92.1
3:00 PM	92.1	0	92.1
4:00 PM	92.1	0	92.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	53.5	0	53.5
9:00 PM	53.5	0	53.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		L_{dn}	**87.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
40	10	50
40	10	50
	L_{dn}	**77.8**

Alternatives F & J Nighttime Construction for Bypass

L_{dn} at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	81.0	0	81.0
9:00 AM	81.0	0	81.0
10:00 AM	81.0	0	81.0
11:00 AM	81.0	0	81.0
Noon	81.0	0	81.0
1:00 PM	81.0	0	81.0
2:00 PM	81.0	0	81.0
3:00 PM	81.0	0	81.0
4:00 PM	81.0	0	81.0
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	82.5	0	82.5
9:00 PM	82.5	0	82.5
10:00 PM	82.5	10	92.5
11:00 PM	82.5	10	92.5
		L_{dn}	**83.2**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
82.5	-10	72.5
82.5	-10	72.5
82.5	0	82.5
82.5	0	82.5
	L_{dn}	**73.2**

Alternatives F & J Nighttime Construction for Bypass

L_{dn} at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	87.0	0	87.0
9:00 AM	87.0	0	87.0
10:00 AM	87.0	0	87.0
11:00 AM	87.0	0	87.0
Noon	87.0	0	87.0
1:00 PM	87.0	0	87.0
2:00 PM	87.0	0	87.0
3:00 PM	87.0	0	87.0
4:00 PM	87.0	0	87.0
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	0	53.5
8:00 PM	88.5	0	88.5
9:00 PM	88.5	0	88.5
10:00 PM	88.5	10	98.5
11:00 PM	88.5	10	98.5
		L_{dn}	**89.2**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
87.00	-10	77.0
53.5	0	53.5
53.5	0	53.5
53.5	0	53.5
88.5	-10	78.5
88.5	-10	78.5
88.5	0	88.5
88.5	0	88.5
	L_{dn}	**79.2**

CNEL Calculation

CNEL, the Community Noise Equivalent Level is calculated the same as L_{dn}, but with a lower penalty of 5 dBA (instead of 10 dBA) from the hours of 7 pm to 10 pm. Pages C-16 to C-26 present detailed tables used to calculate CNEL, both mitigated and unmitigated, for each alternative.

For Alternatives F and J CNEL was also calculated for the circumstance of nighttime installation of box culverts under Sir Francis Drake Boulevard. Nighttime construction was estimated to occur for 4 hours, from 8 pm to midnight. An excavator was assumed to be the loudest piece of daytime equipment during this construction task.

Summary

Unmitigated

ALT	CNEL 50 ft	CNEL 25 ft
A	81.8	87.8
B	81.6	87.6
F	80.8	86.8
G	81.2	87.2
J	81.8	87.8

Mitigated

ALT	CNEL 50 ft	CNEL 25 ft
A	71.9	77.8
B	71.6	77.6
F	70.8	76.8
G	71.3	77.3
J	71.9	77.8

Alternatives F & J Nighttime Construction on Sir Francis Drake Boulevard

	CNEL 50 ft	CNEL 25 ft
Unmitigated	83.8	89.8
Mitigated	73.9	79.8

Alternative A

CNEL at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	86.1	0	86.1
9:00 AM	86.1	0	86.1
10:00 AM	86.1	0	86.1
11:00 AM	86.1	0	86.1
Noon	86.1	0	86.1
1:00 PM	86.1	0	86.1
2:00 PM	86.1	0	86.1
3:00 PM	86.1	0	86.1
4:00 PM	86.1	0	86.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**81.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**71.9**

Alternative A

CNEL at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	92.1	0	92.1
9:00 AM	92.1	0	92.1
10:00 AM	92.1	0	92.1
11:00 AM	92.1	0	92.1
Noon	92.1	0	92.1
1:00 PM	92.1	0	92.1
2:00 PM	92.1	0	92.1
3:00 PM	92.1	0	92.1
4:00 PM	92.1	0	92.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**87.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**77.8**

Alternative B

CNEL at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	85.8	0	85.8
9:00 AM	85.8	0	85.8
10:00 AM	85.8	0	85.8
11:00 AM	85.8	0	85.8
Noon	85.8	0	85.8
1:00 PM	85.8	0	85.8
2:00 PM	85.8	0	85.8
3:00 PM	85.8	0	85.8
4:00 PM	85.8	0	85.8
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**81.6**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
85.8	-10	75.8
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**71.6**

Alternative B

CNEL at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	91.8	0	91.8
9:00 AM	91.8	0	91.8
10:00 AM	91.8	0	91.8
11:00 AM	91.8	0	91.8
Noon	91.8	0	91.8
1:00 PM	91.8	0	91.8
2:00 PM	91.8	0	91.8
3:00 PM	91.8	0	91.8
4:00 PM	91.8	0	91.8
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**87.6**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
91.8	-10	81.8
91.8	-10	81.8
91.8	-10	81.8
91.8	-10	81.8
91.8	-10	81.8
91.8	-10	81.8
91.8	-10	81.8
91.8	-10	81.8
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**77.6**

Alternative F

CNEL at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	85.0	0	85.0
9:00 AM	85.0	0	85.0
10:00 AM	85.0	0	85.0
11:00 AM	85.0	0	85.0
Noon	85.0	0	85.0
1:00 PM	85.0	0	85.0
2:00 PM	85.0	0	85.0
3:00 PM	85.0	0	85.0
4:00 PM	85.0	0	85.0
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**80.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
85.0	-10	75.0
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**70.8**

Alternative F

CNEL at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	91.1	0	91.1
9:00 AM	91.1	0	91.1
10:00 AM	91.1	0	91.1
11:00 AM	91.1	0	91.1
Noon	91.1	0	91.1
1:00 PM	91.1	0	91.1
2:00 PM	91.1	0	91.1
3:00 PM	91.1	0	91.1
4:00 PM	91.1	0	91.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**86.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
91.1	-10	81.1
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**76.8**

Alternative G

CNEL at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	85.5	0	85.5
9:00 AM	85.5	0	85.5
10:00 AM	85.5	0	85.5
11:00 AM	85.5	0	85.5
Noon	85.5	0	85.5
1:00 PM	85.5	0	85.5
2:00 PM	85.5	0	85.5
3:00 PM	85.5	0	85.5
4:00 PM	85.5	0	85.5
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**81.2**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
85.5	-10	75.5
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**71.3**

Alternative G

CNEL at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	91.5	0	91.5
9:00 AM	91.5	0	91.5
10:00 AM	91.5	0	91.5
11:00 AM	91.5	0	91.5
Noon	91.5	0	91.5
1:00 PM	91.5	0	91.5
2:00 PM	91.5	0	91.5
3:00 PM	91.5	0	91.5
4:00 PM	91.5	0	91.5
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**87.2**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
91.5	-10	81.5
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**77.3**

Alternative J

CNEL at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	86.1	0	86.1
9:00 AM	86.1	0	86.1
10:00 AM	86.1	0	86.1
11:00 AM	86.1	0	86.1
Noon	86.1	0	86.1
1:00 PM	86.1	0	86.1
2:00 PM	86.1	0	86.1
3:00 PM	86.1	0	86.1
4:00 PM	86.1	0	86.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**81.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
86.1	-10	76.1
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**71.9**

Alternative J

CNEL at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	92.1	0	92.1
9:00 AM	92.1	0	92.1
10:00 AM	92.1	0	92.1
11:00 AM	92.1	0	92.1
Noon	92.1	0	92.1
1:00 PM	92.1	0	92.1
2:00 PM	92.1	0	92.1
3:00 PM	92.1	0	92.1
4:00 PM	92.1	0	92.1
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	53.5	5	58.5
9:00 PM	53.5	5	58.5
10:00 PM	40	10	50
11:00 PM	40	10	50
		CNEL	**87.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
92.1	-10	82.1
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
53.5	5	58.5
53.5	5	58.5
40	10	50
40	10	50
	CNEL	**77.8**

Alternatives F & J Nighttime Construction for Bypass

CNEL at 50 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	81.0	0	81.0
9:00 AM	81.0	0	81.0
10:00 AM	81.0	0	81.0
11:00 AM	81.0	0	81.0
Noon	81.0	0	81.0
1:00 PM	81.0	0	81.0
2:00 PM	81.0	0	81.0
3:00 PM	81.0	0	81.0
4:00 PM	81.0	0	81.0
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	82.5	5	87.5
9:00 PM	82.5	5	87.5
10:00 PM	82.5	10	92.5
11:00 PM	82.5	10	92.5
		CNEL	**83.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
81.0	-10	71.0
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
82.5	-5	77.5
82.5	-5	77.5
82.5	0	82.5
82.5	0	82.5
	CNEL	**73.9**

Alternatives F & J Nighttime Construction for Bypass

CNEL at 25 feet

Unmitigated

Hour	L_{eq}	Weight	Weighted Noise (L_i)
Midnight	40	10	50
1:00 AM	40	10	50
2:00 AM	40	10	50
3:00 AM	40	10	50
4:00 AM	40	10	50
5:00 AM	40	10	50
6:00 AM	40	10	50
7:00 AM	53.5	0	53.5
8:00 AM	87.0	0	87.0
9:00 AM	87.0	0	87.0
10:00 AM	87.0	0	87.0
11:00 AM	87.0	0	87.0
Noon	87.0	0	87.0
1:00 PM	87.0	0	87.0
2:00 PM	87.0	0	87.0
3:00 PM	87.0	0	87.0
4:00 PM	87.0	0	87.0
5:00 PM	53.5	0	53.5
6:00 PM	53.5	0	53.5
7:00 PM	53.5	5	58.5
8:00 PM	88.5	5	93.5
9:00 PM	88.5	5	93.5
10:00 PM	88.5	10	98.5
11:00 PM	88.5	10	98.5
		CNEL	**89.8**

Mitigated (Noise Barrier)

L_{eq}	Weight	Weighted Noise (L_i)
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
40	10	50
53.5	0	53.5
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
87.0	-10	77.0
53.5	0	53.5
53.5	0	53.5
53.5	5	58.5
88.5	-5	83.5
88.5	-5	83.5
88.5	0	88.5
88.5	0	88.5
	CNEL	**79.8**