

Appendix H

Attachment D

Road Construction Emissions Model, Version 6.3.2

Emission Estimates for -> Overhead										
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	6.2	28.0	36.3	42.3	2.3	40.0	10.4	2.1	8.3	4,095.3
Grading/Excavation	8.5	42.2	57.7	43.1	3.1	40.0	11.2	2.8	8.3	7,119.7
Drainage/Utilities/Sub-Grade	8.6	45.6	67.4	43.5	3.5	40.0	11.5	3.2	8.3	8,205.9
Paving	3.0	18.0	16.8	1.0	1.0	-	0.9	0.9	-	2,150.4
Maximum (pounds/day)	8.6	45.6	67.4	43.5	3.5	40.0	11.5	3.2	8.3	8,205.9
Total (tons/construction project)	0.4	2.3	3.1	2.7	0.2	2.6	0.7	0.2	0.5	375.0

Notes: Project Start Year -> 2011
 Project Length (months) -> 6
 Total Project Area (acres) -> 7
 Maximum Area Disturbed/Day (acres) -> 4
 Total Soil Imported/Exported (yd³/day)-> 20

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Overhead										
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	2.8	12.7	16.5	19.2	1.0	18.2	4.7	0.9	3.8	1,861.5
Grading/Excavation	3.9	19.2	26.2	19.6	1.4	18.2	5.1	1.3	3.8	3,236.2
Drainage/Utilities/Sub-Grade	3.9	20.7	30.6	19.8	1.6	18.2	5.2	1.4	3.8	3,729.9
Paving	1.4	8.2	7.6	0.5	0.5	-	0.4	0.4	-	977.4
Maximum (kilograms/day)	3.9	20.7	30.6	19.8	1.6	18.2	5.2	1.4	3.8	3,729.9
Total (megagrams/construction project)	0.4	2.1	2.8	2.5	0.2	2.3	0.6	0.1	0.5	340.2

Notes: Project Start Year -> 2011
 Project Length (months) -> 6
 Total Project Area (hectares) -> 3
 Maximum Area Disturbed/Day (hectares) -> 2
 Total Soil Imported/Exported (meters³/day)-> 15

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Hauling emission default values can be overridden in cells C45 through C46.

Soil Hauling Emissions		User Override of	
User Input	Soil Hauling Defaults	Default Values	
Miles/round trip	200.00	30	
Round trips/day		1	
Vehicle miles traveled/day (calculated)			200

Hauling Emissions	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate (grams/mile)	1.02	13.03	6.99	0.49	0.43	1861.89
Emission rate (grams/trip)	11.39	8.02	196.83	0.02	0.01	217.22
Pounds per day	0.5	5.8	3.9	0.2	0.2	821.2
Tons per construction period	0.01	0.08	0.05	0.00	0.00	10.84

Worker commute default values can be overridden in cells C60 through C65.

Worker Commute Emissions		User Override of Worker	
	Commute Default Values	Default Values	
Miles/ one-way trip	30.00	20	
One-way trips/day		2	
No. of employees: Grubbing/Land Clearing	10.00	9	
No. of employees: Grading/Excavation	14.00	11	
No. of employees: Drainage/Utilities/Sub-Grade	16.00	10	
No. of employees: Paving	4.00	10	

	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	0.149	0.263	2.686	0.034	0.019	426.620
Emission rate - Grading/Excavation (grams/mile)	0.149	0.263	2.686	0.034	0.019	426.620
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	0.149	0.263	2.686	0.034	0.019	426.620
Emission rate - Paving (grams/mile)	0.149	0.263	2.686	0.034	0.019	426.620
Emission rate - Grubbing/Land Clearing (grams/trip)	0.878	0.372	8.574	0.130	0.012	191.860
Emission rate - Grading/Excavation (grams/trip)	0.878	0.372	8.574	0.130	0.012	191.860
Emission rate - Draining/Utilities/Sub-Grade (gr/trip)	0.878	0.372	8.574	0.130	0.012	191.860
Emission rate - Paving (grams/trip)	0.878	0.372	8.574	0.130	0.012	191.860
Pounds per day - Grubbing/Land Clearing	0.274	0.380	4.305	0.056	0.026	580.719
Tons per const. Period - Grub/Land Clear	0.004	0.005	0.062	0.001	0.000	8.304
Pounds per day - Grading/Excavation	0.274	0.380	4.305	0.056	0.026	580.719
Tons per const. Period - Grading/Excavation	0.004	0.005	0.057	0.001	0.000	7.665
Pounds per day - Drainage/Utilities/Sub-Grade	0.274	0.380	4.305	0.056	0.026	580.719
Tons per const. Period - Drain/Util/Sub-Grade	0.006	0.009	0.099	0.001	0.001	13.415
Pounds per day - Paving	0.156	0.380	4.305	0.056	0.026	242.430
Tons per const. Period - Paving	0.002	0.006	0.066	0.001	0.000	3.733
tons per construction period	0.016	0.025	0.284	0.004	0.002	33.118

Water truck default values can be overridden in cells C91 through C93 and E91 through E93.

Water Truck Emissions	User Override of	Program Estimate of	User Override of Truck	Default Values		
	Default # Water Trucks	Number of Water Trucks	Miles Traveled/Day	Miles Traveled/Day		
Grubbing/Land Clearing - Exhaust		1				40
Grading/Excavation - Exhaust		1				40
Drainage/Utilities/Subgrade		1				40
	ROG	NOx	CO	PM10	PM2.5	CO2
Emission rate - Grubbing/Land Clearing (grams/mile)	1.02	13.03	6.99	0.49	0.43	1861.89
Emission rate - Grading/Excavation (grams/mile)	1.02	13.03	6.99	0.49	0.43	1861.89
Emission rate - Draining/Utilities/Sub-Grade (gr/mile)	1.02	13.03	6.99	0.49	0.43	1861.89
Pounds per day - Grubbing/Land Clearing	0.09	1.15	0.62	0.04	0.04	164.04
Tons per const. Period - Grub/Land Clear	0.00	0.02	0.01	0.00	0.00	2.17
Pound per day - Grading/Excavation	0.09	1.15	0.62	0.04	0.04	164.04
Tons per const. Period - Grading/Excavation	0.00	0.02	0.01	0.00	0.00	2.17
Pound per day - Drainage/Utilities/Subgrade	0.09	1.15	0.62	0.04	0.04	164.04
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.03	0.01	0.00	0.00	3.79

Fugitive dust default values can be overridden in cells C110 through C112.

Fugitive Dust	User Override of Max	Default	PM10	PM10	PM2.5	PM2.5
	Acreage Disturbed/Day	Maximum Acreage/Day	pounds/day	tons/per period	pounds/day	tons/per period
Fugitive Dust - Grubbing/Land Clearing		4	40.0	0.6	8.3	0.1
Fugitive Dust - Grading/Excavation		4	40.0	1.2	8.3	0.2
Fugitive Dust - Drainage/Utilities/Subgrade		4	40.0	0.8	8.3	0.2

Off-Road Equipment Emissions								
Grubbing/Land Clearing	Default							
Override of Default Number of Vehicles	Number of Vehicles	Type	ROG	CO	NOx	PM10	PM2.5	CO2
	<i>Program-estimate</i>		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	1.07	4.90	8.17	0.49	0.45	821.04
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Graders	1.37	5.81	10.63	0.62	0.57	971.80
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Other General Industrial Equipment	1.62	3.92	3.10	0.36	0.33	281.56
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		1 Rubber Tired Dozers	1.46	5.26	10.84	0.63	0.58	785.03
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00		2 Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00		4 Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Tractors/Loaders/Backhoes	0.30	3.22	2.00	0.09	0.08	491.07
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing	pounds per day	5.8	23.1	34.7	2.2	2.0	3350.5
	Grubbing/Land Clearing	tons per phase	0.1	0.3	0.5	0.0	0.0	47.9

Grading/Excavation		Default	ROG	CO	NOx	PM10	PM2.5	CO2
Override of Default Number of Vehicles	Number of Vehicles	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
	<i>Program-estimate</i>							
2.00		Aerial Lifts	0.69	2.51	4.48	0.36	0.33	384.90
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
2.00	0	Cranes	1.63	5.92	15.86	0.61	0.56	1612.34
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1	Excavators	1.07	4.90	8.17	0.49	0.45	821.04
1.00		Forklifts	0.25	1.15	1.92	0.12	0.11	195.65
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
2.00		Other General Industrial Equipment	1.62	3.92	3.10	0.36	0.33	281.56
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Dozers	1.46	5.26	10.84	0.63	0.58	785.03
0.00	1	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
3.00		Tractors/Loaders/Backhoes	0.91	9.65	6.01	0.26	0.24	1473.22
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Grading/Excavation	pounds per day	7.6	33.3	50.4	2.8	2.6	5553.7
	Grading	tons per phase	0.1	0.4	0.7	0.0	0.0	73.3

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles		ROG	CO	NOx	PM10	PM2.5	CO2
	<i>Program-estimate</i>		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
3.00		Aerial Lifts	1.04	3.77	6.72	0.54	0.49	577.34
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
3.00		Cranes	2.44	8.88	23.79	0.92	0.85	2418.52
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Excavators	1.07	4.90	8.17	0.49	0.45	821.04
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
3.00		Other Construction Equipment	0.98	4.96	8.35	0.46	0.42	894.86
		Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Pavers	0.00	0.00	0.00	0.00	0.00	0.00
		Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
		Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
1.00		Rubber Tired Dozers	1.46	5.26	10.84	0.63	0.58	785.03
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
4.00		Tractors/Loaders/Backhoes	1.22	12.87	8.02	0.34	0.32	1964.29
0.00	1	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage	pounds per day	8.2	40.6	65.9	3.4	3.1	7461.1
	Drainage	tons per phase	0.2	0.9	1.5	0.1	0.1	172.4

Paving	Default		ROG	CO	NOx	PM10	PM2.5	CO2
	Number of Vehicles	Type						
Override of Default Number of Vehicles	Program-estimate		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
		Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00
		Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00
		Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00
		Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00
		Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00
		Cranes	0.00	0.00	0.00	0.00	0.00	0.00
		Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Excavators	0.00	0.00	0.00	0.00	0.00	0.00
		Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
		Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00
		Graders	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00
		Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00
		Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	1.00	Other General Industrial Equipment	0.81	1.96	1.55	0.18	0.17	140.78
		Other Material Handling Equipment	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	1 Pavers	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	1 Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00
		Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00
		Pumps	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	2 Rollers	0.00	0.00	0.00	0.00	0.00	0.00
		Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00
	1.00	Rubber Tired Dozers	1.46	5.26	10.84	0.63	0.58	785.03
		Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Scrapers	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	4 Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00
		Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00
		Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00
		Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00
	2.00	Tractors/Loaders/Backhoes	0.61	6.43	4.01	0.17	0.16	982.15
		Trenchers	0.00	0.00	0.00	0.00	0.00	0.00
		Welders	0.00	0.00	0.00	0.00	0.00	0.00
	Paving	pounds per day	2.9	13.7	16.4	1.0	0.9	1908.0
	Paving	tons per phase	0.0	0.2	0.3	0.0	0.0	29.4
Total Emissions all Phases (tons per construction period) =>			0.4	1.9	2.9	0.2	0.1	323.0

Equipment default values for horsepower, load factor, and hours/day can be overridden in cells C285 through C317, E285 through E317, and G285 through G317.

Equipment		Default Values Horsepower		Default Values Load Factor		Default Values Hours/day
Aerial Lifts		60		0.46	12.00	8
Air Compressors	50.00	106		0.48	12.00	8
Bore/Drill Rigs		291		0.75	12.00	8
Cement and Mortar Mixers		10		0.56	12.00	8
Concrete/Industrial Saws		19		0.73	12.00	8
Cranes	290.00	399		0.43	12.00	8
Crushing/Proc. Equipment		142		0.78	12.00	8
Excavators		168		0.57	12.00	8
Forklifts		145		0.30	12.00	8
Generator Sets		549		0.74	12.00	8
Graders		174		0.61	12.00	8
Off-Highway Tractors		267		0.65	12.00	8
Off-Highway Trucks		479		0.57	12.00	8
Other Construction Equipment	160.00	75	0.20	0.62	12.00	8
Other General Industrial Equipment	36.00	238		0.51	12.00	8
Other Material Handling Equipment		191		0.59	12.00	8
Pavers		100		0.62	12.00	8
Paving Equipment		104		0.53	12.00	8
Plate Compactors		8		0.43	12.00	8
Pressure Washers		1		0.60	12.00	8
Pumps		53		0.74	12.00	8
Rollers		95		0.56	12.00	8
Rough Terrain Forklifts		93		0.60	12.00	8
Rubber Tired Dozers	150.00	357		0.59	12.00	8
Rubber Tired Loaders		157		0.54	12.00	8
Scrapers		313		0.72	12.00	8
Signal Boards		20		0.78	12.00	8
Skid Steer Loaders		44		0.55	12.00	8
Surfacing Equipment		362		0.45	12.00	8
Sweepers/Scrubbers		91		0.68	12.00	8
Tractors/Loaders/Backhoes		108		0.55	12.00	8
Trenchers		63		0.75	12.00	8
Welders		45		0.45	12.00	8