Appendix E: Noise and Vibration Technical Report

Description for Appendix E: Noise and Vibration Technical Report

Potential construction noise levels were assessed based on the methodology developed by the Federal Transit Administration (FTA 2018). Construction equipment types and quantities were provided by the City and are expected to vary by construction phase. The source levels used to calculate noise exposure are based on reference noise levels for various equipment types provided by the Federal Highway Administration (FHWA). Usage factors for construction noise are used in the analysis to develop reasonable worst-case noise exposure values. The noise level value accounts for the energy-average of noise over a specified interval (usually one hour), and usage factors represent the amount of time a type of equipment is used during a typical interval. Construction equipment types, quantities, source levels, and usage factors are shown in the table titled *Off-Road Equipment Inventory* in Appendix E.

Potential noise levels resulting from construction of the proposed project were evaluated by combining the noise levels of the two loudest pieces of equipment that would likely operate at the same time (for example, an excavator, bulldozer, and truck being operated simultaneously during the site preparation phase) and applying the appropriate usage factor (percent of time equipment is in operation) to each piece of equipment. Sound levels from construction activities are calculated as a function of distance from the source(s), based on point-source attenuation over hard (i.e., acoustically reflective) ground, noting that 6 dB of reduction per doubling of distance can be assumed over hard ground. The *Construction Noise* worksheets provided in Appendix E show the loudest two pieces of equipment that could operate concurrently and the associated sound levels at various distances for each sub-phase.

References

Federal Transit Administration. 2018. Transit Noise and Vibration Impact Assessment Manual. September. U.S. Department of Transportation. Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transitnoise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf. Accessed: April 18, 2024.

Summary Table	Grubbing/Land Clearing	Grading/Excavation	Drainage/Utilities/Subgrade	Paving
3 Loudest Pieces @ 50 Feet		-		-
L _{max}	86	88	88	91
L _{eg}	82	84	84	85
, and distances (feet):				
	5 02	94	94	07
5	0 86	88	88	91
10	0 80	82	82	85
20	0 74	75	75	79
30	0 70	72	72	75
40	0 68	69	69	73
50	0 66	68	68	71
60	0 64	66	66	69
70	0 63	65	65	68
80	0 62	63	63	67
90	0 61	62	62	66
100	0 60	62	62	65
120	0 58	60	60	63
140	0 57	59	59	62
160	0 56	57	57	61
180	0 55	56	56	60
200	0 54	55	55	59
L _{eq} @ distances (feet):				
2	5 88	90	90	91
5	0 82	84	84	85
10	0 76	78	78	79
20	0 70	72	72	73
30	0 66	68	68	69
40	0 64	65	65	67
50	0 62	64	64	65
60	0 60	62	62	63
70	0 59	61	61	62
80	0 58	59	59	61
90	0 57	58	58	60
100	0 56	58	58	59
120	10 54	56	56	57
140	10 53	55	55	56
160	10 52	53	53	55
		52	52	54
200	iu 50	52	52	53

No	Quantity	Description	нр	Load Factor Hour	Total Wor	k Sub-Phase	FHWA	Acoustical	Lmax at 50	Leq at 50	Lmax Bank	Leg Pank	Top 3 Loudest Equipment Modeling Pank	Impact
1	Quantity	Grubbing/Land Clearing		Load Tactor Hour	Sludy Days	Number		0361 40101	leet (ubA)	leet (uBA)	Nalik	Leq Kalik	Rank	Equipment:
1	1	Crawler Tractors	212		8	1	Tractor	40%	84	80	1	1	1	Ν
	1	Excavators	158		8	-	Excavator	40%	81	77	2	2	2	N
	6	Signal Boards	6		8	-	Man Lift	20%	75	68	3	3	- 3	N
2		Grading/Excavation	-		-								-	
_	1	Crawler Tractors	212		8	2	2 Tractor	40%	84	80	2	2	2	N
	3	Excavators	158		8	2	2 Excavator	40%	81	77	5	5		N
	1	Graders	187		8	2	Grader	40%	85	81	1	1	1	N
	2	Rollers	80		8	2	2 Roller	20%	80	73	6	7		1
	1	Rubber Tired Loaders	203		8	2	Front End Loader	40%	79	75	7	6		,
	2	Scrapers	367		8	2	Scraper	40%	84	80	2	2	3	
	6	Signal Boards	6		8	2	2 Man Lift	20%	75	68	8	8		,
	2	Tractors/Loaders/Backhoes	97		8	2	2 Tractor	40%	84	80	2	2		1
3		Drainage/Utilities/Subgrade			-									
l l	1	Air Compressors	78		8	3	3 Compressor (air)	40%	78	74	8	8		1
	1	Generator Sets	84		8	3	6 Generator	50%	81	78	6	5		1
	1	Graders	187		8	3	3 Grader	40%	85	81	1	1	1	1
	1	Plate Compactors	8		8	3	Compactor (ground)	20%	83	76	5	7		1
	1	Pumps	84		8	3	8 Pumps	50%	81	78	6	5		1
	1	Rough Terrain Forklifts	100		8	3	8 Tractor	40%	84	80	2	2	2	1
	2	Scrapers	367		8	3	8 Scraper	40%	84	80	2	2		1
	6	Signal Boards	6		8	3	8 Man Lift	20%	75	68	9	9		1
	2	Tractors/Loaders/Backhoes	97		8	3	8 Tractor	40%	84	80	2	2	3	
4		Paving												
	1	Pavers	130		8	4	l Paver	50%	77	74	4	3		1
	1	Paving Equipment	132		8	4	Pavement Scarafier	20%	90	83	1	1	1	r
	3	Rollers	80		8	4	Roller	20%	80	73	3	4		I
	6	Signal Boards	6		8	4	I Man Lift	20%	75	68	5	5		r
	2	Tractors/Loaders/Backhoes	97		8	4	Tractor	40%	84	80	2	2	2	

Sub-Phase:

Construction Noise Grubbing/Land Clearing

				Maximum		
	1			Lovel	Utilization	Log Sound Loval
	Source Date:				Factor	
				(UDA)	Facioi	(UDA)
1	Crawler Tractors			84	40%	80.0
2	Excavators			81	40%	77.0
	1					
	Calculated Data:					
ļ	All Sources Combined	- Lmax sound lev	vel (dBA) at 50 feet	=		86
	All Sources Combined	- Leq sound leve	el (dBA) at 50 feet =			82
	Distance Between	Geometric	Ground Effect		Calculated	Calculated Leq
	Source and	Attenuation (dB)	Attenuation (dB)		Lmax Sound	Sound Level
	Receiver (ft.)				Level (dBA)	(dBA)
	25	6	0.0		92	88
	50	0	0.0		86	82
	100	-6	0.0		80	76
	200	-12	0.0		74	70
	300	-16	0.0		70	66
	400	-18	0.0		68	64
	500	-20	0.0		66	62
	600	-22	0.0		64	60
	700	-23	0.0		63	59
	800	-24	0.0		62	58
	900	-25	0.0		61	57
	1000	-26	0.0		60	56
	1200	-28	0.0		58	54
	1400	-29	0.0		57	53
	1600	-30	0.0		56	52
	1800	-31	0.0		55	51
	2000	-32	0.0		54	50
	Geometric attenuation	based on 6 dB pe	er doubling of distan	ice.		
	Ground affect attenuat	tion based on 1.5	dB per doubling of a	distance		
	Note: This calculation	does not include t	the effects, if any, of	f local shieldir	ng	
	Ifrom walls topography	or other harriers	which may reduce s	sound levels f	urther	

Sub-Phase:

Construction Noise Grading/Excavation

Source Data:			Maximum Sound Level (dBA)	Utilization Factor	Leq Sound Level (dBA)					
Graders				40%						
Crawler Tractors			84	40%	80.0					
Calculated Data:										
All Sources Combined	- Lmax sound lev	vel (dBA) at 50 fee	t =		88					
All Sources Combined	- Leq sound leve	l (dBA) at 50 feet =	=		84					
Distance Between	Geometric	Ground Effect		Calculated	Calculated Leq					
Source and	Attenuation (dB)	Attenuation (dB)		Lmax Sound	Sound Level					
Receiver (ft.)				Level (dBA)	(dBA)					
25	6	0.0		94	90					
50	0	0.0		88	84					
100	-6	0.0		82	78					
200	-12	0.0		75	72					
300	-16	0.0		72	68					
400	-18	0.0		69	65					
500	-20	0.0		68	64					
600	-22	0.0		66	62					
700	-23	0.0		65	61					
800	-24	0.0		63	59					
900	-25	0.0		62	58					
1000	-26	0.0		62	58					
1200	-28	0.0		60	56					
1400	-29	0.0		59	55					
1600	-30	0.0		57	53					
1800	-31	0.0		56	52					
2000	-32	0.0		55	52					
Geometric attenuation	based on 6 dB pe	er doubling of dista	nce.							
Ground affect attenuat	tion based on 1.5	dB per doubling of	distance							
Note: This calculation	Note: This calculation does not include the effects if any of local shielding									
from walls, topography or other barriers which may reduce sound levels further.										

2

1 2

Sub-Phase:

Construction Noise Drainage/Utilities/Subgrade

					Maximum Sound		
						Utilization	Leq Sound Level
	Source Data:				(dBA)	Factor	(aba)
1	Graders				85	40%	81.0
2	Rough Terrain Forklift	S			84	40%	80.0
	Calculated Data:						
	All Sources Combined	I - Lmax sound lev	vel (dBA) at 5	50 feet =			88
	All Sources Combined	I - Leq sound leve	el (dBA) at 50	feet =			84
	Distance Between	Geometric	Ground Eff	ect		Calculated	Calculated Leq
	Source and	Attenuation (dB)	Attenuation	(dB)		Lmax Sound	Sound Level
	Receiver (ft.)					Level (dBA)	(dBA)
	25	6	0.0			94	90
	50	0	0.0			88	84
	100	-6	0.0			82	78
	200	-12	0.0			75	72
	300	-16	0.0			72	68
	400	-18	0.0			69	65
	500	-20	0.0			68	64
	600	-22	0.0			66	62
	700	-23	0.0			65	61
	800	-24	0.0			63	59
	900	-25	0.0			62	58
	1000	-26	0.0			62	58
	1200	-28	0.0			60	56
	1400	-29	0.0			59	55
	1600	-30	0.0			57	53
	1800	-31	0.0			56	52
	2000	-32	0.0			55	52
	Geometric attenuation	based on 6 dB pe	er doubling of	distanc	e.		
	Ground affect attenuat	tion based on 1.5	dB per doubl	ing of di	stance		
	Note: This calculation	does not include t	he effects, if	any, of l	ocal shieldir	ng	
	from walls, topography	y or other barriers	which may re	educe sc	ound levels f	urther.	

3

4

Construction Noise

Sub-Phase:

				Maximum Sound		
	Source Data:			Level (dBA)	Utilization Factor	Leq Sound Level
					1 80101	
1	Paving Equipment			90	20%	83.0
2	Tractors/Loaders/Back	khoes		84	40%	80.0
	Calculated Data:					
	All Sources Combined	- Lmax sound le	vel (dBA) at 50 fe	et =		91
	All Sources Combined	- Lea sound leve	el (dBA) at 50 feet	=		85
			()			
	Distance Between	Geometric	Ground Effect		Calculated	Calculated Leg
	Source and	Attenuation (dB)	Attenuation (dB)		Lmax Sound	Sound Level
	Receiver (ft.)	()	()		Level (dBA)	(dBA)
	25	6	0.0		97	91
	50	0	0.0		91	85
	100	-6	0.0		85	79
	200	-12	0.0		79	73
	300	-16	0.0		75	69
	400	-18	0.0		73	67
	500	-20	0.0		71	65
	600	-22	0.0		69	63
	700	-23	0.0		68	62
	800	-24	0.0		67	61
	900	-25	0.0		66	60
	1000	-26	0.0		65	59
	1200	-28	0.0		63	57
	1400	-29	0.0		62	56
	1600	-30	0.0		61	55
	1800	-31	0.0		60	54
	2000	-32	0.0		59	53
	Geometric attenuation	based on 6 dB pe	er doubling of dist	ance.		
	Ground affect attenuat	tion based on 1.5	dB per doubling c	of distance		
	Note: This calculation	does not include t	he effects, if any,	of local shieldin	g	
	from walls, topography	or other barriers	which may reduce	e sound levels f	urther.	