

PM2.5 Mobile 6.2 emission factors in grams/mile - CY2010

	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M
Rural Interstate	0.0234	0.0234	0.0213	0.0213
Rural Principal Arterial	0.0148	0.0148	0.0137	0.0137
Rural Minor Arterial	0.0115	0.0115	0.0122	0.0107
Rural Major Collector	0.0092	0.0092	0.0087	0.0087
Rural Minor Collector	0.0101	0.0101	0.0094	0.0094
Rural Local	0.0122	0.0122	0.0114	0.0114
Urban Interstate	0.0183	0.0183	0.0167	0.0167
Urban Freeway	0.0134	0.0134	0.0124	0.0124
Urban Principal Arterial	0.008	0.008	0.0075	0.0075
Urban Minor Arterial	0.0079	0.0079	0.0074	0.0074
Urban Collector	0.0076	0.0076	0.0074	0.0074
Urban Local	0.0083	0.0083	0.0079	0.0079
Urban HOV	0.0073	0.0073	0.0071	0.0071

Appendix B: Emission Factor Chart

NOx	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	2.763	2.937	2.488	2.652
Rural Principal Arterial	1.141	1.253	0.993	1.094
Rural Minor Arterial	0.949	1.065	0.943	0.931
Rural Major Collector	0.841	0.962	0.73	0.839
Rural Minor Collector	0.875	0.993	0.758	0.864
Rural Local	0.968	1.082	0.844	0.948
Urban Interstate	1.348	1.454	1.176	1.271
Urban Freeway	1.153	1.268	0.999	1.101
Urban Principal Arterial	0.834	0.964	0.729	0.848
Urban Minor Arterial	0.821	0.95	0.717	0.834
Urban Collector	0.829	0.96	0.725	0.845
Urban Local	0.876	1.008	0.77	0.89
Urban HOV	1.063	1.196	0.924	1.041

CO	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	28.337	35.823	17.815	23.018
Rural Principal Arterial	12.048	14.205	5.888	7.317
Rural Minor Arterial	12.497	14.744	6.694	7.634
Rural Major Collector	12.588	14.873	6.043	7.563
Rural Minor Collector	12.559	14.82	6.085	7.584
Rural Local	12.159	14.337	5.893	7.343
Urban Interstate	11.82	13.925	5.91	7.3
Urban Freeway	12.933	15.287	6.494	8.043
Urban Principal Arterial	13.224	15.764	6.37	8.063
Urban Minor Arterial	13.128	15.627	6.316	7.982
Urban Collector	13.332	15.906	6.448	8.163
Urban Local	13.492	16.127	6.605	8.378
Urban HOV	15.633	18.593	8.117	10.045

VOC	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	4.213	4.75	3.941	4.39
Rural Principal Arterial	0.748	0.867	0.612	0.697
Rural Minor Arterial	0.759	0.881	0.685	0.71
Rural Major Collector	0.805	0.939	0.66	0.757
Rural Minor Collector	0.773	0.899	0.631	0.722
Rural Local	0.796	0.926	0.654	0.748
Urban Interstate	0.712	0.821	0.581	0.658
Urban Freeway	0.727	0.84	0.588	0.669
Urban Principal Arterial	0.891	1.045	0.738	0.85
Urban Minor Arterial	0.878	1.029	0.726	0.836
Urban Collector	0.905	1.062	0.749	0.864
Urban Local	0.936	1.098	0.778	0.898
Urban HOV	0.722	0.834	0.576	0.654

PM (Exhaust PM)	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	0.0234	0.0234	0.0213	0.0213
Rural Principal Arterial	0.0148	0.0148	0.0137	0.0137
Rural Minor Arterial	0.0115	0.0115	0.0122	0.0107
Rural Major Collector	0.0092	0.0092	0.0087	0.0087
Rural Minor Collector	0.0101	0.0101	0.0094	0.0094
Rural Local	0.0122	0.0122	0.0114	0.0114
Urban Interstate	0.0183	0.0183	0.0167	0.0167
Urban Freeway	0.0134	0.0134	0.0124	0.0124
Urban Principal Arterial	0.008	0.008	0.0075	0.0075
Urban Minor Arterial	0.0079	0.0079	0.0074	0.0074
Urban Collector	0.0076	0.0076	0.0074	0.0074
Urban Local	0.0083	0.0083	0.0079	0.0079
Urban HOV	0.0073	0.0073	0.0071	0.0071

PM (Total PM)	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	0.0234	0.0234	0.0213	0.0213
Rural Principal Arterial	0.0148	0.0148	0.0137	0.0137
Rural Minor Arterial	0.0115	0.0115	0.0122	0.0107
Rural Major Collector	0.0092	0.0092	0.0087	0.0087
Rural Minor Collector	0.0101	0.0101	0.0094	0.0094
Rural Local	0.0122	0.0122	0.0114	0.0114
Urban Interstate	0.0183	0.0183	0.0167	0.0167
Urban Freeway	0.0134	0.0134	0.0124	0.0124
Urban Principal Arterial	0.008	0.008	0.0075	0.0075
Urban Minor Arterial	0.0079	0.0079	0.0074	0.0074
Urban Collector	0.0076	0.0076	0.0074	0.0074
Urban Local	0.0083	0.0083	0.0079	0.0079
Urban HOV	0.0073	0.0073	0.0071	0.0071

CO2	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	661	661	661	661
Rural Principal Arterial	566.7	566.7	566.7	566.7
Rural Minor Arterial	530.8	530.8	532.6	532.7
Rural Major Collector	505.7	505.7	505.7	505.7
Rural Minor Collector	514.9	514.9	515	515
Rural Local	538.4	538.4	538.4	538.4
Urban Interstate	605.4	605.4	605.5	605.5
Urban Freeway	551.7	551.7	551.8	551.8
Urban Principal Arterial	490.9	490.9	491	491
Urban Minor Arterial	490.3	490.3	490.4	490.4
Urban Collector	488.7	488.7	488.8	488.8
Urban Local	495.7	495.7	495.8	495.8
Urban HOV	492.5	492.5	492.6	492.6

SO2	Winter	Winter	Summer	Summer
	I/M	Non-I/M	I/M	Non-I/M
Rural Interstate	0.0122	0.0122	0.0122	0.0122
Rural Principal Arterial	0.0105	0.0105	0.0105	0.0105
Rural Minor Arterial	0.0098	0.0098	0.0098	0.0098
Rural Major Collector	0.0093	0.0093	0.0093	0.0093
Rural Minor Collector	0.0095	0.0095	0.0095	0.0095
Rural Local	0.0099	0.0099	0.0099	0.0099
Urban Interstate	0.0112	0.0112	0.0112	0.0112
Urban Freeway	0.0102	0.0102	0.0102	0.0102
Urban Principal Arterial	0.009	0.009	0.009	0.009
Urban Minor Arterial	0.009	0.009	0.009	0.009
Urban Collector	0.009	0.009	0.009	0.009
Urban Local	0.0091	0.0091	0.0091	0.0091
Urban HOV	0.0091	0.0091	0.0091	0.0091

Vehicle Miles Traveled

Percentage of Vehicles subject to I/M program

90

	Daily VMT	Seasonal VMT	I/M VMT	Non-I/M VMT
Rural Interstate	0	0	0	0
Rural Principal Arterial	153,048	22,957,191	20,661,472	2,295,719
Rural Minor Arterial	71,182	10,677,345	9,609,611	1,067,735
Rural Major Collector	69,670	10,450,544	9,405,490	1,045,054
Rural Minor Collector	135,233	20,285,012	18,256,511	2,028,501
Rural Local	280,269	42,040,403	37,836,362	4,204,040
Urban Interstate	7,240,094	1,086,014,031	977,412,628	108,601,403
Urban Freeway	4,505,670	675,850,557	608,265,501	67,585,056
Urban Principal Arterial	5,021,191	753,178,584	677,860,726	75,317,858
Urban Minor Arterial	4,622,381	693,357,206	624,021,485	69,335,721
Urban Collector	3,598,201	539,730,127	485,757,114	53,973,013
Urban Local	6,662,840	999,426,033	899,483,430	99,942,603
Urban HOV	25,733	3,859,875	3,473,888	385,988
Total	32,385,513			

2010 On-Road Annual Emissions (metric tons)

NOX	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M	Annual
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	23.5747391	2.87653599	20.516841	2.511516662	49.47963311
Rural Minor Arterial	9.11952054	1.13713726	9.0618629	0.994060838	20.31258151
Rural Major Collector	7.91001672	1.00534233	6.8660074	0.876800638	16.65816707
Rural Minor Collector	15.9744468	2.01430167	13.838435	1.752625019	33.57980853
Rural Local	36.6255987	4.54877155	31.93389	3.98543016	77.09369017
Urban Interstate	1317.55222	157.90644	1149.4373	138.0323833	2762.928296
Urban Freeway	701.330123	85.6978506	607.65724	74.41114629	1469.096355
Urban Principal Arterial	565.335845	72.6064155	494.16047	63.86954393	1195.972274
Urban Minor Arterial	512.321639	65.8689345	447.4234	57.82599096	1083.43997
Urban Collector	402.692648	51.8140922	352.17391	45.60719572	852.2878433
Urban Local	787.947485	100.742144	692.60224	88.94891697	1670.240787
Urban HOV	3.69274256	0.46164107	3.2098722	0.401813003	7.766068801
Total	4380.38428	546.217966	3825.6715	478.8156105	9231.089405

CO	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M	Annual
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	248.9294102	32.61068939	121.65	16.798	419.99
Rural Minor Arterial	120.0913047	15.74267776	64.327	8.1511	208.31
Rural Major Collector	118.3963026	15.54309403	56.837	7.9037	198.68
Rural Minor Collector	229.2835168	30.06238748	111.09	15.384	385.82
Rural Local	460.052329	60.27332512	222.97	30.87	774.17
Urban Interstate	11553.01726	1512.274538	5776.5	792.79	19635
Urban Freeway	7866.697725	1033.172746	3950.1	543.59	13394
Urban Principal Arterial	8964.030236	1187.31072	4318	607.29	15077
Urban Minor Arterial	8192.154057	1083.509305	3941.3	553.44	13770
Urban Collector	6476.113846	858.4947397	3132.2	440.58	10907
Urban Local	12135.83044	1611.774364	5941.1	837.32	20526
Urban HOV	54.30728539	7.176665865	28.198	3.8772	93.559
Total	56364.59643	7440.768587	27636	3854.1	95295

TOTALS (US tons/yr)	
NOx	10,338.82
CO	106,730.94
VOC	8,406.39
PM 2.5	117.04
CO2	5,726,558.3
SO2	105.81

VOC	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M	Annual
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	15.4547808	1.99038843	12.644821	1.600116192	31.69010604
Rural Minor Arterial	7.29369451	0.94067411	6.5825833	0.758091509	15.57504344
Rural Major Collector	7.5714191	0.98130608	6.2076231	0.791106178	15.55145447
Rural Minor Collector	14.1122827	1.82362256	11.519858	1.464577852	28.92034132
Rural Local	30.1177444	3.89294127	24.744981	3.14462211	61.90028869
Urban Interstate	695.917791	89.1617519	567.87674	71.45972323	1424.416003
Urban Freeway	442.209019	56.7714468	357.66011	45.21440224	901.8549829
Urban Principal Arterial	603.973907	78.707162	500.26122	64.02017965	1246.962464
Urban Minor Arterial	547.890864	71.3464565	453.0396	57.9646624	1130.241581
Urban Collector	439.610188	57.3193395	363.83208	46.63268296	907.3942892
Urban Local	841.916491	109.736978	699.79811	89.7484578	1741.200035
Urban HOV	2.50814687	0.32191359	2.0009593	0.252435835	5.083455572
Total	3646.06818	472.672068	3004.1677	382.7986221	7505.706589

PM	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M	Annual
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	0.30578978	0.033976642	0.2831	0.0315	0.6543
Rural Minor Arterial	0.110510523	0.012278947	0.1172	0.0114	0.2515
Rural Major Collector	0.086530504	0.0096145	0.0818	0.0091	0.1871
Rural Minor Collector	0.184390757	0.020487862	0.1716	0.0191	0.3956
Rural Local	0.46160362	0.051289291	0.4313	0.0479	0.9922
Urban Interstate	17.88665109	1.987405677	16.323	1.8136	38.01
Urban Freeway	8.150757714	0.905639746	7.5425	0.8381	17.437
Urban Principal Arterial	5.422885805	0.602542867	5.084	0.5649	11.674
Urban Minor Arterial	4.929769733	0.547752193	4.6178	0.5131	10.608
Urban Collector	3.691754067	0.410194896	3.5946	0.3994	8.096
Urban Local	7.46571247	0.829523608	7.1059	0.7895	16.191
Urban HOV	0.02535938	0.002817709	0.0247	0.0027	0.0556
Total	48.69635606	5.410706229	45.353	5.0376	104.5

CO2	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M	Annual
Rural Interstate	0.00	0.00	0.00	0.00	0.00
Rural Principal Arterial	11708.86	1300.98	11708.86	1300.98	26019.68
Rural Minor Arterial	5100.78	566.75	5118.08	568.78	11354.40
Rural Major Collector	4756.36	528.48	4756.36	528.48	10569.68
Rural Minor Collector	9400.28	1044.48	9402.10	1044.68	20891.53
Rural Local	20371.10	2263.46	20371.10	2263.46	45269.11
Urban Interstate	591725.60	65747.29	591823.35	65758.15	1315054.39
Urban Freeway	335580.08	37286.68	335640.90	37293.43	745801.09
Urban Principal Arterial	332761.83	36973.54	332829.62	36981.07	739546.05
Urban Minor Arterial	305957.73	33995.30	306020.14	34002.24	679975.41
Urban Collector	237389.50	26376.61	237438.08	26382.01	527586.20
Urban Local	445873.94	49541.55	445963.88	49551.54	990930.91
Urban HOV	1710.89	190.10	1711.24	190.14	3802.36
Total	2300626.05	255625.12	2300626.05	255625.12	5112998.45

SO2	Winter I/M	Winter Non-I/M	Summer I/M	Summer Non-I/M	Annual
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	0.001607003	0.241050502	0.2169	0.0241	0.4837
Rural Minor Arterial	0.000697587	0.104637983	0.0942	0.0105	0.21
Rural Major Collector	0.000647934	0.097190059	0.0875	0.0097	0.195
Rural Minor Collector	0.001284717	0.192707612	0.1734	0.0193	0.3867
Rural Local	0.002774667	0.416199985	0.3746	0.0416	0.8352
Urban Interstate	0.081089048	12.16335715	10.947	1.2163	24.408
Urban Freeway	0.045957838	6.893675678	6.2043	0.6894	13.833
Urban Principal Arterial	0.045190715	6.778607257	6.1007	0.6779	13.602
Urban Minor Arterial	0.041601432	6.240214852	5.6162	0.624	12.522
Urban Collector	0.032383808	4.857571141	4.3718	0.4858	9.7475
Urban Local	0.060631846	9.094776904	8.1853	0.9095	18.25
Urban HOV	0.000234166	0.035124864	0.0316	0.0035	0.0705
Total	0.313866594	47.07998912	42.372	4.708	94.474

- 1. Break down VMT by seasons.** VMT data is available from CDOT and is updated around June of every year. This data is based on CDOT's year round traffic counts and NCDOT's freeway traffic counts that occur every other year. The data from CDOT will be miles traveled on an average week day for each roadway type, and is typically multiplied by 300 to obtain an annual total (per Joe McLelland of CDOT). For the emissions inventory, the daily number is multiplied by 150 to determine a seasonal VMT. For example, if a roadway type has an average daily VMT of 10,000 miles, the summer VMT should be 1,500,000, and the winter VMT would also be 1,500,000.
- 2. Break down VMT by I/M.** Using the I/M fraction from NCDAQ, the summer and winter VMT is further broken down into winter I/M, winter non-I/M, summer I/M, and summer non-I/M. For example, if 90% of the vehicles are subject to I/M requirements, then the 1,500,000 seasonal VMT would be split into 1,350,000 miles for I/M VMT and 150,000 miles for non-I/M VMT.
- 3. Calculate on road mobile inventory.** Multiply the emission factor for each season, I/M status, and roadway type by the appropriate VMT. Total all emissions to obtain one number for on road mobile emissions for each pollutant. The Emissions tab of this workbook will contain the final annual emissions.