Appendix I

Noise and Vibration

Traffic Noise Calculations

		7am-7pm	7pm-10pm	10pm-7am
Project Number:	Arica VP	12	3	9
Model Description:	Reference Energy Mean Emission Levels (REMEL): originally from FHWA-RD-77-108			
	See Caltrans Technical Noise Supplement (TeNS 2013): Table 4-2			
Model Assumptions:	no shielding, no barriers, no finite road adjustment			
	Peak Hour from Peak vph [in terms of Leq(h)]; or CNEL from ADT vpd-distributed per time fractions			
	AM-to-PM split approximated from Riverside Co 2008 guideline, does not reflect daytime-only construction			

Road Segment / Receptor Inputs

Road Name/Segment: Ragsdale Rd to BLM access road

Scenario: Negligible existing, plus Construction of Arica VP

Average Daily Traffic Mix (%)

	7am-7pm	7pm-10pm	10pm-7am
	75	15	10

ADT (vpd)	**Peak Hr (vph)**	Day (vph)	Evening (vph)	Night (vph)
2200	1016	137.5	110.0	24.4

Vehicle Type Mix		Peak Hr	Day	Evening	Night
	ADT Mix (%)	(vph)	(vph)	(vph)	(vph)
Autos	90.0	914.4	123.8	99.0	22.0
Medium Duty Trucks	3.0	30.5	4.1	3.3	0.7
Heavy Duty Trucks	7.0	71.1	9.6	7.7	1.7

		REMEL Traffic Flow Adjustment			
	(TeNS 2013)	Peak Hr	Day	Evening	Night
Autos	68.1	-1.7	-10.4	-11.4	-17.9
MD Trucks	75.7	-16.5	-25.2	-26.2	-32.7
HD Trucks	79.9	-12.8	-21.5	-22.5	-29.0

Distance Adjustment: -3.1

	A	B	C
Autos	41.7408	1.1485	50.128
MD Trucks	33.919	20.591	68.003
HD Trucks	35.8799	21.0197	74.298

Receptor Distance: >15m Ref: 30.5 (m) / 100.1 (ft)

Drop-off (alpha 0.5=soft, 0=hard): 0.00 (alpha)

Speed: 40 (mph) / 64 (kph)

Scenario Results

Leq(h) Peak Hour (dBA)	Leq(h) Day (dBA)	Leq(h) Evening (dBA)	Leq(h) Night (dBA)	Ldn @ Rec (dBA)	CNEL @ Rec (dBA)
67.0	58.3	57.4	50.8	59.4	60.0

Centerline Distance to CNEL Contour

70 Contour XX CNEL (ft)	*65 Contour YY CNEL (ft)*	*60 Contour ZZ CNEL (ft)*	*55 Contour ZZ CNEL (ft)*
22	*47*	*101*	*217*

Noise Calculation, Construction Equipment & Stationary Source Noise

Project Number: Arica VP

Model Description: Composite Noise Level Calc, Various Distances, No Shielding
Model Approach and Cite: General Assesessment: FTA, 2018: Transit Noise and Vibration Impact Assessment Guidelines. Section 7.1
Levels and Use Factors: FHWA, 2006: Roadway Construction Noise Model, User's Guide. Table 1 (Actual measured Lmax).

		Refc (ft)						
		50						
Sources / Activity	**Equipment**	**Lmax**	**Acoustic Use Factor**	**Refc Leq(h)**	**Recept @ (ft)**	**Item @ Recept Leq (dBA)**		**Composite @ Recept Leq (dBA)**
PV Panel System Installation (Impact Hammer [maximum unmitigated levels])						Composite >>>>>>>>>>>>>>		62
	Pile Driver (Impact; Table 7-1: FTA, 2018)	101	20	94	2000	62	1.6E+06	
	Crane	81	20	74	2000	42	1.6E+04	
	Backhoe or Loader	79	40	75	2000	43	2.0E+04	
	Dump Truck	76	40	72	2000	40	1.0E+04	
PV Panel System Installation (Light-Duty Hammer [e.g., Vermeer PD10, 49 hp: 114 dBA contin @ 1m])						Composite >>>>>>>>>>>>>>		52
	Mounted Impact Hammer (FHWA, 2006)	90	20	83	2000	51	1.3E+05	
	Crane	81	20	74	2000	42	1.6E+04	
	Backhoe or Loader	79	40	75	2000	43	2.0E+04	
	Dump Truck	76	40	72	2000	40	1.0E+04	
Site Preparation						Composite >>>>>>>>>>>>>>		52
	Grader	85	40	81	2000	49	7.9E+04	
	Dozer	82	40	78	2000	46	4.0E+04	
	Backhoe or Loader	79	40	75	2000	43	2.0E+04	
	Dump Truck	76	40	72	2000	40	1.0E+04	
						Composite >>>>>>>>>>>>>>		51
Electrical System Installation	Crane	81	20	74	2000	42	1.6E+04	
	Drill rig, auger	84	20	77	2000	45	3.1E+04	
	Concrete Mixer Truck	79	40	75	2000	43	2.0E+04	
	Compactor	83	20	76	2000	44	2.5E+04	
	Generator	81	50	78	2000	46	3.9E+04	

Individual Construction Equipment (Typical Noise Levels)

Pile Driver (Impact; Table 7-1: FTA, 2018)	101	20	94
Pile Driver (Sonic; Table 7-1: FTA, 2018 & FHWA, 2006)	95	20	88
Mounted Impact Hammer (FHWA, 2006)	90	20	83
Scraper	84	40	80
Dozer	82	40	78
Grader	85	40	81
Forklift or Man Lift	75	20	68
Crane	81	20	74
Backhoe or Loader	79	40	75
Excavator	81	40	77
Compactor	83	20	76
Generator	81	50	78
Drill rig, auger	84	20	77

Operation Phase	Equipment	Lmax	Acoustic Use Factor	Refc Leq(h)	Recept @ (ft)	Item @ Recept Leq (dBA)	Composite @ Recept Leq (dBA)
						Composite >>>>>>>>>>>>>>	34
Operations (Inverters/Tracker Motors)	Inverters (spec. @ 10m, SMA 2015)	66	100	66	2000	34	2.5E+03
	Tracker Motors (estd. PVMS DEIR p.3.11-15)	50	10	40	2000	8	6.3E+00
	Pickup Truck (RCNM, sporadic use factor)	75	1	55	2000	23	2.0E+02
						Composite >>>>>>>>>>>>>>	34
Operations (Inverters/Tracker Motors)	Inverters (spec. @ 10m, SMA 2015)	66	100	66	2000	34	2.5E+03
	Tracker Motors (estd. PVMS DEIR p.3.11-15)	50	10	40	2000	8	6.3E+00
	Pickup Truck (RCNM, sporadic use factor)	75	1	55	2000	23	2.0E+02
						Composite >>>>>>>>>>>>>>	38
Operations (hypothetical BESS, a/c or hvac)	Generic Equiv (81 dB @ 10 ft, Sta Paula 2017 IS)	67	100	67	2000	35	3.1E+03
	Inverters (spec. @ 10m, SMA 2015)	66	100	66	2000	34	2.5E+03
	Tracker Motors (estd. PVMS DEIR p.3.11-15)	50	10	40	2000	8	6.3E+00
	Pickup Truck (RCNM, sporadic use factor)	75	1	55	2000	23	2.0E+02

Vibration Source Levels for Construction Equipment

Project Number: Arica VP

Model Approach and Cite: FTA, 2018: Table 7-4 and Eq. 7-2, 7-3.
Caltrans, 2020 = "Distinctly Perceptible" over 0.24 in/sec

Vibration Assessment, Individual Source

Reference Source (at 25 ft): PPV 0.644 in/sec , Pile Driver (impact, upper range)
Reference Source (at 25 ft): Lv 104 VdB, Pile Driver (impact, typical)

	D (ft) =	ppv(eq) =		Damage Criterion (over 0.5 in/sec)	Riv Co 2015: annoying to people in buildings (over 0.2 in/sec)	Lv(D) =		Human Perceptibilty (over 65 Vdb)	Human Annoyance (over 80 VdB)
(ref)	25	0.644	in/sec	Yes	Yes	104.0	VdB	Yes	Yes
At 50 feet	50	0.228	in/sec	No	Yes	95.0	VdB	Yes	Yes
At 100 feet	100	0.081	in/sec	No	No	85.9	VdB	Yes	Yes
At 300 feet	300	0.015	in/sec	No	No	71.6	VdB	Yes	No
	600	0.005	in/sec	No	No	62.6	VdB	No	No

Vibration Assessment, Individual Source

Reference Source (at 25 ft): PPV 0.210 in/sec , Vibratory Roller (compactor)
Reference Source (at 25 ft): Lv 94 VdB, Vibratory Roller (compactor)

	D (ft) =	ppv(eq) =		Damage Criterion (over 0.5 in/sec)	Riv Co 2015: annoying to people in buildings (over 0.2 in/sec)	Lv(D) =		Human Perceptibilty (over 65 Vdb)	Human Annoyance (over 80 VdB)
(ref)	25	0.210	in/sec	No	Yes	94.0	VdB	Yes	Yes
At 50 feet	50	0.074	in/sec	No	No	85.0	VdB	Yes	Yes
At 100 feet	100	0.026	in/sec	No	No	75.9	VdB	Yes	No
At 300 feet	300	0.005	in/sec	No	No	61.6	VdB	No	No
	600	0.002	in/sec	No	No	52.6	VdB	No	No

Vibration Assessment, Individual Source

Reference Source (at 25 ft):	PPV	0.089	in/sec , Large Bulldozer
Reference Source (at 25 ft):	Lv	87	VdB, Large Bulldozer

	D (ft) =	ppv(eq) =		Damage Criterion (over 0.5 in/sec)	Riv Co 2015: annoying to people in buildings (over 0.2 in/sec)	Lv(D) =		Human Perceptibilty (over 65 Vdb)	Human Annoyance (over 80 VdB)
(ref)	25	0.089	in/sec	No	No	87.0	VdB	Yes	Yes
At 50 feet	50	0.031	in/sec	No	No	78.0	VdB	Yes	No
At 100 feet	100	0.011	in/sec	No	No	68.9	VdB	Yes	No
At 300 feet	300	0.002	in/sec	No	No	54.6	VdB	No	No
	600	0.001	in/sec	No	No	45.6	VdB	No	No

Vibration Assessment, Individual Source

Reference Source (at 25 ft):	PPV	0.076	in/sec , Loaded Trucks
Reference Source (at 25 ft):	Lv	86	VdB, Loaded Trucks

	D (ft) =	ppv(eq) =		Damage Criterion (over 0.5 in/sec)	Riv Co 2015: annoying to people in buildings (over 0.2 in/sec)	Lv(D) =		Human Perceptibilty (over 65 Vdb)	Human Annoyance (over 80 VdB)
(ref)	25	0.076	in/sec	No	No	86.0	VdB	Yes	Yes
At 50 feet	50	0.027	in/sec	No	No	77.0	VdB	Yes	No
At 100 feet	100	0.010	in/sec	No	No	67.9	VdB	Yes	No
At 300 feet	300	0.002	in/sec	No	No	53.6	VdB	No	No
	600	0.001	in/sec	No	No	44.6	VdB	No	No