

Appendix H

Attachment E

Road Construction Emissions Model, Version 6.3.2

Emission Estimates for -> KM Green											
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	2.7	13.6	22.9	11.0	1.0	10.0	3.0	0.9	2.1	2,039.6	
Grading/Excavation	2.9	15.2	24.3	11.1	1.1	10.0	3.0	1.0	2.1	2,226.1	
Drainage/Utilities/Sub-Grade	2.9	12.4	19.0	3.2	1.2	2.0	1.5	1.1	0.4	2,172.0	
Paving	1.6	8.8	12.5	0.6	0.6	-	0.5	0.5	-	1,731.0	
Maximum (pounds/day)	2.9	15.2	24.3	11.1	1.2	10.0	3.0	1.1	2.1	2,226.1	
Total (tons/construction project)	0.1	0.4	0.6	0.2	0.0	0.2	0.1	0.0	0.0	68.0	

Notes: Project Start Year -> 2011
 Project Length (months) -> 3
 Total Project Area (acres) -> 1
 Maximum Area Disturbed/Day (acres) -> 1
 Total Soil Imported/Exported (yd³/day)-> 10

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 -> KM Green											
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	1.2	6.2	10.4	5.0	0.5	4.5	1.4	0.4	0.9	927.1	
Grading/Excavation	1.3	6.9	11.0	5.0	0.5	4.5	1.4	0.4	0.9	1,011.9	
Drainage/Utilities/Sub-Grade	1.3	5.6	8.6	1.4	0.5	0.9	0.7	0.5	0.2	987.3	
Paving	0.7	4.0	5.7	0.3	0.3	-	0.2	0.2	-	786.8	
Maximum (kilograms/day)	1.3	6.9	11.0	5.0	0.5	4.5	1.4	0.5	0.9	1,011.9	
Total (megagrams/construction project)	0.1	0.3	0.5	0.2	0.0	0.2	0.1	0.0	0.0	61.6	

Notes: Project Start Year -> 2011
 Project Length (months) -> 3
 Total Project Area (hectares) -> 0
 Maximum Area Disturbed/Day (hectares) -> 0
 Total Soil Imported/Exported (meters³/day)-> 8

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.

Road Construction Emissions Model

Version 6.3.2

Data Entry Worksheet

Note: Required data input sections have a yellow background.
 Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
 The user is required to enter information in cells C10 through C25.



Input Type

Project Name	KM Green	
Construction Start Year	2011	Enter a Year between 2005 and 2025 (inclusive)
Project Type	1	1 New Road Construction 2 Road Widening 3 Bridge/Overpass Construction
Project Construction Time	3.0	months
Predominant Soil/Site Type: Enter 1, 2, or 3	2	1. Sand Gravel 2. Weathered Rock-Earth 3. Blasted Rock
Project Length	0.05	miles
Total Project Area	0.5	acres
Maximum Area Disturbed/Day	0.5	acres
Water Trucks Used?	2	1. Yes No 2.
Soil Imported	5.0	yd ³ /day
Soil Exported	5.0	yd ³ /day
Average Truck Capacity	10.0	yd ³ (assume 20 if unknown)

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

The remaining sections of this sheet contain areas that can be modified by the user, although those modifications are optional.

Note: The program's estimates of construction period phase length can be overridden in cells C34 through C37.

Construction Periods	User Override of	Program	2005		2006		2007	
	Construction Months	Calculated		%		%		%
Grubbing/Land Clearing	0.10	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation	0.10	1.35	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	2.05	0.90	0.00	0.00	0.00	0.00	0.00	0.00
Paving	0.75	0.45	0.00	0.00	0.00	0.00	0.00	0.00
Totals	3.00	3.00						

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

Soil Hauling Emissions	User Override of						
	Soil Hauling Defaults	Default Values					
User Input							
Miles/round trip	40.00	30					
Round trips/day		1					
Vehicle miles traveled/day (calculated)			40				
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	0.1	1.2	1.5	0.0	0.0	165.0	
Tons per construction period	0.00	0.00	0.00	0.00	0.00	0.18	

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		3
No. of employees: Grading/Excavation		5
No. of employees: Drainage/Utilities/Sub-Grade		5
No. of employees: Paving		4

	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	0.072	0.100	1.130	0.015	0.007	152.439
Tons per const. Period - Grub/Land Clear	0.000	0.000	0.001	0.000	0.000	0.168
Pounds per day - Grading/Excavation	0.072	0.100	1.130	0.015	0.007	152.439
Tons per const. Period - Grading/Excavation	0.000	0.000	0.001	0.000	0.000	0.168
Pounds per day - Drainage/Utilities/Sub-Grade	0.072	0.100	1.130	0.015	0.007	152.439
Tons per const. Period - Drain/Util/Sub-Grade	0.002	0.002	0.025	0.000	0.000	3.437
Pounds per day - Paving	0.097	0.100	1.130	0.015	0.007	222.916
Tons per const. Period - Paving	0.001	0.001	0.009	0.000	0.000	1.839
tons per construction period	0.003	0.003	0.037	0.000	0.000	5.612

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		0				0
Grading/Excavation - Exhaust		0				0
Drainage/Utilities/Subgrade		0				0
	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	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grub/Land Clear	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00
Pound per day - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Subgrade	0.00	0.00	0.00	0.00	0.00	0.00

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		0.5	10.0	0.0	2.1	0.0
Fugitive Dust - Grading/Excavation		0.5	10.0	0.1	2.1	0.0
Fugitive Dust - Drainage/Utilities/Subgrade	0.10	0.5	2.0	0.0	0.4	0.0

Off-Road Equipment Emissions

Grubbing/Land Clearing		Default Number of Vehicles	ROG	CO	NOx	PM10	PM2.5	CO2	
Override of Default Number of Vehicles	Program-estimate	Type	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	
		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	
		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 Rubber Tired Dozers	2.55	12.24	22.60	0.96	0.89	1868.68	
		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 Signal Boards	0.08	0.19	0.19	0.02	0.02	18.44	
		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	
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	
		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	2.6	12.4	22.8	1.0	0.9	1887.1
		Grubbing/Land Clearing	tons per phase	0.0	0.0	0.0	0.0	0.0	2.1

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>							
		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
	0	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
0.00	1	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
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	Other Construction Equipment	0.04	0.14	0.23	0.02	0.02	21.58
		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
		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	2.55	12.24	22.60	0.96	0.89	1868.68
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	Signal Boards	0.08	0.19	0.19	0.02	0.02	18.44
		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
		Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00
		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	2.7	12.6	23.0	1.0	0.9	1908.7
	Grading	tons per phase	0.0	0.0	0.0	0.0	0.0	2.1

Paving	Default		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	CO2 pounds/day		
	Override of Default Number of Vehicles	Number of Vehicles <i>Program-estimate</i>							Type	
	1.00		0.35	1.26	2.24	0.18	0.16	192.45		
		Aerial Lifts	0.35	1.26	2.24	0.18	0.16	192.45		
		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		
	1.00	Cranes	0.81	2.96	7.93	0.31	0.28	806.17		
		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		
		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		
	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	1 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		
		Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00		
		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		
		Signal Boards	0.08	0.19	0.19	0.02	0.02	18.44		
		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		
		Paving		pounds per day	1.5	7.6	12.4	0.6	0.5	1508.1
		Paving		tons per phase	0.0	0.1	0.1	0.0	0.0	12.4
Total Emissions all Phases (tons per construction period) =>			0.1	0.3	0.6	0.0	0.0	62.2		

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		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		75		0.62	12.00	8
Other General Industrial Equipment		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		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	0.20	0.75	12.00	8
Welders		45		0.45	12.00	8