

APPENDIX D

CONSTRUCTION EMISSIONS ANALYSIS

	Daily Trips (total # deliveries/Total # days for task)	Daily Round Trip Distance (miles)	Average Speed (mph)	Days On Site	EMFAC 7 - Emission Factor (g/mi)						Emissions (g/day)						Peak Site Emissions (lbs)										
					CO	ROC	NOx	PM10	SO2	PM2.5	CO2	CO	ROC	NOx	PM10	SO2	PM2.5	CO2	CO	ROC	NOx	PM10	SO2	PM2.5	CO2		
Trackwork																											
Sound Walls (240 days, 14 worker crew, 60 feet wall /day)																											
Person vehicles	7	30	35	240	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	295.224	5.444	12.333	3.444	0.044	1.778	44592.626		
Delivery Trucks	1.1	30	35	240	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	37.618	6.232	81.151	3.532	0.127	2.825	18384.803		
On Site Trucks	1.1	0.1	15	240	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.275	0.066	0.356	0.022	0.001	0.019	91.926		
Road Crossings (240 days, 25 worker crew, 20 crossings @ 2-3 weeks each)																											
Person vehicles	12.5	30	35	240	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	527.186	9.722	22.024	6.151	0.079	3.175	79629.689		
Delivery Trucks	2.3	30	35	240	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	75.236	12.464	162.301	7.064	0.254	5.650	36769.605		
On Site Trucks	2.3	0.1	15	240	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.551	0.132	0.712	0.045	0.002	0.038	183.851		
Bridges																											
Person vehicles	11	30	35	40	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	77.321	1.426	3.230	0.902	0.012	0.466	11679.021		
Delivery Trucks	2.9	30	35	40	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	16.162	2.678	34.865	1.518	0.054	1.214	7898.656		
On Site Trucks	2.9	0.1	15	40	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.118	0.028	0.153	0.010	0.000	0.008	39.494		
Culvert Placement																											
Person vehicles	5	30	35	40	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	35.146	0.648	1.468	0.410	0.005	0.212	5308.646		
Delivery Trucks	1.4	30	35	40	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	7.802	1.293	16.831	0.733	0.026	0.586	3813.144		
On Site Trucks	1.4	0.1	15	40	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.057	0.014	0.074	0.005	0.000	0.004	19.066		
Embankment																											
Person vehicles	10.5	30	35	60	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	110.709	2.042	4.625	1.292	0.017	0.667	16722.235		
Delivery Trucks	2.2	30	35	60	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	18.391	3.047	39.674	1.727	0.062	1.381	8988.126		
On Site Trucks	2.2	0.1	15	60	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.135	0.032	0.174	0.011	0.000	0.009	44.941		
Track Construction																											
Person vehicles	16.5	30	35	131	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	379.838	7.005	15.868	4.432	0.057	2.287	57373.191		
Delivery Trucks	5.2	30	35	131	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	95.061	15.749	205.068	8.926	0.320	7.139	46458.510		
On Site Trucks	5.2	0.1	15	131	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.696	0.166	0.900	0.057	0.002	0.048	232.297		
Turnout Construction																											
Person vehicles	6	30	35	225	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	237.234	4.375	9.911	2.768	0.036	1.429	35833.360		
Delivery Trucks	2.4	30	35	225	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	73.843	12.234	159.295	6.934	0.249	5.545	36088.687		
On Site Trucks	2.4	0.1	15	225	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.541	0.129	0.699	0.044	0.002	0.037	180.447		
Signals/Systems																											
Person vehicles	8	30	35	240	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	337.399	6.222	14.095	3.937	0.051	2.032	50963.001		
Delivery Trucks	0.5	30	35	240	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	17.276	2.862	37.269	1.622	0.058	1.297	8443.391		
On Site Trucks	0.5	0.1	15	240	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.126	0.030	0.163	0.010	0.000	0.009	42.218		

	Daily Trips (total # deliveries/Total # days for task)	Daily Round Trip Distance (miles)	Average Speed (mph)	Days On Site	EMFAC 7 - Emission Factor (g/mi)						Emissions (g/day)						Peak Site Emissions (lbs)									
					CO	ROC	NOx	PM10	SO2	PM2.5	CO2	CO	ROC	NOx	PM10	SO2	PM2.5	CO2	CO	ROC	NOx	PM10	SO2	PM2.5	CO2	
Stations																										
Utility Work (10 Days, outside site, by utility owners)																										
Person vehicles	3	30	35	10	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	5.272	0.097	0.220	0.062	0.001	0.032	796.297	
Delivery Trucks	0.8	30	35	10	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	1.115	0.185	2.404	0.105	0.004	0.084	544.735	
On Site Trucks	0.8	0.1	15	10	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.008	0.002	0.011	0.001	0.000	0.001	2.724	
Street/Driveway Work (8 Days)																										
Person vehicles	5	30	35	8	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	7.029	0.130	0.294	0.082	0.001	0.042	1061.729	
Delivery Trucks	3.5	30	35	8	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	3.901	0.646	8.416	0.366	0.013	0.293	1906.572	
On Site Trucks	3.5	0.1	15	8	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.029	0.007	0.037	0.002	0.000	0.002	9.533	
Station Earthwork (20 Days)																										
Person vehicles	6	30	35	20	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	21.087	0.389	0.881	0.246	0.003	0.127	3185.188	
Delivery Trucks	1.4	30	35	20	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	3.901	0.646	8.416	0.366	0.013	0.293	1906.572	
On Site Trucks	1.4	0.1	15	20	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.029	0.007	0.037	0.002	0.000	0.002	9.533	
Station Site Utility Work (10 Days)																										
Person vehicles	4	30	35	10	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	7.029	0.130	0.294	0.082	0.001	0.042	1061.729	
Delivery Trucks	1.0	30	35	10	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	1.393	0.231	3.006	0.131	0.005	0.105	680.919	
On Site Trucks	1.0	0.1	15	10	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.010	0.002	0.013	0.001	0.000	0.001	3.405	
Station Facility Work (35 days)																										
Person vehicles	6	30	35	35	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	36.903	0.681	1.542	0.431	0.006	0.222	5574.078	
Delivery Trucks	2.6	30	35	35	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	12.539	2.077	27.050	1.177	0.042	0.942	6128.268	
On Site Trucks	2.6	0.1	15	35	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.092	0.022	0.119	0.007	0.000	0.006	30.642	
Station Landscaping (15 Days, all hand tools)																										
Person vehicles	6	30	35	15	2.657	0.049	0.111	0.031	0.000	0.016	401.331	79.71	1.47	3.33	0.93	0.012	0.48	12039.93	15.816	0.292	0.661	0.185	0.002	0.095	2388.891	
Delivery Trucks	1.0	30	35	15	2.107	0.349	4.544	0.198	0.007	0.158	1029.542	63.198	10.47	136.332	5.934	0.213	4.746	30886.27	2.090	0.346	4.508	0.196	0.007	0.157	1021.378	
On Site Trucks	1.0	0.1	15	15	4.627	1.107	5.980	0.378	0.015	0.316	1544.340	0.46268	0.11068	0.59804	0.03778	0.00148	0.031624	154.434	0.015	0.004	0.020	0.001	0.000	0.001	5.107	

Conversion
Factor 0.0022046

TOTALS (lbs/day)

CO	ROC	NOx	PM10	SO2	PM2.5	CO2
8.37	0.35	3.21	0.21	0.01	0.14	1719.68

	HP	# Pieces	hr/day	Days on site	LF (ED)	CO lb/hr/uni t	NOX lb/hr/uni t	PM10 lb/hr/uni t	PM2.5 lb/hr/uni t	VOC lb/hr/uni t	SOx lb/hr/uni t	CO ₂ lb/hr/uni t	CO	NOX	PM10	PM2.5	VOC	SOX	CO2	
Trackwork																				
Sound Walls (180 days, 14 worker crew, 60 feet wall /day)																				
Backhoe	150	1	6	180	0.21	0.254	0.384	0.041	0.040	0.066	0.0075	34.815	57.5165	87.1366	9.34416	9.04932	15.0435	1.69834	7895.96	
Small Mobile Crane	250	1	4	180	0.43	0.212	1.056	0.047	0.046	0.074	0.026	119.443	65.6971	326.938	14.675	14.2416	23.0033	7.95462	36979.5	
Dump Truck (onsite)	350	1	6	180	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	248.062	706.655	47.0254	45.6235	56.4559	23.3461	108531	
Water Truck (onsite)	350	1	8	180	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	330.749	942.206	62.7005	60.8314	75.2746	31.1281	144708	
Concrete Pump	350	1	8	12	0.43	0.482	1.399	0.095	0.093	0.132	0.026	122.042	19.8928	57.7425	3.93811	3.8184	5.42832	1.08366	5037.89	
Small Soil Boring Rig	350	1	6	60	0.43	0.953	2.837	0.158	0.153	0.209	0.026	120.058	147.524	439.137	24.412	23.6689	32.4151	3.99768	18585	
Road Crossings (240 days, 25 worker crew, 20 crossings @ 2-3 weeks each, max 4 pieces simultaneously)																				
End Loader	300	1	6	120	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	57.335	92.6554	9.32904	9.05688	15.2706	1.87698	8726.41	
Water Truck	350	0	6	240	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	0	0	0	0	0	0	0	
Backhoe	150	0	6	240	0.21	0.254	0.384	0.041	0.040	0.066	0.0075	34.815	0	0	0	0	0	0	0	
Roller/compactor	200	1	4	60	0.59	0.3943	1.251	0.0789	0.0763	0.0948	0.03253	151.243	55.8329	177.142	11.1722	10.8041	13.4237	4.60678	21416	
Dump Truck	350	0	6	240	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	0	0	0	0	0	0	0	
Paving Machine	350	1	4	60	0.59	0.47986	1.41866	0.09141	0.08867	0.1097	0.03451	160.416	67.9488	200.882	12.9444	12.556	15.5335	4.88616	22714.9	
Track Tamper	200	0	5	60	0.21	0.01923	0.02701	0.00271	0.00262	0.00424	0.00124	5.74863	0	0	0	0	0	0	0	
Ballast Regulator	150	0	5	60	0.59	0.361	0.9118	0.0667	0.0646	0.077	0.02063	95.9233	0	0	0	0	0	0	0	
Light Plants (4)	160	4	10	40	0.43	0.0738	0.1528	0.0144	0.014	0.0199	0.00364	16.9097	50.7744	105.126	9.9072	9.632	13.6912	2.50766	11633.9	
Welder's Truck	200	0	6	40	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	0	0	0	0	0	0	0	
Signal Boom Truck	200	0	5	200	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	0	0	0	0	0	0	0	
Mapes Road (60 days, 24 worker crew)																				
End Loader	300	1	6	60	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	28.6675	46.3277	4.66452	4.52844	7.63528	0.93849	4363.2	
Water Truck	350	1	6	60	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	82.6873	235.552	15.6751	15.2078	18.8186	7.78202	36176.9	
Backhoe	150	1	6	60	0.21	0.254	0.384	0.041	0.040	0.066	0.0075	34.815	19.1722	29.0455	3.11472	3.01644	5.01449	0.56611	2631.99	
Roller/compactor (2)	200	2	4	54	0.59	0.3943	1.251	0.0789	0.0763	0.0948	0.03253	151.243	100.499	318.855	20.11	19.4473	24.1626	8.2922	38548.9	
Dump Truck	350	1	6	60	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	82.6873	235.552	15.6751	15.2078	18.8186	7.78202	36176.9	
Paving Machine (2)	350	2	4	54	0.59	0.47986	1.41866	0.09141	0.08867	0.1097	0.03451	160.416	122.308	361.587	23.2998	22.6008	27.9603	8.79509	40886.9	
Road Graders (2)	200	2	7	54	0.59	0.383	1.2412	0.0783	0.0759	0.094	0.03467	161.161	170.833	553.625	34.9249	33.8544	41.9278	15.463	71884.2	
Earthmoving Machine	150	1	7	30	0.59	0.85678	2.83682	0.11032	0.10701	0.11534	0.05127	238.326	106.155	257.958	13.6692	13.2591	14.2903	6.35193	29528.6	
Electrical Crew	160	1	7	30	0.43	0.2229	1.0853	0.04966	0.04817	0.07683	0.02531	117.673	20.1278	98.0026	4.484	4.34948	6.93773	2.28572	10625.9	
Landscape Crew	200	1	8	30	0.43	0.2611	0.7635	0.0519	0.0503	0.07171	0.01414	65.7354	26.9496	78.7921	5.35176	5.1912	7.40036	1.45923	6783.89	
Bridges (40 days, 22 worker crew, 3 bridges simultaneously)																				
End Loader	300	1	8	20	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	12.7411	20.5901	2.07312	2.01264	3.3936	0.41711	1939.2	
Dump Trucks (2)	700	2	6	12	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	33.0749	94.2206	6.27005	6.08314	7.52746	3.11281	14470.8	
Mobile Crane	400	1	6	40	0.43	0.6034	2.1818	0.0991	0.0961	0.1336	0.04453	207.0132	62.2709	225.162	10.2271	9.91752	13.7875	4.59501	21363.8	
Pile Diver	400	1	8	20	0.43	0.95298	2.83682	0.15766	0.15293	0.20944	0.04828	224.458	65.565	195.173	10.847	10.5216	14.4097	3.32179	15442.7	
Welding Machines (set c	450	3	8	12	0.21	0.33719	0.26648	0.05116	0.04963	0.072	0.00582	27.0466	20.3931	16.1169	3.09443	3.0016	4.35472	0.35182	1635.78	
Track Tamper	200	1	5	10	0.21	0.01923	0.02701	0.00271	0.00262	0.00424	0.00124	5.74863	0.20194	0.28363	0.02841	0.02756	0.04451	0.01298	60.3606	
Ballast Regulator	150	1	5	10	0.59	0.361	0.9118	0.067	0.0646	0.077	0.02063	95.9233	10.6495	26.8981	1.9765	1.9057	2.2715	0.6085	2829.74	
Water Truck	350	1	6	40	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	55.1249	157.034	10.4501	10.1386	12.5458	5.18769	24117.9	
Backhoe	150	1	5	40	0.21	0.254	0.384	0.041	0.040	0.066	0.0075	34.815	10.6512	16.1364	1.7304	1.6758	2.78583	0.31451	1462.21	
Small Compactor	15	1	8	6	0.43	0.0471	0.0801	0.0079	0.0076	0.0131	0.00169	7.91936	0.97214	1.65326	0.16306	0.15686	0.27038	0.03497	163.456	

	HP	# Pieces	hr/day	Days on site	LF (ED)	CO lb/hr/uni t	NOX lb/hr/uni t	PM10 lb/hr/uni t	PM2.5 lb/hr/uni t	VOC lb/hr/uni t	SOx lb/hr/uni t	CO ₂ lb/hr/uni t	CO	NOX	PM10	PM2.5	VOC	SOX	CO ₂	
Culvert Placement (40 days, 10 worker crew)																				
End Loader	300	1	4	40	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	12.7411	20.5901	2.07312	2.01264	3.3936	0.41711	1939.2	
Backhoe	150	1	6	40	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	12.7814	19.3637	2.07648	2.01096	3.34299	0.37744	1754.66	
Water Truck	350	1	7	40	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	64.3124	183.207	12.1918	11.8283	14.6367	6.0523	28137.6	
Dump Truck	350	1	7	40	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	64.3124	183.207	12.1918	11.8283	14.6367	6.0523	28137.6	
Small Compactor	15	1	4	40	0.43	0.0471	0.0801	0.0079	0.0076	0.0131	0.00169	7.91936	3.24048	5.51088	0.54352	0.52288	0.90128	0.11656	544.852	
Embankment (60 Days)																				
End Loaders (3)	900	3	6	60	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	86.0026	138.983	13.9936	13.5853	22.9068	2.81552	13089.6	
D-7 Bulldozer (2)	600	2	6	60	0.59	1.0859	2.6184	0.1401	0.1359	0.146	0.06379	296.541	461.29	1112.3	59.5145	57.7303	62.0208	27.0992	125971	
Road Grader	300	1	8	60	0.59	0.383	1.2412	0.0783	0.0759	0.094	0.03467	161.161	108.466	351.508	22.1746	21.4949	26.6208	9.8178	45640.8	
Dump Trucks (4)	1400	4	8	60	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	440.999	1256.28	83.6006	81.1085	100.366	41.5015	192944	
Backhoe (2)	300	2	7	60	0.21	0.254	0.384	0.041	0.040	0.066	0.0075	34.815	44.735	67.7729	7.26768	7.03836	11.7005	1.32093	6141.3	
Water Truck	350	1	8	60	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	110.25	314.069	20.9002	20.2771	25.0915	10.3754	48235.9	
Compactor	250	1	8	60	0.43	0.04706	0.08008	0.00787	0.00764	0.0131	0.0017	7.91936	9.71224	16.5288	1.62534	1.57658	2.71092	0.35158	1634.56	
Track Construction (131 Days, 1000' of track laid per day)																				
End Loader	300	1	8	131	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	83.4543	134.865	13.5789	13.1828	22.2281	2.73209	12701.8	
Backhoe	150	1	8	131	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	55.8123	84.5547	9.0673	8.78119	14.5977	1.64818	7662	
TLM	1500	1	8	131	0.21	4.2865	6.2817	0.6312	0.6122	1.0181	0.10123	470.663	943.373	1382.48	138.914	134.733	224.063	22.2787	103584	
RR Car Mover	300	1	6	131	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	180.534	514.288	34.224	33.2038	41.0874	16.9897	79886.2	
Track Tamper	200	1	8	131	0.21	0.01923	0.02701	0.00271	0.00262	0.00424	0.00124	5.74863	4.23272	5.94479	0.59553	0.57767	0.93303	0.27214	1265.16	
Ballast Regulator	150	1	8	131	0.59	0.361	0.9118	0.067	0.0646	0.077	0.02063	95.9233	223.214	563.784	41.4274	39.9435	47.6106	12.7541	59311.3	
Dynamic Track Stabilizer	700	1	4	131	0.21	1.82211	2.27828	0.24704	0.23963	0.32965	0.04279	198.938	200.504	250.702	27.1848	26.3692	36.2746	4.70865	21891.2	
Water Truck	350	1	9	131	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	270.801	771.431	51.336	49.8057	61.631	25.4845	118479	
Dump Truck	350	1	9	131	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	270.801	771.431	51.336	49.8057	61.631	25.4845	118479	
Welder's Truck	200	1	9	131	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	270.801	771.431	51.336	49.8057	61.631	25.4845	118479	
Turnout Construction (255 Days, 15 turnarounds at 15 days each)																				
End Loader	300	1	6	255	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	121.837	196.893	19.8242	19.2459	32.4513	3.98865	18543.6	
Backhoe	150	1	6	255	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	81.4817	123.443	13.2376	12.8199	21.3116	2.40621	11185.9	
Welders' Truck	200	1	8	50	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	91.8748	261.724	17.4168	16.8976	20.9096	8.64614	40196.6	
Track Tamper	200	1	6	36	0.21	0.01923	0.02701	0.00271	0.00262	0.00424	0.00124	5.74863	0.87239	1.22526	0.12274	0.11906	0.1923	0.05609	260.758	
Ballast Regulator	150	1	6	36	0.59	0.361	0.9118	0.067	0.0646	0.077	0.02063	95.9233	46.0058	116.2	8.53848	8.23262	9.81288	2.62871	12224.5	
Dump or Water Truck	350	1	6	90	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	124.031	353.327	23.5127	22.8118	28.228	11.6723	54265.4	
Light Plant	40	1	10	10	0.43	0.0738	0.1528	0.0144	0.014	0.0199	0.00364	16.9097	3.1734	6.5704	0.6192	0.602	0.8557	0.15673	727.118	
Signals/Systems not at Crossings (240 Days, 7 control points, 4 wayside signal sites, and about 8 smaller sites)																				
End Loader	300	1	6	36	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	17.2005	27.7966	2.79871	2.71706	4.58136	0.5631	2617.92	
Backhoe	150	1	4	240	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	51.1258	77.4547	8.30592	8.04384	13.372	1.50978	7018.63	
Water Truck	350	1	6	36	0.59	0.389	1.109	0.074	0.072	0.089	0.037	170.324	49.6124	141.331	9.40507	9.1247	11.2912	4.66892	21706.1	
Ditching Machine	80	1	6	60	0.59	0.494	0.5986	0.0756	0.0734	0.0729	0.01442	67.0527	104.926	127.143	16.0574	15.5902	15.484	3.06348	14242	
Signal Boom Truck (2)	400	1	5	240	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	275.624	785.172	52.2504	50.6928	62.7288	25.9384	120590	
Small Compactor	15	1	4	60	0.43	0.0471	0.0801	0.0079	0.0076	0.0131	0.00169	7.91936	4.86072	8.26632	0.81528	0.78432	1.35192	0.17484	817.278	

	HP	# Pieces	hr/day	Days on site	LF (ED)	CO lb/hr/uni t	NOX lb/hr/uni t	PM10 lb/hr/uni t	PM2.5 lb/hr/uni t	VOC lb/hr/uni t	SOx lb/hr/uni t	CO ₂ lb/hr/uni t	CO	NOX	PM10	PM2.5	VOC	SOX	CO2	
Stations																				
Utility Work (10 Days, outside site, by utility owners)																				
Backhoe	150	1	6	10	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	3.19536	4.84092	0.51912	0.50274	0.83575	0.09436	438.664	
Utility Crew Truck	200	1	4	10	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	9.18748	26.1724	1.74168	1.68976	2.09096	0.86461	4019.66	
Paving Machine	150	1	4	3	0.59	0.331	0.856	0.062	0.060	0.072	0.020	91.470	2.34604	6.05881	0.44095	0.42772	0.50792	0.1393	647.607	
Pavement Roller	150	1	4	3	0.59	0.283	0.799	0.058	0.056	0.065	0.020	92.117	2.00685	5.65927	0.41045	0.39814	0.46344	0.14029	652.188	
Street/Driveway Work (8 Days)																				
Backhoe	150	1	6	8	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	2.55629	3.87274	0.4153	0.40219	0.6686	0.07549	350.931	
End Loader	300	1	4	8	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	2.54822	4.11802	0.41462	0.40253	0.67872	0.08342	387.84	
Road Grader	300	1	5	8	0.59	0.383	1.2412	0.0783	0.0759	0.094	0.03467	161.161	9.0388	29.2923	1.84788	1.79124	2.2184	0.81815	3803.4	
Paving Machine	150	1	5	4	0.59	0.331	0.856	0.062	0.060	0.072	0.020	91.470	3.91007	10.098	0.73492	0.71287	0.84653	0.23217	1079.34	
Pavement Roller	150	1	5	8	0.59	0.283	0.799	0.058	0.056	0.065	0.020	92.117	6.68951	18.8642	1.36817	1.32713	1.54478	0.46764	2173.96	
Traffic Signal Bucket Tru	250	1	6	8	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	11.025	31.4069	2.09002	2.02771	2.50915	1.03754	4823.59	
Station Earthwork (20 Days)																				
Earthmovers (2)	800	2	7	20	0.59	0.85678	2.08199	0.11032	0.10701	0.11534	0.05127	238.326	141.54	343.945	18.2256	17.6788	19.0537	8.46923	39371.5	
End Loader(2)	600	2	5	20	0.21	0.3792	0.6128	0.0617	0.0599	0.101	0.01241	57.7143	15.9264	25.7376	2.5914	2.5158	4.242	0.52139	2424	
Road Graders (2)	600	2	5	20	0.59	0.383	1.2412	0.0783	0.0759	0.094	0.03467	161.161	45.194	146.462	9.2394	8.9562	11.092	4.09075	19017	
Water Truck	300	1	8	20	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	36.7499	104.69	6.96672	6.75904	8.36384	3.45846	16078.6	
Station Site Utility Work (10 Days)																				
Backhoe	150	1	5	20	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	5.3256	8.0682	0.8652	0.8379	1.39291	0.15727	731.107	
Electric Crew Truck	200	1	4	20	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	18.375	52.3448	3.48336	3.37952	4.18192	1.72923	8039.31	
Water Pipe Crew Truck	200	1	4	20	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	18.375	52.3448	3.48336	3.37952	4.18192	1.72923	8039.31	
Station Facility Work (35 days)																				
Backhoe	200	1	6	35	0.21	0.254	0.384	0.041	0.040	0.066	0.007	34.815	11.1838	16.9432	1.81692	1.75959	2.92512	0.33026	1535.32	
Paving Machine	150	1	6	10	0.59	0.331	0.856	0.062	0.060	0.072	0.020	91.470	11.7302	30.2941	2.20477	2.13862	2.53959	0.69652	3238.03	
Pavement Roller	150	1	6	10	0.59	0.283	0.799	0.058	0.056	0.065	0.020	92.117	10.0343	28.2963	2.05226	1.99069	2.31718	0.70145	3260.94	
Concrete Pump Truck	200	1	6	10	0.59	0.3893	1.109	0.0738	0.0716	0.089	0.037	170.324	13.7812	39.2586	2.61252	2.53464	3.13644	1.29692	6029.48	
Small Crane	150	1	6	20	0.43	0.15221	0.67889	0.03602	0.03494	0.05153	0.01569	72.9439	7.85395	35.0307	1.8588	1.80304	2.65884	0.80964	3763.9	
Station Landscaping (15 Days, all hand tools)																				
Total Four Stations																				
													1554.29	4095.19	261.534	253.662	313.799	111.773	519623	
Layover Facility (equivalent to two stations)																				
													777.147	2047.6	130.767	126.831	156.899	55.8867	259811	

Average Daily Emissions (lb/day)

CO	NOX	PM10	PM2.5	VOC	SOx	CO2
25.6	64.1	4.4	4.3	5.6	1.7	8126.5

Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\SWANN\My Documents\STV WORK FOLDER\Construction AQ\PM Emissions from Embankment Site.urb924

Project Name: PVL Embankment Fugitive Dust Assessment

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report

CONSTRUCTION EMISSION ESTIMATES

	<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>
2010 TOTALS (lbs/day unmitigated)	1,132.53	5.41	1,137.93	236.52	4.97	241.49
2010 TOTALS (lbs/day mitigated)	256.82	5.41	262.23	53.84	4.97	58.61

43.1 ← Adjusted For Peak Year → 9.5

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

PM10 Dust PM10 Exhaust PM10 PM2.5 Dust PM2.5 Exhaust PM2.5

1/26/2010 3:51:15 AM

Time Slice 8/2/2010-11/1/2010	1,132.53	5.41	1,137.93	236.52	4.97	241.49
Active Days: 66						
Fine Grading 08/01/2010-11/01/2010	50.02	4.15	54.17	10.45	3.82	14.27
Fine Grading Dust	50.00	0.00	50.00	10.44	0.00	10.44
Fine Grading Off Road Diesel	0.00	4.14	4.14	0.00	3.81	3.81
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.02	0.01	0.03	0.01	0.01	0.02
Mass Grading 08/01/2010-11/01/2010	1,082.51	1.25	1,083.76	226.07	1.15	227.22
Mass Grading Dust	1,082.50	0.00	1,082.50	226.07	0.00	226.07
Mass Grading Off Road Diesel	0.00	1.25	1.25	0.00	1.15	1.15
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.01	0.00	0.01	0.00	0.00	0.00

Phase Assumptions

Phase: Fine Grading 8/1/2010 - 11/1/2010 - Default Fine Site Grading/Excavation Description

Total Acres Disturbed: 5

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (300 hp) operating at a 0.61 load factor for 6 hours per day

4 Off Highway Trucks (350 hp) operating at a 0.57 load factor for 8 hours per day

1 Plate Compactors (250 hp) operating at a 0.43 load factor for 8 hours per day

2 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

5 Tractors/Loaders/Backhoes (300 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

1/26/2010 3:51:15 AM

Phase: Mass Grading 8/1/2010 - 11/1/2010 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 5

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 8750 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 0.65

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Mitigated

<u>PM10 Dust</u>	<u>PM10 Exhaust</u>	<u>PM10</u>	<u>PM2.5 Dust</u>	<u>PM2.5 Exhaust</u>	<u>PM2.5</u>
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1/26/2010 3:51:15 AM

Time Slice 8/2/2010-11/1/2010	<u>256.82</u>	<u>5.41</u>	<u>262.23</u>	<u>53.64</u>	<u>4.97</u>	<u>58.61</u>
Active Days: 86						
Fine Grading 08/01/2010-11/01/2010	11.36	4.15	15.51	2.38	3.82	6.20
Fine Grading Dust	11.34	0.00	11.34	2.37	0.00	2.37
Fine Grading Off Road Diesel	0.00	4.14	4.14	0.00	3.81	3.81
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.02	0.01	0.03	0.01	0.01	0.02
Mass Grading 08/01/2010-11/01/2010	245.46	1.25	246.72	51.26	1.15	52.42
Mass Grading Dust	245.46	0.00	245.46	51.26	0.00	51.26
Mass Grading Off Road Diesel	0.00	1.25	1.25	0.00	1.15	1.15
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.01	0.00	0.01	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 8/1/2010 - 11/1/2010 - Default Fine Site Grading/Excavation Description

For Soil Stabilizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stabilizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stabilizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Soil Stabilizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

The following mitigation measures apply to Phase: Mass Grading 8/1/2010 - 11/1/2010 - Default Mass Site Grading/Excavation Description

For Soil Stabilizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stabilizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

Page: 5

1/26/2010 3:51:15 AM

PM10: 5% PM25: 5%

For Soil Stabilizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Soil Stabilizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

Average Daily Diesel Freight Locomotive Emissions (lb/day)*

0.0022046 (conv factor)

	CO Calculation	ROC Calculation	NOx Calculation	PM10 Calculation	SO2 Calculation	PM2.5 Calculation	CO2 Calculation
Emission (g/hp-hr)	1.28	0.399	7.5	0.225	0.00454	0.21825	49.42
Number of Locos	8	8	8	8	8	8	8
Main Engine Load Factor	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Days per Year	365	365	365	365	365	365	365
# Hours of Operation	5	5	5	5	5	5	5
Main Engine (hp)	3000	3000	3000	3000	3000	3000	3000
Emissions (g/day)	252.4931507	78.70684932	1479.452055	44.38356164	0.895561644	43.05205479	9748.60274
Emissions (lb/day)	0.56	0.17	3.26	0.10	0.00	0.09	21.49
Emission (g/hp-hr)	1.28	0.399	7.5	0.225	0.00454	0.21825	49.42
Number of Locos	80	80	80	80	80	80	80
Main Engine Load Factor	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Days per Year	365	365	365	365	365	365	365
# Hours of Operation	5	5	5	5	5	5	5
Main Engine (hp)	3000	3000	3000	3000	3000	3000	3000
Emissions (g/day)	2524.931507	787.0684932	14794.52055	443.8356164	8.955616438	430.5205479	97486.0274
Emissions (lb/day)	5.57	1.74	32.62	0.98	0.02	0.95	214.92
Total	6.12	1.91	35.88	1.08	0.02	1.04	236.41

*Locomotive Emissions From EPA's Emission Factors for Locomotives (EPA-420-F-09-025)

**URBEMIS 7 Construction Model - FUGITIVE DUST & SOILS EMISSIONS FOR
EMBANKMENT CONSTRUCTION***

Pollutant	# Days on site	Peak Site Emissions (lbs)	Average Daily Emissions (lb/day)
PM10	60.0	262.0	43.1
PM2.5	60.0	58.0	9.5

*Embankment construction represents the only activity that has considerable soil work. Other activities producing any fugive dust can be minimized by appropriate dust control measures

PVL Construction Emission Totals (lbs/day)

	<u>CO</u>	<u>NOX*</u>	<u>PM10</u>	<u>PM2.5</u>	<u>VOC</u>	<u>SOx</u>	<u>CO2</u>
TOTAL	44	98	49	15	9	2	12118
SCAQMD CEQA DAILY CONSTRUCTION EMISSION LIMITS	550	100	150	55	75	150	NA

* Use 15% reduction mitigation measures for NOx

STV Incorporated 11/23/2010

RCTC PVL CONSTRUCTION SCENARIO

By: Michael E. McGinley
Revision Date: January 25, 2010

This paper presents a suggested arrangement of construction activities on the PVL project. It (along with the companion document for stations) is to demonstrate all of the activities that will occur on the project.

There is, as yet, no estimate of the layover facility available for preparation of an environmental construction impact estimate. If none is available, including the work for two station sites would be a reasonable first approximation.

There will be constraints as to what days of the week some activities can occur. Road crossing work is likely to be done on weekend days (and some nights) to minimize traffic impacts and non-critical path work is likely to be done on weekdays to avoid overtime and lighting expenses. The contractors will choose the work plan and schedule that best matches their resources. The result of these constraints is that not all activities are likely to occur on the same day, the peak day of activity will be short of the sum of all these individual activities.

Notes:

- This is a very rough estimate of the horsepower (HP) of the equipment used
- Where more than one machine is listed, the HP number is the sum of the HP per unit times the number of those units on the job
- The hours per day are an estimate that some stand-by time results in equipment not running or working at full capacity
- Days indicates that some machines are only needed for part of the duration of the project element, if no days are cited, then assume full duration
- Quantities could not thoroughly be cross-checked with preliminary design or cost estimates due to differing formats and incomplete embankment design. This document assumes no net import or export of fill material at stations, check this
- Cubic Yards of railway embankment are not known at this time, however a reasonable estimate of the impact is offered as the number of days that dump trucks and end loaders work along the embankment making short hauls; it is assumed that there is no net import or export of embankment material
- Contractor will develop actual work plan, and owner representative will approve
- Assume several, but not all, of these activities could be done in parallel; for the most part track and signal work will follow embankment and utility work.
- The overhead work (owner's Construction Management, Contractor's supervision, engineering support, etc.) are not included herein, if no other means is available suggest assuming 12 full time professional staff using 8 assigned light trucks.

Trip Assumptions:

- Compute the total number of crew commuting trips as the product of the number of employees times the duration of each phase of work.
- Estimate average crew commuting distance as 30 miles round trip (varies by station)
- Crew members using assigned light trucks are assumed to commute in them
- Material delivery trip numbers are based on rough quantity estimates for each station or project element with bulk materials such as HMA Paving and Aggregate Base as 20-ton loads
- Distances for material 30 miles round trip except where noted (varies by location along the line)

Changes from 1/22 document:

- Quantities reduced about 10% for sound walls and road crossings
- Quantities increased about 10% for track and turnouts
- No changes to utilities, bridges, culverts, embankment, or signals.

STATIONS

Refer to the companion document.

UTILITY RELOCATIONS (On right of way, by utility owners, not at stations or crossings)

Crew Size Avg. 12 (two at 6 each, on average)

Days: 45 (likely 2-3 days each for 2-4 utility owners' crews at about 30 locations)

Backhoe (2)	300 HP	12 hrs/day
Utility crew truck (2)	400 HP	8 hrs/day

Delivery trips for aggregate base	60
Delivery trips for replacement utility elements	45

SOUND WALLS

Crew Size 14

Days 180 (based on 10,651 lineal ft. built at 60 feet per day, change these numbers if the final length of walls is different or productivity is known to be different)

The contractor will probably have one crew building these walls, this is an estimate of the work crew composition. I invite John or Eric to refine this.

Backhoe	150 HP	6hr/day	
Small Mobile Crane	250 HP	4 hr/day	
Dump Truck	350 HP	6 hr/day	
Water Truck	350 HP	8 hr/day	
Concrete Pump	350 HP	8 hr/day	12 days
Small Soil Boring Rig	350 HP	6 hr/day	60 days

Delivery Trips:

Concrete	100
Precast panels/blocks	170

ROAD CROSSINGS

Crew Size	25
Days	210 (18 crossings, 2-3 weeks each)

If the project is awarded to one contractor, it is likely that not more than one road crossing surface will be under construction at the same time however prefabrication of panels, utility relocations, etc. will proceed at several sites at once. A typical road crossing will utilize a suite of equipment similar to the list below. Due to the constrained working area, not more than 3 or 4 of these machines can work simultaneously, except that the light plants will work all night long (but not in daylight hours).

This segment includes utility relocations within the street area, which are assumed to be minimal (one per crossing) because most utilities are already configured conform to railroad track and the track is not changing location except at a few locations in Perris.

This list includes the signal crews installing the warning devices and control houses. Signal crews will stage their work ahead of the crossing site work, and will modify their devices simultaneously with the road crossing surface work. Note that the final stages of work (removing and replacing the track and crossing panels and testing and placing the signals into service) will very likely be done on weekends, and on a 24-hour basis, to minimize traffic impacts.

End Loader	300 HP	6 hr/day	100 days
Water Truck	350 HP	6 hr/day	
Backhoe	150 HP	6 hr/day	
Roller/compactor	200 HP	4 hr/day	54 days
Dump Truck	350 HP	6 hr/day	
Paving Machine	350 HP	4 hr/day	54 days
Track Tamper	200 HP	5 hr/day	54 days
Ballast Regulator	150 HP	5 hr/day	54 days
Light Plants (4)	160 HP	10 hr/day	40 days
Welder's Truck	200 HP	6 hr/day	38 days
Signal Boom Truck (2)	400 HP	5 hr/day	180 days

Delivery Trips:	
Aggregate Base	90
Track Ballast	120
Track Material	80
Signal Material	80
HMA Paving	100

MAPES ROAD

Crew Size: 24
Duration 60 days

This is a new road. Traditional public agency road construction processes will be followed; there is no changed working conditions due to railroad operations or mitigation of construction traffic impacts as is found in the road crossings reported above. All the work can be done in weekday daytime hours.

End Loader	300 HP	6 hr/day	
Water Truck	350 HP	6 hr/day	
Backhoe	150 HP	6 hr/day	
Roller/compactors (2)	400 HP	4 hr/day	54 days
Dump Truck	350 HP	6 hr/day	
Paving Machines (2)	700 HP	4 hr/day	54 days
Road Graders (2)	600 HP	7 hr/day	54 days
Earthmoving Mach. (2)	700 HP	7 hr/day	30 days
Electrical Crew Tk	240 HP	78hr/day	30 days
Landscape Crew Tk	240 HP	8 hr/day	30 days

Delivery Trips:	
HMA Paving	222
Aggregate Base	111
Street Lamps	8
Conduit	8
Landscape Mat'l	8

BRIDGES

Crew Size 22
Days 40

There are three bridges to construct. The machinery listed would not all work at the same bridge at the same time, but could, with careful staging, work in parallel at the three sites, however this is very optimistic in terms of efficiency. The listing below assumes driven piles, if the final design or a contractor alternate is drilled piles, the impact would not be significantly different.

End Loader	300 HP	8 hr/day	20 days
Dump Trucks (2)	700 HP	6 hr/day	12 days
Mobile Crane	400 HP	6 hr/day	
Pile Driver	400 HP	8 hr/day	20 days
Welding Machines (3)	450 HP	8 hr/day	12 days
Track Tamper	200 HP	5 hr/day	10 days
Ballast Regulator	150 HP	5 hr/day	10 days
Water Truck	350 HP	6 hr/day	
Backhoe	150 HP	5 hr/day	
Small Compactor	15 HP	8 hr/day	6 days

Delivery Trips:

Aggregate Base	30
Track Ballast	40
Track Material	6
Bridge Material	40

CULVERT MODIFICATIONS and REPLACEMENT

Crew Size 10
Days 40 (32 locations)

This work may be done within the embankment work but is probably going to be a separate crew and location. Probably not more than one such operation will be working at the same time. Because these are small, congested sites, at any time not more than three pieces of equipment would be working simultaneously.

End Loader	300 HP	4 hr/day
Backhoe	150 HP	6 hr/day
Water Truck	350 HP	7 hr/day
Dump Truck	350 HP	7 hr/day
Small Compactor	15 HP	4 hr/day

Delivery Trips:	
Aggregate Base	40
Culvert Pipe	8
Concrete	8

EMBANKMENT

Crew Size	21
Days	60

The roadbed must be modified by creating drainage channels, widening cuts, and widening fills. This is a typical “dirt job” with removals and placement and compaction of native fill material. Related work may include small areas of precast block retaining walls and revisions to, extensions of, or replacement of culverts as cited above. The following list of equipment could, if managed carefully, all work at the same time.

End Loaders (3)	900 HP	6 hr/day
D-7 Bulldozer (2)	600 HP	6 hr/day
Road Grader	300 HP	8 hr/day
Dump Trucks (4)	1400 HP	8 hr/day
Backhoe (2)	300 HP	7 hr/day
Water Truck	350 HP	8 hr/day
Compactor	250 HP	8 hr/day

Delivery Trips:	
Aggregate Base	40
Haul off debris	40
Concrete Blocks	8

TRACK CONSTRUCTION

130,914 lineal feet of PVL construction (no BNSF construction in the first phase so it is not counted here, when and if it is constructed the BNSF will use their own work crews; the details of how they equip and operate these crews is unknown).

Crew Size	33
Days	131 (average 9 hrs/day due to constrained work windows for part of the project, finishing 1000 feet per day)

The following scenario assumes that the contractor will use a Track Laying Machine (TLM), the most economical method of building track with new materials. The contractor may use other methods with more, smaller machines. The equipment list includes the machines that will remove the old track material, which is only true for about 1/2 of the line, but to illustrate the busiest day, it is included here. The following list of equipment could, if managed carefully, all work at the same time. This scenario assumes

about 1000 feet of track either constructed new, reconstructed, or rehabilitated each work day.

End Loader	300 HP	8 hr/day
Backhoe	150 HP	8 hr/day
TLM	1500 HP	8 hr/day
RR Car Mover	300 HP	6 hr/day
Track Tamper	200 HP	8 hr/day
Ballast Regulator	150 HP	8 hr/day
Dynamic Track Stabilizer	700 HP	4 hr/day
Water Truck	350 HP	9 hr/day
Dump Truck	350 HP	9 hr/day
Welder's Truck	200 HP	9 hr/day

Delivery Trips:

Required Railroad Mode:

Welded Rail: Four trains of 40 cars each. 5 days to unload each train, 6000 HP of locomotives working 5 hours per day for each of four trains.

Concrete Ties: 260 car loads of 220 ties each, delivered in small groups in routine BNSF freight trains with no net increase in BNSF train operating hours or HP.

Optional Railroad Mode:

112,000 tons of ballast as 1000 100-ton rail cars plus 12,000 tons as 600 truck delivery trips. Most turnout and crossing trackwork will need truck delivery. If contractor can arrange delivery of railroad carloads of ballast then the number of truck trips is reduced significantly. For this scenario, assume 40 deliveries of 25-car trains to be unloaded in one day each with two 3000 HP locomotives plus the 600 truck trips.

Truck Mode:

Track ballast if supplemental to rail delivery above:	600 trips
Track ballast if no rail delivery:	5600 trips
Misc Track Material	25

TURNOUT CONSTRUCTION

Crew Size 12

Days 255 (15 turnouts at 15 days each plus 5 at 6 days each)

There will probably be a crew continuously engaged in turnout prefabrication, installation, or construction in-place. It may be working at the same time (but away from) a road crossing, embankment, bridge, culvert, or track crew. Due to the congested work area, not more than three of these machines are likely to work at the same time, plus the light plant if the work is at night.

End Loader	300 HP	6 hr/day	
Backhoe	150 HP	6 hr/day	
Welders' Truck	200 HP	8 hr/day	50 days
Track Tamper	200 HP	6 hr/day	36 days
Ballast Regulator	150 HP	6 hr/day	36 days
Dump or Water Truck	350 HP	6 hr/day	90 days
Light Plants	40 HP	10 hr/day	10 days

Delivery Trips:

Aggregate Base and Ballast	100		
Rails and Special Trackwork	70	(1)	
Concrete switch ties	300	(1)	
Removal of old turnout parts	60	(2)	

Notes:

- (1) These components are manufactured in Pueblo CO and Seattle and Pasco WA. They may be delivered to a staging yard on the project which would result in about a 15 mile trip to the place of installation, or they may be delivered directly from the vendor to the place of installation. Hard to count how far back in the distribution chain to count impacts.
- (2) About 7 turnouts are wholly new and about 8 are replacements of existing turnouts therefore disposal of old turnout material quantity is much smaller than new material delivery.

SIGNALS/SYSTEMS (not at road crossings)

Crew Size 16
Days 240

There will be signal facilities constructed at 7 Control Points, 4 wayside signal sites, and about 20 smaller located along the line. This scenario envisions that the site work (building the foundation pad, excavating cable trenches, installing signal foundations, installing signal houses and masts) will be performed in sequence at one site at a time. Following the site work, each location will have signal crews working there for several weeks installing wiring and devices, and checking circuits. The list below is for one signal site work crew plus two signal technical crews working simultaneously.

End Loader	300 HP	6 hr/day	36 days
Backhoe	150 HP	4 hr/day	
Water Truck	350 HP	6 hr/day	36 days
Ditching Machine	80 HP	6 hr/day	60 days
Signal Boom Truck (2)	400 HP	5 hr/day	
Small Compactor	15 HP	4 hr/day	60 days

Delivery Trips:

Aggregate base and walkway rock	30 trips
Signal equipment	50 trips
Cable	44 trips

Notes:

The “end loader” could be a rough terrain crane such as a “Speed Swing” for some of these jobs, the HP rating would be similar.

The “dump truck” could be any of several trucks used to move construction equipment including rear-dump, bottom dump, or flatbed or low-boy trailer trucks. They are all used, but often not all at once.

Station Construction Equipment by Phase
Revisions 25Jan10 by M. E. McGinley to support environmental documents.

Notes:

- This is a very rough estimate of the activities at a typical station, multiply by the number of stations (4?).
- Most quantities could not be cross-checked with preliminary design or cost estimates due to differing formats
- Quantities for HMA Paving assume 3” depth and sum of the four stations divided by 4 leads to the number of delivery trips at 20 tons/trip
- Assumes no net import or export of fill material at stations, except for debris and brush clearing
- STV station designers should revise this worksheet if practicable
- Contractor will develop actual work plan, and owner representative will approve
- Assume two stations active at maximum effort, one in utility/street/excavation stage, one in facilities/landscape stage.

Trip Assumptions:

- Compute the total number of crew commuting trips is the product of the number of employees times the duration of each phase of work.
- Estimate average crew commuting distance as 30 miles round trip (varies by station)
- Material delivery trip numbers are based on rough quantity estimates for each station, with 20-ton loads for HMA Paving and Aggregate Base
- Distances for material 30 miles round trip (varies by station)

Utility Work (outside site, by utility owners)

Days: 10 (likely 2-3 days each for 2-4 utility owners)

Crew Size Avg. 6

Backhoe	150 HP	6 hrs/day	
Utility crew truck	200 HP	4 hrs/day	
Paving Machine	150HP	4 hr/day	3 days
Pavement Roller	150 HP	4 hr/day	3 days

Delivery Trips:

Aggregate Base	4
HMA Paving	4

Street/Driveway Work

Days: 8

Crew Size Avg. 10

Backhoe	150 HP	6hr/day
End Loader	300 HP	4 hr/day
Road Grader	300 HP	5 hr/day

Paving Machine	150 HP	5 hr/day	4 days
Pavement Roller	150 HP	5 hr/day all days (either pavement roller or compactor)	
Traffic signal crew	6 employees, 6 days (estimate at 2 stations)		
Traffic signal bucket/boom truck	250 HP	6 hr/day	

Delivery Trips:

Aggregate Base:	10
HMA Paving	8
Concrete	4

Station Earthwork

Days: 20

Crew Size Avg. 12

Earthmovers (2)	800 HP	7 hrs/day
End Loaders (2)	600 HP	5 hrs/day
Road Graders (2)	600 HP	5 hrs/day
Water truck	300 HP	8 hrs/day

Delivery Trips:

Aggregate Base:	90
Concrete	4

Station Site Utility Work

Days: 10

Crew Size Avg. 8

Backhoe	150 HP	5 hr/day
Electrical Crew Truck	200 HP	4 hr/day
Water pipe Crew Truck	200 HP	4 hr/day

Delivery Trips:

Aggregate Base:	6
Utility materials	4

Station Facility work

Days: 35

Crew Size Avg. 16

Backhoe	200 HP	6 hr/day	
Paving Machine	150 HP	6 hr/day	10 days
Paving Roller	150 HP	6 hr/day	10 days
Concrete pump truck	200 HP	6 hr/day	10 days
Small crane for communication shelter and canopy erection	150 HP	6 hr/day	20 days

Delivery Trips:

HMA Paving 170

Concrete 12

Components 8 (canopies, handrails, communications shelter, etc.)

Station Landscaping

Days: 15

Crew Size Avg. 6

Assume small hand and power tools, no estimate of HP or hours feasible.

Delivery trips pipe and fittings 3

Delivery trips mulch, and plants/trees 6

NOTES ON COMPILATION OF PVL CONSTRUCTION IMPACTS REPORT

January 25, 2010

By: Michael E. McGinley

This is a companion document to the “RCTC PVL Construction Scenario” and “Station Construction Equipment by Phase” reports dated January 25, 2010.

Crew size, equipment lists, and production rates are based on past experience with SCRRRA construction of track, road crossings, signals, embankments, and stations. The author has no experience with sound walls.

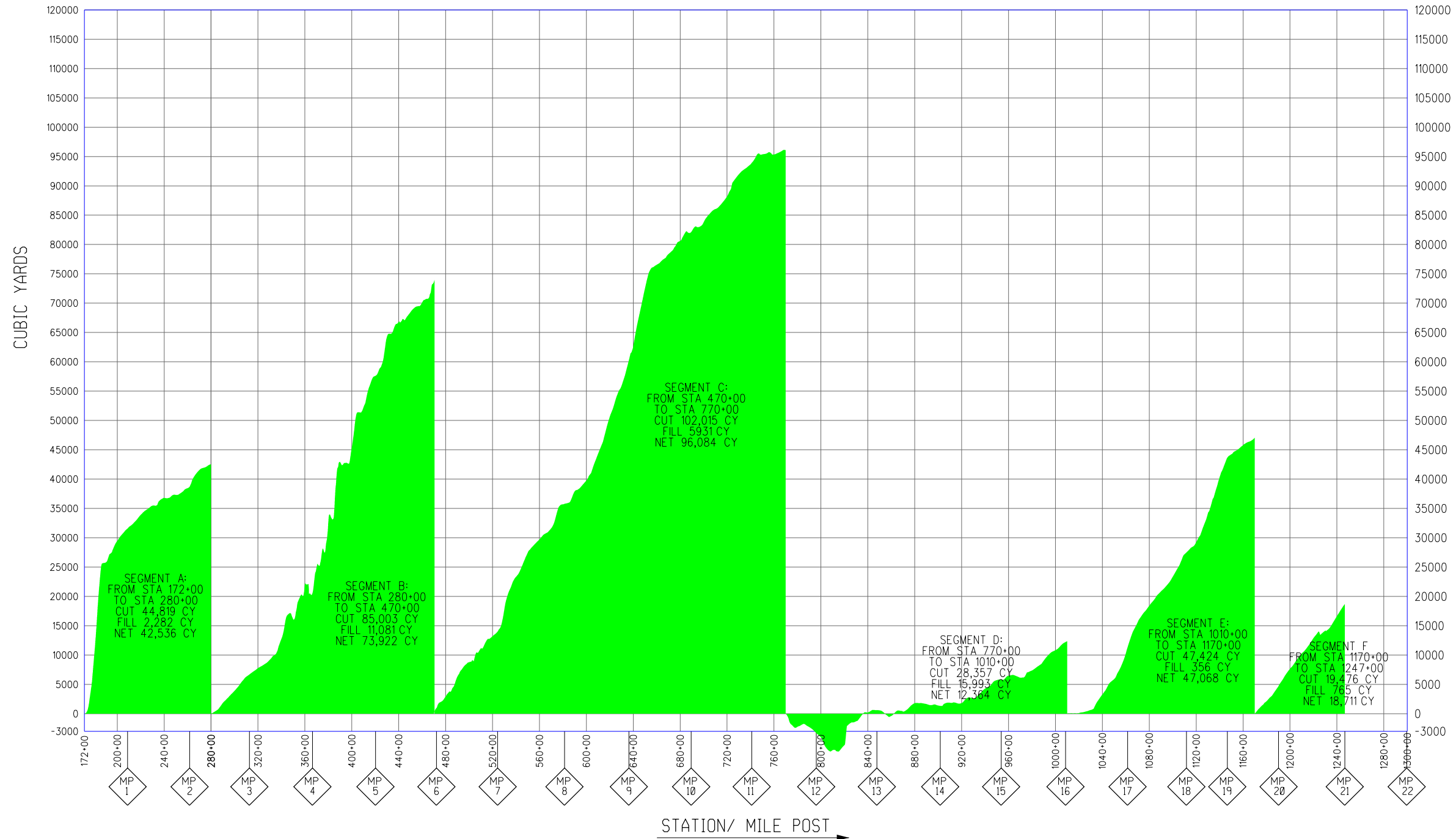
Embankment work was estimated as a set of equipment working towards a daily goal of improved embankment instead of as a known quantity of earth to be moved because much of the terrain is quite irregular and quite a lot of the embankment changes are very short moves of small quantities of material for clearing out cuts, opening up drainage channels, and shaping walkways and shoulders along the existing track. As a back-check, the quantities of earthwork in the estimate represent about 60 days of moving 8750 CY per day. This would be divided between hauls using dump trucks or earthmovers and local “shoves” pushing dirt out of cuts and onto embankments. With about three end loaders, four dump trucks, and two dozers, this seems reasonable.

Track material removal was based on 90-lb rail and 100 lbs per old crosstie.

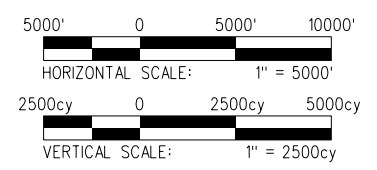
Rail delivery of CWR was listed in lieu of postulating the delivery of rail sticks in railroad cars and establishing a local temporary welding plant and then postulating the transport of the locally-made CWR to the places of installation along the line.

Rail delivery of track ballast is dependent upon negotiation of purchase of the ballast from a rock quarry and the shipment by the BNSF. A very good solution would be to purchase ballast from the BNSF source at Newberry Springs (near Barstow). Other quarries may not have railroad track access to the BNSF. Rail access by a quarry to the UP railroad is not a viable option due to the institutional barriers to shipments over two different companies.

The station estimates have firm numbers for delivery of HMA Paving and Aggregate base, however the delivery of concrete for formed platforms, sidewalks, and curbs is only estimated.



LEGEND
 CUMULATIVE LIMIT FOR EACH SEGMENT EXCAVATION/ HAUL



11/13/2010 11:19:22 AM noriega

REVISION	DATE	WORK IN PROGRESS	BY	SUB.	APP.
	6-07-10				

DESIGNED BY
J. GONZALEZ

DRAWN BY
J. GONZALEZ

CHECKED BY
N. ORTEGA

APPROVED BY
M. Z. GHANDEHARI

DATE
6-07-10

RIVERSIDE COUNTY TRANSPORTATION COMMISSION

APPROVED - BY SCRRRA

STV Incorporated
 ENGINEERS/ARCHITECTS/PLANNERS/CONSTRUCTION MANAGERS
 9130 ANAHEIM PLACE, SUITE 210
 RANCHO CUCAMONGA, CA. 91730-8540

PATTERSON & ASSOCIATES, INC.
 CIVIL/TRACK/UTORH ENGINEERING
 725 TOWN & COUNTRY RD
 SUITE 300
 ORANGE, CA. 92668

RCTC PERRIS VALLEY LINE

"90%" MASS HAUL DIAGRAM EXHIBIT

CONTRACT NO.	
DRAWING NO.	DISCIPLINE/SEQUENCE
REVISION	SHEET NO.
	XXX
SCALE	
AS SHOWN	