APPENDIX - A

TRANSPORTATION EMISSIONS REDUCTION MESURES (TERMs) ANALYSIS INSTRUCTIONS

Call for Projects

For the 2009 Financially Constrained Long Range Plan (CLRP) and Fiscal Year 2010-2015 Transportation Improvement Program (TIP)

TERM EMISSIONS REDUCTION CALCULATIONS

This section of the 'Call for Projects' document contains instructions for analyzing transportation emissions reduction measure (TERM) projects. Section I provides information to estimate VOC and NOx, and Section II provides the necessary information to estimate PM 2.5 emissions. Examples of analysis of commuting vehicle trip TERMs and their ozone precursors (VOC and NOx) and fine particulate matter (PM 2.5) emissions reduction are also included.

Section I

Table 1 provides an overview of the three emissions components, namely Start-up (Cold Start), Running, and Hot Soak. The methodology that will be used to analyze TERMs for the 2009 CLRP and FY 2010 - 2015 TIP utilizes the latest travel demand results from the Version 2.2 travel demand model and emissions rate data from the Mobile 6.2 emissions model.

The introduction of the Mobile 6 emissions model offered the potential for a more disaggregate emissions reduction analysis of TERMs. Instead of the 8 different vehicle classes used in the Mobile 5b model, the Mobile 6 model utilizes 28 vehicle classes (the current model version is Mobile 6.2). Four categories of TERMs have been developed utilizing the disaggregate nature of the vehicle classes. The four categories are:

- TERMs impacting the <u>traffic stream</u> (all vehicle types), such as the Signal Optimization TERM, will continue to be analyzed using a regional composite vehicle emissions factor. Tables 2, 3, 4, and 5 display emissions factors for analysis years 2009, 2010, 2020 and 2030. Weighted average of arterial and freeway emissions factors are shown in the tables; these factors are plotted in the exhibit 1 and 2.

- TERMs impacting <u>commute</u> trips, such as the Employer Outreach and Telework Resources Center TERM (item # 75 and # 90 on the TERM tracking sheet, page 1-2), will be analyzed using an average light duty vehicle emissions factor composed of emissions factors for several classes of light duty vehicles and for motorcycles. Tables 7, 6, 7, 8, and 9 display emissions factors for commuting vehicle trips for analysis years 2009, 2010, 2020 and 2030. Weighted average of arterial and freeway emissions factors are shown in the tables; these factors are plotted in the exhibit 3 and 4.

- TERMs impacting all types of <u>heavy duty diesel</u> vehicles, such as a Diesel Fuel Additive TERM, are considered as engine technology (heavy duty diesel vehicles) category.

- TERMs impacting an individual heavy duty vehicle type of a specific weight class, are categorized as a <u>specific vehicle type</u>, such as school buses, transit buses, tractor trailers. Emissions rates for specific weight classes can be generated as needed.

- TERMs impacting vehicle idling such as roundabouts in place of traffic signals can be analyzed using the individual vehicle type idling emissions factors or the traffic stream idling emissions factors for year 2010, 2020, and 2030 shown in Table 10.

Tables 2 through 9 show Cold Start, Running, Hot Soak emissions factors for VOC and NOx for the analysis years 2009, 2010, 2020 and 2030 to be used for analyzing "Traffic Stream" and "Commute" TERMs. Exhibits 1 through 4 show the plots of NOx and VOC running emissions factors for these years. Table 10 shows idling emissions factors for NOx and VOC for different vehicle types and PM2.5 factors for heavy duty vehicles for all three analysis year. Table 11 shows the 2005 regional average speeds generated by the post-processor, which are used to compute hourly speeds for emissions calculations. Since there is little variation through time, the 2005 speeds may be used for any of the analysis years; use specific speeds for each application, where available. Table 12 provides the Mobile 6 vehicle classifications. Tables 13, 14, and 15 show summary travel demand data such as person trips, transit trips, average occupancy and VMT

The cost effectiveness calculation methodology is explained following the emissions factors tables and is a primary criterion used to select TERMs. The final section provides an example of a commuting vehicle TERM analysis using the emissions factors included in the tables.

For purpose of determining emissions reductions, the start-up, running, and hot soak portions of each trip must be considered. Table 1 shows the procedure to use in the analysis.

Table 1: Mobile Source Emissions Overview

Emissions = Start up emissions + Running emissions + Soak emissions

Start-up emissions = Vehicle Trip Origin x Start up emissions rate (Cold start in Grams/Trip)

Running emissions =VMT x Running emissions rate (Grams/Mile)

Hot Soak emissions = Trip Destination x Hot Soak emission rate (Grams/Trip)

Emissions factors were obtained from the Mobile 6.2 model and are contained herein. NOx emissions do not occur in the hot soak portion of the trip, therefore only VOC factors are shown for this category. Diurnal and resting loss (VOC) emissions are vehicle-related, not trip-related, and are not estimated here.

It may be noted that the running emissions factors and cold start/hot soak emissions factors shown in the attached tables were generated using the Mobile 6.2 emissions model with the latest VMT and vehicle registration data as input to the model. These are the factors that were used in the conformity analysis of the 2007 CLRP and FY 2008-2013 TIP. Running emissions factors for speed ranges 1 to 65 mph are shown in the emissions factor tables. If the actual speed for a TERM is known use the appropriate emissions factors, otherwise use emissions factors for average travel speed.

Table 2: 2009 Running, Cold Start, and Hot Soak Average Emissions Factors for "Traffic Stream" TERMs (Mobile6.2)

Emission Type	Speed (mph)	Average 2009 Running Emission Factor (g/mi)					
		Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60%, Freeway- 40%	NOx		Arterial - 60%, Freeway- 40%
Running (g/mi)	1	3.1310	3.1310	3.1310	1.5925	1.6508	1.6158
Running (g/mi)	2	3.1310	3.1310	3.1310	1.5925	1.6508	1.6158
Running (g/mi)	3	2.4518	2.4518	2.4518	1.5269	1.5852	1.5502
Running (g/mi)	4	1.6029	1.6028	1.6028	1.4450	1.5033	1.4683
Running (g/mi)	5	1.0934	1.0934	1.0934	1.3959	1.4539	1.4191
Running (g/mi)	6	0.9059	0.8971	0.9024	1.3074	1.3343	1.3182
Running (g/mi)	7	0.7722	0.7571	0.7662	1.2443	1.2488	1.2461
Running (g/mi)	8	0.6718	0.6520	0.6639	1.1971	1.1847	1.1921
Running (g/mi)	9	0.5937	0.5699	0.5842	1.1603	1.1348	1.1501
Running (g/mi)	10	0.5313	0.5049	0.5207	1.1309	1.0947	1.1164
Running (g/mi)	11	0.4894	0.4616	0.4783	1.0848	1.0427	1.0680
Running (g/mi)	12	0.4546	0.4253	0.4429	1.0464	0.9993	1.0276
Running (g/mi)	13	0.4253	0.3947	0.4131	1.0138	0.9626	0.9933
Running (g/mi)	14	0.4000	0.3686	0.3874	0.9862	0.9312	0.9642
Running (g/mi)	15	0.3781	0.3460	0.3652	0.9618	0.9038	0.9386
Running (g/mi)	16	0.3564	0.3285	0.3452	0.9378	0.8933	0.9200
Running (g/mi)	17	0.3374	0.3131	0.3277	0.9163	0.8843	0.9035
Running (g/mi)	18	0.3206	0.2996	0.3122	0.8974	0.8761	0.8889
Running (g/mi)	19	0.3055	0.2875	0.2983	0.8805	0.8688	0.8758
Running (g/mi)	20	0.2919	0.2765	0.2857	0.8651	0.8622	0.8639
Running (g/mi)	21	0.2806	0.2675	0.2754	0.8512	0.8559	0.8531
Running (g/mi)	22	0.2706	0.2596	0.2662	0.8382	0.8500	0.8429
Running (g/mi)	23	0.2612	0.2524	0.2576	0.8267	0.8446	0.8338
Running (g/mi)	24	0.2527	0.2455	0.2498	0.8159	0.8396	0.8254
Running (g/mi)	25	0.2449	0.2394	0.2427	0.8059	0.8353	0.8177
Running (g/mi)	26	0.2380	0.2336	0.2362	0.7980	0.8320	0.8116
Running (g/mi)	27	0.2314	0.2279	0.2300	0.7906	0.8291	0.8060
Running (g/mi)	28	0.2254	0.2229	0.2244	0.7835	0.8263	0.8006
Running (g/mi)	29	0.2199	0.2178	0.2190	0.7771	0.8238	0.7958
Running (g/mi)	30	0.2146	0.2136	0.2142	0.7710	0.8213	0.7911
Running (g/mi)	31	0.2098	0.2088	0.2094	0.7683	0.8203	0.7891
Running (g/mi)	32	0.2048	0.2043	0.2046	0.7655	0.8194	0.7871
Running (g/mi)	33	0.2004	0.2000	0.2002	0.7632	0.8185	0.7853
Running (g/mi)	34	0.1964	0.1961	0.1963	0.7610	0.8178	0.7837
Running (g/mi)	35	0.1923	0.1923	0.1923	0.7587	0.8170	0.7820
Running (g/mi)	36	0.1894	0.1894	0.1894	0.7624	0.8207	0.7857
Running (g/mi)	37	0.1867	0.1867	0.1867	0.7661	0.8245	0.7894
Running (g/mi)	38	0.1837	0.1837	0.1837	0.7693	0.8277	0.7926
Running (g/mi)	39	0.1813	0.1813	0.1813	0.7724	0.8308	0.7958
Running (g/mi)	40	0.1789	0.1789	0.1789	0.7755	0.8338	0.7988
Running (g/mi)	41	0.1763	0.1763	0.1763	0.7827	0.8409	0.8060
Running (g/mi)	42	0.1741	0.1741	0.1741	0.7893	0.8477	0.8126
Running (g/mi)	43	0.1720	0.1720	0.1720	0.7958	0.8541	0.8191
Running (g/mi)	44	0.1699	0.1699	0.1699	0.8021	0.8602	0.8253
Running (g/mi)	45	0.1678	0.1678	0.1678	0.8079	0.8663	0.8313
Running (g/mi)	46	0.1661	0.1661	0.1661	0.8183	0.8766	0.8416
Running (g/mi)	47	0.1637	0.1637	0.1637	0.8286	0.8868	0.8519
Running (g/mi)	48	0.1622	0.1622	0.1622	0.8383	0.8965	0.8616
Running (g/mi)	49	0.1606	0.1606	0.1606	0.8474	0.9057	0.8707
Running (g/mi)	50	0.1586	0.1586	0.1586	0.8564	0.9147	0.8797
Running (g/mi)	51	0.1570	0.1570	0.1570	0.8716	0.9298	0.8949
Running (g/mi)	52	0.1555	0.1555	0.1555	0.8858	0.9439	0.9090
Running (g/mi)	53	0.1540	0.1540	0.1540	0.8996	0.9579	0.9229
Running (g/mi)	54	0.1525	0.1525	0.1525	0.9129	0.9710	0.9362
Running (g/mi)	55	0.1513	0.1513	0.1513	0.9258	0.9838	0.9490
Running (g/mi)	56	0.1503	0.1503	0.1503	0.9463	1.0047	0.9697
Running (g/mi)	57	0.1493	0.1493	0.1493	0.9664	1.0248	0.9898
Running (g/mi)	58	0.1492	0.1492	0.1492	0.9858	1.0441	1.0091
Running (g/mi)	59	0.1482	0.1482	0.1482	1.0045	1.0628	1.0278
Running (g/mi)	60	0.1474	0.1474	0.1474	1.0225	1.0808	1.0458
Running (g/mi)	61	0.1471	0.1471	0.1471	1.0515	1.1099	1.0749
Running (g/mi)	62	0.1467	0.1467	0.1467	1.0798	1.1380	1.1031
Running (g/mi)	63	0.1464	0.1464	0.1464	1.1069	1.1653	1.1303
Running (g/mi)	64	0.1460	0.1460	0.1460	1.1333	1.1916	1.1566
Running (g/mi)	65	0.1452	0.1452	0.1452	1.1589	1.2172	1.1822

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	1.0373	0.5761
Hot Soak Loss (g/trip end)	0.5929	-
Hot Start (g/trip start, Light Duty Only)	0.1789	0.1267

Table 3: 2010 Running, Cold Start, and Hot Soak Average Emissions Factors for "Traffic Stream" TERMs (Mobile6.2)

Emission Type	Speed (mph)	Average 2010 Running Emission Factor (g/mi)					
		Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60%, Freeway- 40%	NOx		Arterial - 60%, Freeway- 40%
Running (g/mi)	1	2.8327	2.8327	2.8327	1.3837	1.4276	1.4012
Running (g/mi)	2	2.8327	2.8327	2.8327	1.3837	1.4276	1.4012
Running (g/mi)	3	2.2207	2.2207	2.2207	1.3262	1.3701	1.3437
Running (g/mi)	4	1.4556	1.4556	1.4556	1.2543	1.2984	1.2720
Running (g/mi)	5	0.9963	0.9963	0.9963	1.2113	1.2553	1.2289
Running (g/mi)	6	0.8264	0.8183	0.8232	1.1340	1.1498	1.1403
Running (g/mi)	7	0.7050	0.6912	0.6995	1.0788	1.0748	1.0772
Running (g/mi)	8	0.6139	0.5955	0.6066	1.0372	1.0183	1.0296
Running (g/mi)	9	0.5434	0.5216	0.5347	1.0049	0.9743	0.9927
Running (g/mi)	10	0.4867	0.4622	0.4769	0.9791	0.9392	0.9631
Running (g/mi)	11	0.4485	0.4224	0.4381	0.9386	0.8934	0.9205
Running (g/mi)	12	0.4167	0.3897	0.4059	0.9051	0.8555	0.8852
Running (g/mi)	13	0.3897	0.3616	0.3784	0.8766	0.8232	0.8552
Running (g/mi)	14	0.3669	0.3379	0.3553	0.8523	0.7956	0.8296
Running (g/mi)	15	0.3468	0.3171	0.3349	0.8311	0.7716	0.8073
Running (g/mi)	16	0.3271	0.3012	0.3167	0.8098	0.7627	0.7910
Running (g/mi)	17	0.3095	0.2870	0.3005	0.7911	0.7548	0.7765
Running (g/mi)	18	0.2940	0.2746	0.2862	0.7746	0.7477	0.7638
Running (g/mi)	19	0.2802	0.2633	0.2734	0.7598	0.7416	0.7525
Running (g/mi)	20	0.2677	0.2530	0.2618	0.7465	0.7359	0.7423
Running (g/mi)	21	0.2573	0.2453	0.2525	0.7340	0.7304	0.7326
Running (g/mi)	22	0.2482	0.2379	0.2441	0.7229	0.7253	0.7239
Running (g/mi)	23	0.2398	0.2314	0.2364	0.7126	0.7207	0.7158
Running (g/mi)	24	0.2320	0.2251	0.2292	0.7033	0.7168	0.7087
Running (g/mi)	25	0.2246	0.2194	0.2225	0.6948	0.7129	0.7020
Running (g/mi)	26	0.2184	0.2140	0.2166	0.6878	0.7101	0.6967
Running (g/mi)	27	0.2126	0.2089	0.2111	0.6810	0.7075	0.6916
Running (g/mi)	28	0.2069	0.2041	0.2058	0.6749	0.7052	0.6870
Running (g/mi)	29	0.2017	0.1997	0.2009	0.6692	0.7029	0.6827
Running (g/mi)	30	0.1970	0.1958	0.1965	0.6640	0.7010	0.6788
Running (g/mi)	31	0.1923	0.1913	0.1919	0.6615	0.7000	0.6769
Running (g/mi)	32	0.1880	0.1875	0.1878	0.6594	0.6994	0.6754
Running (g/mi)	33	0.1840	0.1836	0.1839	0.6571	0.6985	0.6736
Running (g/mi)	34	0.1802	0.1799	0.1801	0.6550	0.6977	0.6721
Running (g/mi)	35	0.1764	0.1764	0.1764	0.6531	0.6971	0.6707
Running (g/mi)	36	0.1740	0.1740	0.1740	0.6564	0.7004	0.6740
Running (g/mi)	37	0.1713	0.1713	0.1713	0.6594	0.7035	0.6771
Running (g/mi)	38	0.1689	0.1689	0.1689	0.6623	0.7061	0.6798
Running (g/mi)	39	0.1667	0.1667	0.1667	0.6651	0.7092	0.6827
Running (g/mi)	40	0.1644	0.1644	0.1644	0.6678	0.7117	0.6853
Running (g/mi)	41	0.1622	0.1622	0.1622	0.6742	0.7178	0.6916
Running (g/mi)	42	0.1602	0.1602	0.1602	0.6798	0.7238	0.6974
Running (g/mi)	43	0.1583	0.1583	0.1583	0.6855	0.7294	0.7031
Running (g/mi)	44	0.1562	0.1562	0.1562	0.6909	0.7348	0.7085
Running (g/mi)	45	0.1546	0.1546	0.1546	0.6958	0.7401	0.7135
Running (g/mi)	46	0.1529	0.1529	0.1529	0.7050	0.7490	0.7226
Running (g/mi)	47	0.1511	0.1511	0.1511	0.7138	0.7578	0.7314
Running (g/mi)	48	0.1493	0.1493	0.1493	0.7223	0.7663	0.7399
Running (g/mi)	49	0.1478	0.1478	0.1478	0.7303	0.7743	0.7479
Running (g/mi)	50	0.1464	0.1464	0.1464	0.7382	0.7820	0.7557
Running (g/mi)	51	0.1449	0.1449	0.1449	0.7509	0.7949	0.7685
Running (g/mi)	52	0.1437	0.1437	0.1437	0.7634	0.8073	0.7810
Running (g/mi)	53	0.1424	0.1424	0.1424	0.7754	0.8193	0.7930
Running (g/mi)	54	0.1411	0.1411	0.1411	0.7868	0.8308	0.8044
Running (g/mi)	55	0.1398	0.1398	0.1398	0.7979	0.8420	0.8156
Running (g/mi)	56	0.1391	0.1391	0.1391	0.8160	0.8600	0.8336
Running (g/mi)	57	0.1387	0.1387	0.1387	0.8333	0.8773	0.8509
Running (g/mi)	58	0.1381	0.1381	0.1381	0.8502	0.8940	0.8677
Running (g/mi)	59	0.1376	0.1376	0.1376	0.8662	0.9101	0.8837
Running (g/mi)	60	0.1370	0.1370	0.1370	0.8820	0.9258	0.8995
Running (g/mi)	61	0.1367	0.1367	0.1367	0.9071	0.9509	0.9246
Running (g/mi)	62	0.1364	0.1364	0.1364	0.9313	0.9754	0.9490
Running (g/mi)	63	0.1361	0.1361	0.1361	0.9549	0.9988	0.9725
Running (g/mi)	64	0.1357	0.1357	0.1357	0.9777	1.0217	0.9953
Running (g/mi)	65	0.1355	0.1355	0.1355	0.9998	1.0437	1.0173

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.9434	0.5180
Hot Soak Loss (g/trip end)	0.5663	-
Hot Start (g/trip start, Light Duty Only)	0.1631	0.1150

Table 4: 2020 Running, Cold Start, and Hot Soak Average Emissions Factors for "Traffic Stream" TERMs (Mobile6.2)

| Emission Type	Speed (mph)	Average 2020 Running Emission Factor (g/mi)					
		Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60%, Freeway- 40%	NOx		Arterial - 60%, Freeway- 40%
Running (g/mi)	1	1.5727	1.5727	1.5727	0.4705	0.4743	0.4720
Running (g/mi)	2	1.5727	1.5727	1.5727	0.4705	0.4743	0.4720
Running (g/mi)	3	1.2443	1.2443	1.2443	0.4495	0.4532	0.4509
Running (g/mi)	4	0.8338	0.8338	0.8338	0.4230	0.4265	0.4244
Running (g/mi)	5	0.5876	0.5876	0.5876	0.4068	0.4104	0.4082
Running (g/mi)	6	0.4918	0.4867	0.4897	0.3785	0.3695	0.3749
Running (g/mi)	7	0.4234	0.4146	0.4199	0.3585	0.3405	0.3513
Running (g/mi)	8	0.3723	0.3608	0.3677	0.3433	0.3186	0.3334
Running (g/mi)	9	0.3325	0.3186	0.3269	0.3315	0.3016	0.3195
Running (g/mi)	10	0.3005	0.2851	0.2943	0.3221	0.2881	0.3085
Running (g/mi)	11	0.2775	0.2610	0.2709	0.3076	0.2711	0.2930
Running (g/mi)	12	0.2582	0.2409	0.2512	0.2955	0.2570	0.2801
Running (g/mi)	13	0.2417	0.2239	0.2346	0.2854	0.2452	0.2693
Running (g/mi)	14	0.2279	0.2097	0.2206	0.2765	0.2349	0.2599
Running (g/mi)	15	0.2157	0.1967	0.2081	0.2691	0.2263	0.2520
Running (g/mi)	16	0.2028	0.1865	0.1963	0.2618	0.2244	0.2468
Running (g/mi)	17	0.1918	0.1773	0.1860	0.2554	0.2228	0.2423
Running (g/mi)	18	0.1817	0.1695	0.1768	0.2496	0.2212	0.2383
Running (g/mi)	19	0.1730	0.1619	0.1685	0.2446	0.2201	0.2348
Running (g/mi)	20	0.1649	0.1557	0.1612	0.2402	0.2190	0.2317
Running (g/mi)	21	0.1586	0.1507	0.1554	0.2358	0.2180	0.2287
Running (g/mi)	22	0.1530	0.1464	0.1504	0.2318	0.2171	0.2259
Running (g/mi)	23	0.1482	0.1423	0.1458	0.2285	0.2161	0.2235
Running (g/mi)	24	0.1436	0.1389	0.1417	0.2255	0.2150	0.2213
Running (g/mi)	25	0.1391	0.1357	0.1377	0.2225	0.2144	0.2192
Running (g/mi)	26	0.1354	0.1320	0.1340	0.2199	0.2137	0.2174
Running (g/mi)	27	0.1316	0.1289	0.1305	0.2175	0.2132	0.2158
Running (g/mi)	28	0.1280	0.1261	0.1272	0.2154	0.2125	0.2142
Running (g/mi)	29	0.1250	0.1234	0.1244	0.2134	0.2123	0.2129
Running (g/mi)	30	0.1217	0.1207	0.1213	0.2114	0.2118	0.2115
Running (g/mi)	31	0.1190	0.1183	0.1187	0.2104	0.2113	0.2107
Running (g/mi)	32	0.1164	0.1159	0.1162	0.2094	0.2113	0.2101
Running (g/mi)	33	0.1139	0.1134	0.1137	0.2084	0.2109	0.2094
Running (g/mi)	34	0.1115	0.1113	0.1114	0.2076	0.2106	0.2088
Running (g/mi)	35	0.1096	0.1096	0.1096	0.2067	0.2103	0.2081
Running (g/mi)	36	0.1077	0.1077	0.1077	0.2079	0.2114	0.2093
Running (g/mi)	37	0.1060	0.1060	0.1060	0.2089	0.2124	0.2103
Running (g/mi)	38	0.1045	0.1045	0.1045	0.2097	0.2134	0.2112
Running (g/mi)	39	0.1033	0.1033	0.1033	0.2105	0.2143	0.2120
Running (g/mi)	40	0.1020	0.1020	0.1020	0.2115	0.2151	0.2130
Running (g/mi)	41	0.1005	0.1005	0.1005	0.2133	0.2169	0.2147
Running (g/mi)	42	0.0992	0.0992	0.0992	0.2151	0.2189	0.2166
Running (g/mi)	43	0.0980	0.0980	0.0980	0.2167	0.2202	0.2181
Running (g/mi)	44	0.0968	0.0968	0.0968	0.2185	0.2219	0.2198
Running (g/mi)	45	0.0957	0.0957	0.0957	0.2199	0.2235	0.2214
Running (g/mi)	46	0.0948	0.0948	0.0948	0.2224	0.2261	0.2239
Running (g/mi)	47	0.0938	0.0938	0.0938	0.2251	0.2285	0.2265
Running (g/mi)	48	0.0929	0.0929	0.0929	0.2273	0.2307	0.2287
Running (g/mi)	49	0.0919	0.0919	0.0919	0.2295	0.2330	0.2309
Running (g/mi)	50	0.0911	0.0911	0.0911	0.2315	0.2351	0.2330
Running (g/mi)	51	0.0905	0.0905	0.0905	0.2351	0.2385	0.2365
Running (g/mi)	52	0.0898	0.0898	0.0898	0.2383	0.2420	0.2398
Running (g/mi)	53	0.0894	0.0894	0.0894	0.2414	0.2451	0.2429
Running (g/mi)	54	0.0889	0.0889	0.0889	0.2446	0.2480	0.2460
Running (g/mi)	55	0.0882	0.0882	0.0882	0.2477	0.2513	0.2491
Running (g/mi)	56	0.0883	0.0883	0.0883	0.2522	0.2558	0.2536
Running (g/mi)	57	0.0882	0.0882	0.0882	0.2566	0.2603	0.2581
Running (g/mi)	58	0.0882	0.0882	0.0882	0.2610	0.2647	0.2625
Running (g/mi)	59	0.0882	0.0882	0.0882	0.2653	0.2688	0.2667
Running (g/mi)	60	0.0881	0.0881	0.0881	0.2692	0.2728	0.2706
Running (g/mi)	61	0.0881	0.0881	0.0881	0.2754	0.2788	0.2767
Running (g/mi)	62	0.0883	0.0883	0.0883	0.2815	0.2848	0.2828
Running (g/mi)	63	0.0883	0.0883	0.0883	0.2874	0.2908	0.2887
Running (g/mi)	64	0.0885	0.0885	0.0885	0.2931	0.2966	0.2945
Running (g/mi)	65	0.0886	0.0886	0.0886	0.2985	0.3020	0.2999

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.5272	0.2176
Hot Soak Loss (g/trip end)	0.2826	-
Hot Start (g/trip start, Light Duty Only)	0.0956	0.0509

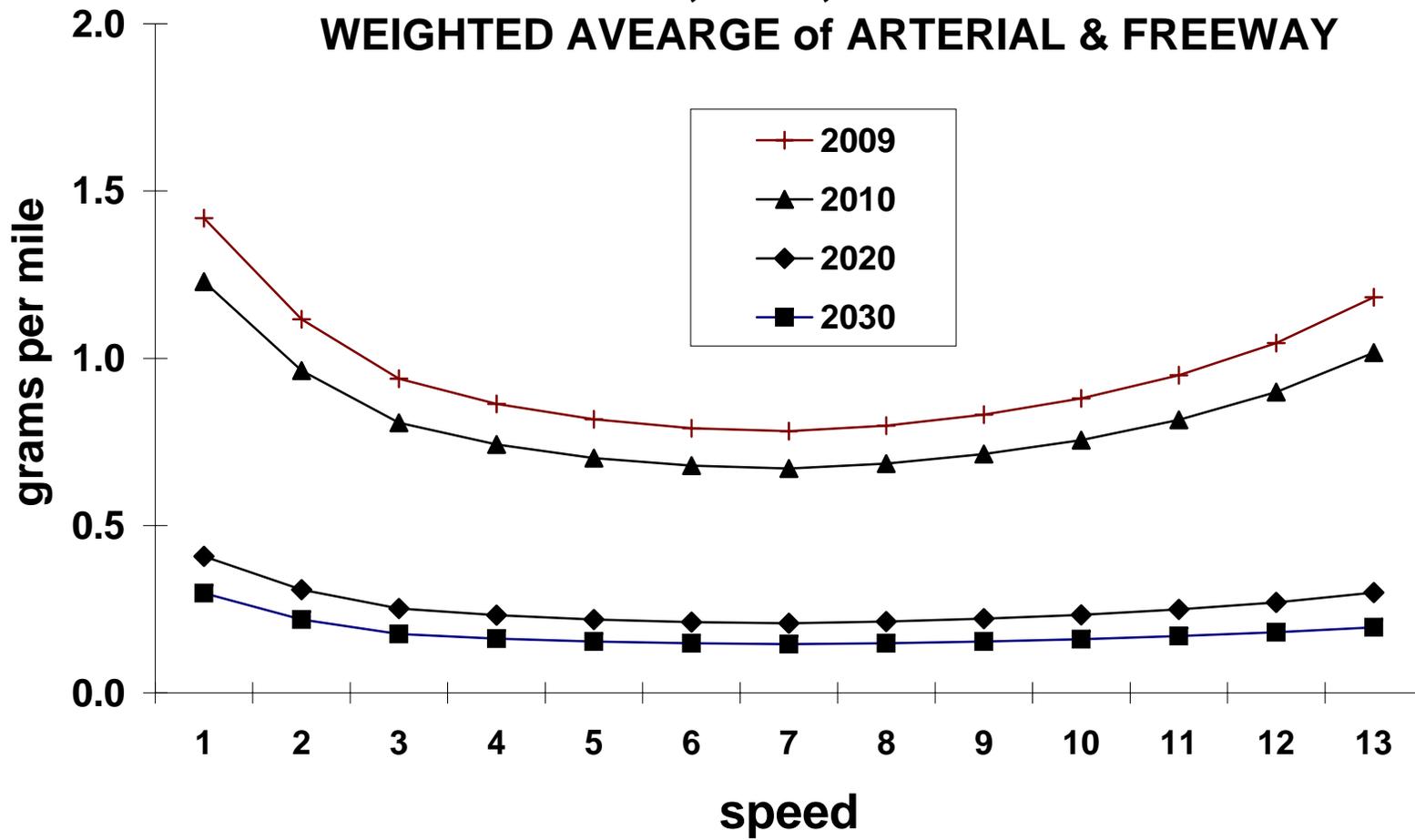**Table 5: 2030 Running, Cold Start, and Hot Soak Average Emissions Factors for "Traffic Stream" TERMs (Mobile6.2)**

Emission Type	Speed (mph)	Average 2030 Running Emission Factor (g/mi)					
		Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60%, Freeway- 40%	NOx		Arterial - 60%, Freeway- 40%
Running (g/mi)	1	1.4783	1.4783	1.4783	0.3478	0.3477	0.3477
Running (g/mi)	2	1.4783	1.4783	1.4783	0.3478	0.3477	0.3477
Running (g/mi)	3	1.1696	1.1696	1.1696	0.3312	0.3312	0.3312
Running (g/mi)	4	0.7837	0.7837	0.7837	0.3102	0.3102	0.3102
Running (g/mi)	5	0.5520	0.5520	0.5520	0.2978	0.2978	0.2978
Running (g/mi)	6	0.4623	0.4575	0.4604	0.2760	0.2651	0.2716
Running (g/mi)	7	0.3980	0.3901	0.3949	0.2606	0.2418	0.2530
Running (g/mi)	8	0.3499	0.3392	0.3456	0.2490	0.2242	0.2391
Running (g/mi)	9	0.3122	0.2997	0.3072	0.2398	0.2106	0.2281
Running (g/mi)	10	0.2824	0.2683	0.2768	0.2325	0.1997	0.2194
Running (g/mi)	11	0.2607	0.2459	0.2548	0.2215	0.1865	0.2075
Running (g/mi)	12	0.2427	0.2271	0.2365	0.2122	0.1758	0.1976
Running (g/mi)	13	0.2275	0.2111	0.2209	0.2046	0.1666	0.1894
Running (g/mi)	14	0.2146	0.1976	0.2078	0.1979	0.1587	0.1822
Running (g/mi)	15	0.2031	0.1858	0.1962	0.1922	0.1519	0.1761
Running (g/mi)	16	0.1910	0.1760	0.1850	0.1865	0.1513	0.1724
Running (g/mi)	17	0.1807	0.1673	0.1753	0.1820	0.1506	0.1694
Running (g/mi)	18	0.1712	0.1597	0.1666	0.1778	0.1502	0.1667
Running (g/mi)	19	0.1626	0.1526	0.1586	0.1741	0.1498	0.1644
Running (g/mi)	20	0.1552	0.1465	0.1517	0.1708	0.1493	0.1622
Running (g/mi)	21	0.1495	0.1420	0.1465	0.1676	0.1489	0.1601
Running (g/mi)	22	0.1441	0.1379	0.1416	0.1648	0.1484	0.1582
Running (g/mi)	23	0.1395	0.1341	0.1373	0.1620	0.1483	0.1565
Running (g/mi)	24	0.1351	0.1308	0.1334	0.1598	0.1478	0.1550
Running (g/mi)	25	0.1311	0.1276	0.1297	0.1576	0.1475	0.1535
Running (g/mi)	26	0.1273	0.1243	0.1261	0.1556	0.1473	0.1522
Running (g/mi)	27	0.1239	0.1214	0.1229	0.1538	0.1470	0.1511
Running (g/mi)	28	0.1204	0.1185	0.1196	0.1523	0.1467	0.1501
Running (g/mi)	29	0.1175	0.1159	0.1169	0.1505	0.1465	0.1489
Running (g/mi)	30	0.1146	0.1136	0.1142	0.1493	0.1464	0.1481
Running (g/mi)	31	0.1118	0.1111	0.1115	0.1483	0.1461	0.1474
Running (g/mi)	32	0.1093	0.1090	0.1092	0.1475	0.1458	0.1468
Running (g/mi)	33	0.1070	0.1067	0.1069	0.1467	0.1456	0.1462
Running (g/mi)	34	0.1048	0.1046	0.1047	0.1458	0.1454	0.1457
Running (g/mi)	35	0.1030	0.1030	0.1030	0.1452	0.1452	0.1452
Running (g/mi)	36	0.1011	0.1011	0.1011	0.1458	0.1458	0.1458
Running (g/mi)	37	0.0996	0.0996	0.0996	0.1466	0.1466	0.1466
Running (g/mi)	38	0.0983	0.0983	0.0983	0.1472	0.1472	0.1472
Running (g/mi)	39	0.0970	0.0970	0.0970	0.1478	0.1478	0.1478
Running (g/mi)	40	0.0957	0.0957	0.0957	0.1484	0.1484	0.1484
Running (g/mi)	41	0.0944	0.0944	0.0944	0.1496	0.1496	0.1496
Running (g/mi)	42	0.0933	0.0933	0.0933	0.1507	0.1507	0.1507
Running (g/mi)	43	0.0919	0.0919	0.0919	0.1517	0.1517	0.1517
Running (g/mi)	44	0.0909	0.0909	0.0909	0.1527	0.1527	0.1527
Running (g/mi)	45	0.0899	0.0899	0.0899	0.1537	0.1537	0.1537
Running (g/mi)	46	0.0889	0.0889	0.0889	0.1553	0.1553	0.1553
Running (g/mi)	47	0.0880	0.0880	0.0880	0.1565	0.1565	0.1565
Running (g/mi)	48	0.0870	0.0870	0.0870	0.1579	0.1579	0.1579
Running (g/mi)	49	0.0863	0.0863	0.0863	0.1593	0.1593	0.1593
Running (g/mi)	50	0.0857	0.0857	0.0857	0.1603	0.1603	0.1603
Running (g/mi)	51	0.0850	0.0850	0.0850	0.1623	0.1623	0.1623
Running (g/mi)	52	0.0844	0.0844	0.0844	0.1643	0.1643	0.1643
Running (g/mi)	53	0.0839	0.0839	0.0839	0.1661	0.1661	0.1661
Running (g/mi)	54	0.0831	0.0831	0.0831	0.1677	0.1677	0.1677
Running (g/mi)	55	0.0827	0.0827	0.0827	0.1695	0.1695	0.1695
Running (g/mi)	56	0.0829	0.0829	0.0829	0.1719	0.1719	0.1719
Running (g/mi)	57	0.0827	0.0827	0.0827	0.1742	0.1742	0.1742
Running (g/mi)	58	0.0830	0.0830	0.0830	0.1765	0.1765	0.1765
Running (g/mi)	59	0.0827	0.0827	0.0827	0.1787	0.1787	0.1787
Running (g/mi)	60	0.0827	0.0827	0.0827	0.1811	0.1811	0.1811
Running (g/mi)	61	0.0828	0.0828	0.0828	0.1843	0.1843	0.1843
Running (g/mi)	62	0.0831	0.0831	0.0831	0.1873	0.1873	0.1873
Running (g/mi)	63	0.0831	0.0831	0.0831	0.1903	0.1903	0.1903
Running (g/mi)	64	0.0832	0.0832	0.0832	0.1932	0.1932	0.1932
Running (g/mi)	65	0.0832	0.0832	0.0832	0.1960	0.1960	0.1960

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.4639	0.1565
Hot Soak Loss (g/trip end)	0.2078	-
Hot Start (g/trip start, Light Duty Only)	0.0854	0.0382

Exhibit - 1
VOC MOBILE6.2 RUNNING EMISSION RATES
TRAFFIC STREAM
FOR 2009, 2010, 2020 AND 2030
WEIGHTED AVEARGE of ARTERIAL & FREEWAY
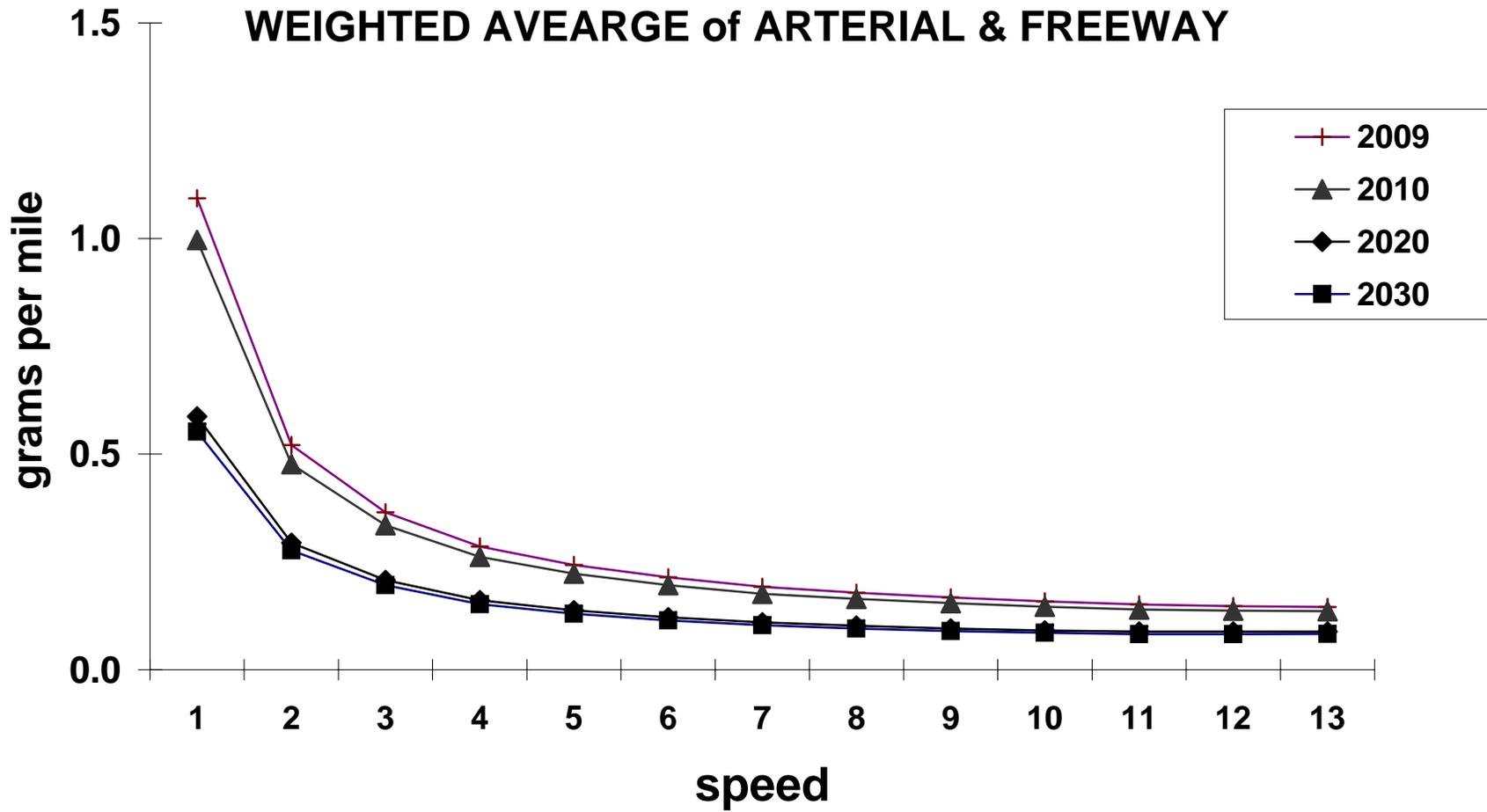
Exhibit - 2
NOx MOBILE6.2 RUNNING EMISSION RATES
TRAFFIC STREAM
FOR 2009, 2010, 2020 AND 2030
WEIGHTED AVEARGE of ARTERIAL & FREEWAY

Table 6: 2009 Running, Cold Start, and Hot Soak Average Emissions Factors for "Commute" TERMs
(Mobile 6.2)

Emission Type	Speed (mph)	Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60%, Freeway- 40%	NOx		Arterial - 60%, Freeway- 40%
Running (g/mi)	1	3.2177	3.2177	3.2177	0.9303	0.9303	0.9303
Running (g/mi)	2	3.2177	3.2177	3.2177	0.9303	0.9303	0.9303
Running (g/mi)	3	2.5028	2.5028	2.5028	0.8834	0.8833	0.8834
Running (g/mi)	4	1.6094	1.6094	1.6094	0.8248	0.8248	0.8248
Running (g/mi)	5	1.0735	1.0734	1.0734	0.7895	0.7895	0.7895
Running (g/mi)	6	0.8815	0.8719	0.8776	0.7303	0.6959	0.7165
Running (g/mi)	7	0.7447	0.7281	0.7381	0.6879	0.6290	0.6644
Running (g/mi)	8	0.6420	0.6201	0.6332	0.6561	0.5789	0.6252
Running (g/mi)	9	0.5618	0.5362	0.5515	0.6314	0.5401	0.5949
Running (g/mi)	10	0.4982	0.4693	0.4866	0.6116	0.5088	0.5705
Running (g/mi)	11	0.4576	0.4273	0.4455	0.5820	0.4726	0.5382
Running (g/mi)	12	0.4242	0.3922	0.4114	0.5572	0.4423	0.5112
Running (g/mi)	13	0.3956	0.3626	0.3824	0.5363	0.4169	0.4885
Running (g/mi)	14	0.3713	0.3370	0.3576	0.5182	0.3949	0.4689
Running (g/mi)	15	0.3501	0.3150	0.3361	0.5028	0.3758	0.4520
Running (g/mi)	16	0.3298	0.2995	0.3177	0.4887	0.3768	0.4439
Running (g/mi)	17	0.3119	0.2854	0.3013	0.4765	0.3778	0.4370
Running (g/mi)	18	0.2962	0.2733	0.2870	0.4655	0.3788	0.4308
Running (g/mi)	19	0.2817	0.2622	0.2739	0.4558	0.3795	0.4253
Running (g/mi)	20	0.2690	0.2523	0.2623	0.4470	0.3802	0.4203
Running (g/mi)	21	0.2590	0.2447	0.2533	0.4390	0.3806	0.4156
Running (g/mi)	22	0.2499	0.2379	0.2451	0.4315	0.3807	0.4112
Running (g/mi)	23	0.2414	0.2317	0.2375	0.4247	0.3808	0.4071
Running (g/mi)	24	0.2336	0.2260	0.2306	0.4188	0.3812	0.4037
Running (g/mi)	25	0.2267	0.2209	0.2243	0.4129	0.3815	0.4004
Running (g/mi)	26	0.2207	0.2159	0.2188	0.4077	0.3813	0.3971
Running (g/mi)	27	0.2150	0.2111	0.2134	0.4028	0.3813	0.3942
Running (g/mi)	28	0.2096	0.2066	0.2084	0.3982	0.3813	0.3914
Running (g/mi)	29	0.2047	0.2027	0.2039	0.3938	0.3813	0.3888
Running (g/mi)	30	0.2000	0.1988	0.1995	0.3898	0.3813	0.3864
Running (g/mi)	31	0.1957	0.1947	0.1953	0.3871	0.3804	0.3844
Running (g/mi)	32	0.1915	0.1906	0.1911	0.3845	0.3797	0.3826
Running (g/mi)	33	0.1875	0.1870	0.1873	0.3822	0.3790	0.3809
Running (g/mi)	34	0.1839	0.1837	0.1838	0.3798	0.3785	0.3793
Running (g/mi)	35	0.1804	0.1804	0.1804	0.3778	0.3778	0.3778
Running (g/mi)	36	0.1779	0.1779	0.1779	0.3792	0.3792	0.3792
Running (g/mi)	37	0.1755	0.1755	0.1755	0.3805	0.3805	0.3805
Running (g/mi)	38	0.1732	0.1732	0.1732	0.3817	0.3817	0.3817
Running (g/mi)	39	0.1711	0.1711	0.1711	0.3830	0.3830	0.3830
Running (g/mi)	40	0.1691	0.1691	0.1691	0.3842	0.3842	0.3842
Running (g/mi)	41	0.1669	0.1669	0.1669	0.3861	0.3861	0.3861
Running (g/mi)	42	0.1650	0.1650	0.1650	0.3881	0.3881	0.3881
Running (g/mi)	43	0.1631	0.1631	0.1631	0.3899	0.3899	0.3899
Running (g/mi)	44	0.1614	0.1614	0.1614	0.3917	0.3917	0.3917
Running (g/mi)	45	0.1594	0.1594	0.1594	0.3932	0.3932	0.3932
Running (g/mi)	46	0.1577	0.1577	0.1577	0.3954	0.3954	0.3954
Running (g/mi)	47	0.1557	0.1557	0.1557	0.3974	0.3974	0.3974
Running (g/mi)	48	0.1541	0.1541	0.1541	0.3993	0.3993	0.3993
Running (g/mi)	49	0.1528	0.1528	0.1528	0.4010	0.4010	0.4010
Running (g/mi)	50	0.1512	0.1512	0.1512	0.4028	0.4028	0.4028
Running (g/mi)	51	0.1498	0.1498	0.1498	0.4048	0.4048	0.4048
Running (g/mi)	52	0.1483	0.1483	0.1483	0.4071	0.4071	0.4071
Running (g/mi)	53	0.1468	0.1468	0.1468	0.4093	0.4093	0.4093
Running (g/mi)	54	0.1455	0.1455	0.1455	0.4113	0.4113	0.4113
Running (g/mi)	55	0.1440	0.1440	0.1440	0.4131	0.4131	0.4131
Running (g/mi)	56	0.1433	0.1433	0.1433	0.4154	0.4154	0.4154
Running (g/mi)	57	0.1426	0.1426	0.1426	0.4177	0.4177	0.4177
Running (g/mi)	58	0.1419	0.1419	0.1419	0.4197	0.4197	0.4197
Running (g/mi)	59	0.1413	0.1413	0.1413	0.4217	0.4217	0.4217
Running (g/mi)	60	0.1407	0.1407	0.1407	0.4237	0.4237	0.4237
Running (g/mi)	61	0.1402	0.1402	0.1402	0.4260	0.4260	0.4260
Running (g/mi)	62	0.1397	0.1397	0.1397	0.4283	0.4283	0.4283
Running (g/mi)	63	0.1393	0.1393	0.1393	0.4304	0.4304	0.4304
Running (g/mi)	64	0.1390	0.1390	0.1390	0.4324	0.4324	0.4324
Running (g/mi)	65	0.1384	0.1384	0.1384	0.4343	0.4343	0.4343

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty	1.0372	0.5761
Hot Soak Loss (g/trip end)	0.5837	-
Hot Start (g/trip start, Light Duty	0.1788	0.1266

Table 7: 2010 Running, Cold Start, and Hot Soak Average Emissions Factors for "Commute" TERMs
(Mobile 6.2)

Emission Type	Speed (mph)	Average 2010 Running Emission Factor (g/mi)					
		Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60%, Freeway- 40%	NOx		Arterial - 60%, Freeway- 40%
Running (g/mi)	1	2.9073	2.9073	2.9073	0.8218	0.8218	0.8218
Running (g/mi)	2	2.9073	2.9073	2.9073	0.8218	0.8218	0.8218
Running (g/mi)	3	2.2637	2.2637	2.2637	0.7804	0.7803	0.7804
Running (g/mi)	4	1.4592	1.4592	1.4592	0.7285	0.7285	0.7285
Running (g/mi)	5	0.9764	0.9764	0.9764	0.6974	0.6974	0.6974
Running (g/mi)	6	0.8027	0.7939	0.7992	0.6451	0.6147	0.6329
Running (g/mi)	7	0.6786	0.6635	0.6726	0.6077	0.5553	0.5867
Running (g/mi)	8	0.5857	0.5654	0.5776	0.5794	0.5109	0.5520
Running (g/mi)	9	0.5134	0.4895	0.5038	0.5577	0.4763	0.5251
Running (g/mi)	10	0.4556	0.4287	0.4448	0.5403	0.4488	0.5037
Running (g/mi)	11	0.4186	0.3904	0.4073	0.5140	0.4168	0.4751
Running (g/mi)	12	0.3880	0.3584	0.3762	0.4919	0.3899	0.4511
Running (g/mi)	13	0.3619	0.3313	0.3497	0.4734	0.3673	0.4310
Running (g/mi)	14	0.3396	0.3082	0.3270	0.4574	0.3478	0.4136
Running (g/mi)	15	0.3207	0.2882	0.3077	0.4438	0.3311	0.3987
Running (g/mi)	16	0.3021	0.2736	0.2907	0.4316	0.3321	0.3918
Running (g/mi)	17	0.2855	0.2607	0.2756	0.4206	0.3331	0.3856
Running (g/mi)	18	0.2709	0.2496	0.2623	0.4110	0.3338	0.3801
Running (g/mi)	19	0.2579	0.2395	0.2505	0.4023	0.3343	0.3751
Running (g/mi)	20	0.2460	0.2302	0.2397	0.3944	0.3351	0.3707
Running (g/mi)	21	0.2368	0.2236	0.2315	0.3873	0.3353	0.3665
Running (g/mi)	22	0.2286	0.2174	0.2241	0.3808	0.3357	0.3628
Running (g/mi)	23	0.2210	0.2119	0.2174	0.3749	0.3359	0.3593
Running (g/mi)	24	0.2140	0.2067	0.2111	0.3697	0.3361	0.3562
Running (g/mi)	25	0.2074	0.2018	0.2051	0.3643	0.3363	0.3531
Running (g/mi)	26	0.2018	0.1972	0.2000	0.3597	0.3364	0.3504
Running (g/mi)	27	0.1968	0.1929	0.1953	0.3554	0.3363	0.3478
Running (g/mi)	28	0.1919	0.1890	0.1907	0.3514	0.3363	0.3454
Running (g/mi)	29	0.1871	0.1851	0.1863	0.3476	0.3363	0.3431
Running (g/mi)	30	0.1832	0.1816	0.1826	0.3439	0.3363	0.3409
Running (g/mi)	31	0.1789	0.1779	0.1785	0.3417	0.3357	0.3393
Running (g/mi)	32	0.1752	0.1744	0.1749	0.3393	0.3350	0.3376
Running (g/mi)	33	0.1717	0.1711	0.1714	0.3373	0.3345	0.3362
Running (g/mi)	34	0.1683	0.1681	0.1682	0.3353	0.3338	0.3347
Running (g/mi)	35	0.1649	0.1649	0.1649	0.3334	0.3334	0.3334
Running (g/mi)	36	0.1629	0.1629	0.1629	0.3347	0.3347	0.3347
Running (g/mi)	37	0.1609	0.1609	0.1609	0.3358	0.3358	0.3358
Running (g/mi)	38	0.1586	0.1586	0.1586	0.3370	0.3370	0.3370
Running (g/mi)	39	0.1569	0.1569	0.1569	0.3382	0.3382	0.3382
Running (g/mi)	40	0.1550	0.1550	0.1550	0.3392	0.3392	0.3392
Running (g/mi)	41	0.1533	0.1533	0.1533	0.3409	0.3409	0.3409
Running (g/mi)	42	0.1513	0.1513	0.1513	0.3428	0.3428	0.3428
Running (g/mi)	43	0.1496	0.1496	0.1496	0.3442	0.3442	0.3442
Running (g/mi)	44	0.1482	0.1482	0.1482	0.3458	0.3458	0.3458
Running (g/mi)	45	0.1465	0.1465	0.1465	0.3474	0.3474	0.3474
Running (g/mi)	46	0.1448	0.1448	0.1448	0.3493	0.3493	0.3493
Running (g/mi)	47	0.1432	0.1432	0.1432	0.3510	0.3510	0.3510
Running (g/mi)	48	0.1418	0.1418	0.1418	0.3528	0.3528	0.3528
Running (g/mi)	49	0.1405	0.1405	0.1405	0.3543	0.3543	0.3543
Running (g/mi)	50	0.1392	0.1392	0.1392	0.3559	0.3559	0.3559
Running (g/mi)	51	0.1378	0.1378	0.1378	0.3579	0.3579	0.3579
Running (g/mi)	52	0.1365	0.1365	0.1365	0.3597	0.3597	0.3597
Running (g/mi)	53	0.1353	0.1353	0.1353	0.3615	0.3615	0.3615
Running (g/mi)	54	0.1342	0.1342	0.1342	0.3634	0.3634	0.3634
Running (g/mi)	55	0.1331	0.1331	0.1331	0.3650	0.3650	0.3650
Running (g/mi)	56	0.1323	0.1323	0.1323	0.3670	0.3670	0.3670
Running (g/mi)	57	0.1321	0.1321	0.1321	0.3690	0.3690	0.3690
Running (g/mi)	58	0.1314	0.1314	0.1314	0.3711	0.3711	0.3711
Running (g/mi)	59	0.1310	0.1310	0.1310	0.3728	0.3728	0.3728
Running (g/mi)	60	0.1306	0.1306	0.1306	0.3747	0.3747	0.3747
Running (g/mi)	61	0.1303	0.1303	0.1303	0.3767	0.3767	0.3767
Running (g/mi)	62	0.1298	0.1298	0.1298	0.3786	0.3786	0.3786
Running (g/mi)	63	0.1295	0.1295	0.1295	0.3805	0.3805	0.3805
Running (g/mi)	64	0.1292	0.1292	0.1292	0.3824	0.3824	0.3824
Running (g/mi)	65	0.1289	0.1289	0.1289	0.3843	0.3843	0.3843

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty	0.9436	0.5180
Hot Soak Loss (g/trip end)	0.5579	-
Hot Start (g/trip start, Light Duty	0.1632	0.1151

Table 8: 2020 Running, Cold Start, and Hot Soak Average Emissions Factors for "Commute" TERMs (Mobile 6.2)

| Emission Type	Speed (mph)	Arterial	Freeway	Weighted Factor VOC Arterial - 60%, Freeway- 40%	Arterial	Freeway	Weighted Factor NOx Arterial - 60%, Freeway- 40%
		VOC			NOx		
Running (g/mi)	1	1.6161	1.6161	1.6161	0.3613	0.3613	0.3613
Running (g/mi)	2	1.6161	1.6161	1.6161	0.3613	0.3613	0.3613
Running (g/mi)	3	1.2686	1.2686	1.2686	0.3429	0.3429	0.3429
Running (g/mi)	4	0.8345	0.8345	0.8345	0.3199	0.3199	0.3199
Running (g/mi)	5	0.5737	0.5737	0.5737	0.3059	0.3059	0.3059
Running (g/mi)	6	0.4757	0.4699	0.4734	0.2824	0.2687	0.2769
Running (g/mi)	7	0.4053	0.3959	0.4016	0.2657	0.2421	0.2563
Running (g/mi)	8	0.3532	0.3406	0.3482	0.2530	0.2219	0.2406
Running (g/mi)	9	0.3121	0.2972	0.3061	0.2431	0.2065	0.2284
Running (g/mi)	10	0.2794	0.2625	0.2726	0.2354	0.1939	0.2188
Running (g/mi)	11	0.2571	0.2392	0.2499	0.2235	0.1795	0.2059
Running (g/mi)	12	0.2385	0.2197	0.2310	0.2138	0.1675	0.1953
Running (g/mi)	13	0.2228	0.2032	0.2150	0.2055	0.1574	0.1862
Running (g/mi)	14	0.2093	0.1892	0.2013	0.1985	0.1488	0.1786
Running (g/mi)	15	0.1975	0.1768	0.1892	0.1921	0.1413	0.1718
Running (g/mi)	16	0.1855	0.1673	0.1782	0.1867	0.1418	0.1688
Running (g/mi)	17	0.1750	0.1591	0.1686	0.1820	0.1423	0.1661
Running (g/mi)	18	0.1657	0.1519	0.1601	0.1775	0.1427	0.1636
Running (g/mi)	19	0.1573	0.1452	0.1525	0.1736	0.1431	0.1614
Running (g/mi)	20	0.1499	0.1393	0.1457	0.1703	0.1434	0.1595
Running (g/mi)	21	0.1442	0.1354	0.1407	0.1671	0.1435	0.1577
Running (g/mi)	22	0.1394	0.1318	0.1364	0.1642	0.1439	0.1561
Running (g/mi)	23	0.1349	0.1287	0.1324	0.1615	0.1440	0.1545
Running (g/mi)	24	0.1307	0.1255	0.1286	0.1592	0.1441	0.1531
Running (g/mi)	25	0.1271	0.1229	0.1255	0.1570	0.1442	0.1519
Running (g/mi)	26	0.1233	0.1200	0.1220	0.1549	0.1442	0.1506
Running (g/mi)	27	0.1202	0.1174	0.1191	0.1531	0.1442	0.1495
Running (g/mi)	28	0.1172	0.1150	0.1163	0.1513	0.1443	0.1485
Running (g/mi)	29	0.1145	0.1127	0.1138	0.1495	0.1443	0.1474
Running (g/mi)	30	0.1117	0.1104	0.1112	0.1479	0.1443	0.1465
Running (g/mi)	31	0.1092	0.1083	0.1089	0.1469	0.1442	0.1458
Running (g/mi)	32	0.1070	0.1065	0.1068	0.1458	0.1439	0.1451
Running (g/mi)	33	0.1050	0.1045	0.1048	0.1449	0.1435	0.1443
Running (g/mi)	34	0.1027	0.1024	0.1026	0.1439	0.1433	0.1437
Running (g/mi)	35	0.1010	0.1010	0.1010	0.1431	0.1431	0.1431
Running (g/mi)	36	0.0995	0.0995	0.0995	0.1438	0.1438	0.1438
Running (g/mi)	37	0.0982	0.0982	0.0982	0.1443	0.1443	0.1443
Running (g/mi)	38	0.0971	0.0971	0.0971	0.1449	0.1449	0.1449
Running (g/mi)	39	0.0959	0.0959	0.0959	0.1455	0.1455	0.1455
Running (g/mi)	40	0.0950	0.0950	0.0950	0.1460	0.1460	0.1460
Running (g/mi)	41	0.0937	0.0937	0.0937	0.1468	0.1468	0.1468
Running (g/mi)	42	0.0925	0.0925	0.0925	0.1475	0.1475	0.1475
Running (g/mi)	43	0.0915	0.0915	0.0915	0.1484	0.1484	0.1484
Running (g/mi)	44	0.0905	0.0905	0.0905	0.1489	0.1489	0.1489
Running (g/mi)	45	0.0896	0.0896	0.0896	0.1498	0.1498	0.1498
Running (g/mi)	46	0.0889	0.0889	0.0889	0.1507	0.1507	0.1507
Running (g/mi)	47	0.0880	0.0880	0.0880	0.1516	0.1516	0.1516
Running (g/mi)	48	0.0872	0.0872	0.0872	0.1524	0.1524	0.1524
Running (g/mi)	49	0.0864	0.0864	0.0864	0.1532	0.1532	0.1532
Running (g/mi)	50	0.0857	0.0857	0.0857	0.1537	0.1537	0.1537
Running (g/mi)	51	0.0851	0.0851	0.0851	0.1547	0.1547	0.1547
Running (g/mi)	52	0.0846	0.0846	0.0846	0.1556	0.1556	0.1556
Running (g/mi)	53	0.0841	0.0841	0.0841	0.1566	0.1566	0.1566
Running (g/mi)	54	0.0838	0.0838	0.0838	0.1575	0.1575	0.1575
Running (g/mi)	55	0.0833	0.0833	0.0833	0.1585	0.1585	0.1585
Running (g/mi)	56	0.0833	0.0833	0.0833	0.1595	0.1595	0.1595
Running (g/mi)	57	0.0832	0.0832	0.0832	0.1602	0.1602	0.1602
Running (g/mi)	58	0.0834	0.0834	0.0834	0.1612	0.1612	0.1612
Running (g/mi)	59	0.0832	0.0832	0.0832	0.1620	0.1620	0.1620
Running (g/mi)	60	0.0835	0.0835	0.0835	0.1630	0.1630	0.1630
Running (g/mi)	61	0.0834	0.0834	0.0834	0.1639	0.1639	0.1639
Running (g/mi)	62	0.0837	0.0837	0.0837	0.1649	0.1649	0.1649
Running (g/mi)	63	0.0837	0.0837	0.0837	0.1657	0.1657	0.1657
Running (g/mi)	64	0.0839	0.0839	0.0839	0.1665	0.1665	0.1665
Running (g/mi)	65	0.0840	0.0840	0.0840	0.1675	0.1675	0.1675

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.5273	0.2177
Hot Soak Loss (g/trip end)	0.2776	-
Hot Start (g/trip start, Light Duty Only)	0.0957	0.0509

Table 9: 2030 Running, Cold Start, and Hot Soak Average Emissons Factors for "Commute" TERMs (Mobile 6.2)

Emission Type	Speed (mph)	Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC		Arterial - 60% Freeway 40%	NOx		Arterial - 60% Freeway 40%
Running (g/mi)	1	1.529	1.529	1.5287	0.313	0.313	0.3133
Running (g/mi)	2	1.529	1.529	1.5287	0.313	0.313	0.3133
Running (g/mi)	3	1.199	1.199	1.1995	0.297	0.297	0.2972
Running (g/mi)	4	0.788	0.788	0.7884	0.277	0.277	0.2771
Running (g/mi)	5	0.541	0.541	0.5413	0.265	0.265	0.2653
Running (g/mi)	6	0.449	0.443	0.4466	0.244	0.232	0.2395
Running (g/mi)	7	0.383	0.374	0.3791	0.230	0.209	0.2212
Running (g/mi)	8	0.333	0.321	0.3282	0.219	0.191	0.2076
Running (g/mi)	9	0.294	0.281	0.2888	0.210	0.178	0.1971
Running (g/mi)	10	0.263	0.248	0.2572	0.203	0.167	0.1885
Running (g/mi)	11	0.243	0.226	0.2359	0.193	0.154	0.1774
Running (g/mi)	12	0.225	0.208	0.2181	0.184	0.144	0.1680
Running (g/mi)	13	0.210	0.192	0.2030	0.177	0.135	0.1600
Running (g/mi)	14	0.197	0.179	0.1900	0.171	0.127	0.1534
Running (g/mi)	15	0.187	0.167	0.1788	0.165	0.121	0.1475
Running (g/mi)	16	0.175	0.158	0.1683	0.161	0.121	0.1448
Running (g/mi)	17	0.165	0.150	0.1593	0.156	0.122	0.1424
Running (g/mi)	18	0.156	0.143	0.1512	0.153	0.122	0.1402
Running (g/mi)	19	0.148	0.137	0.1436	0.149	0.122	0.1385
Running (g/mi)	20	0.141	0.131	0.1372	0.146	0.123	0.1368
Running (g/mi)	21	0.136	0.128	0.1326	0.144	0.123	0.1352
Running (g/mi)	22	0.131	0.124	0.1285	0.141	0.123	0.1336
Running (g/mi)	23	0.127	0.121	0.1247	0.139	0.123	0.1323
Running (g/mi)	24	0.123	0.118	0.1211	0.136	0.123	0.1312
Running (g/mi)	25	0.120	0.116	0.1181	0.135	0.124	0.1301
Running (g/mi)	26	0.116	0.113	0.1150	0.133	0.124	0.1289
Running (g/mi)	27	0.113	0.111	0.1121	0.131	0.124	0.1280
Running (g/mi)	28	0.110	0.108	0.1093	0.129	0.124	0.1271
Running (g/mi)	29	0.107	0.106	0.1070	0.128	0.124	0.1262
Running (g/mi)	30	0.105	0.104	0.1047	0.127	0.124	0.1254
Running (g/mi)	31	0.103	0.102	0.1025	0.126	0.123	0.1247
Running (g/mi)	32	0.101	0.100	0.1005	0.125	0.123	0.1239
Running (g/mi)	33	0.099	0.098	0.0984	0.124	0.123	0.1234
Running (g/mi)	34	0.097	0.096	0.0965	0.123	0.123	0.1228
Running (g/mi)	35	0.095	0.095	0.0950	0.123	0.123	0.1225
Running (g/mi)	36	0.094	0.094	0.0935	0.123	0.123	0.1227
Running (g/mi)	37	0.092	0.092	0.0923	0.124	0.124	0.1236
Running (g/mi)	38	0.091	0.091	0.0912	0.124	0.124	0.1238
Running (g/mi)	39	0.090	0.090	0.0899	0.125	0.125	0.1246
Running (g/mi)	40	0.089	0.089	0.0889	0.125	0.125	0.1247
Running (g/mi)	41	0.088	0.088	0.0882	0.126	0.126	0.1257
Running (g/mi)	42	0.087	0.087	0.0870	0.126	0.126	0.1264
Running (g/mi)	43	0.086	0.086	0.0860	0.127	0.127	0.1268
Running (g/mi)	44	0.085	0.085	0.0851	0.128	0.128	0.1277
Running (g/mi)	45	0.084	0.084	0.0841	0.128	0.128	0.1283
Running (g/mi)	46	0.083	0.083	0.0833	0.129	0.129	0.1289
Running (g/mi)	47	0.082	0.082	0.0825	0.130	0.130	0.1297
Running (g/mi)	48	0.082	0.082	0.0819	0.130	0.130	0.1304
Running (g/mi)	49	0.081	0.081	0.0810	0.131	0.131	0.1313
Running (g/mi)	50	0.080	0.080	0.0803	0.132	0.132	0.1318
Running (g/mi)	51	0.080	0.080	0.0798	0.133	0.133	0.1325
Running (g/mi)	52	0.079	0.079	0.0794	0.133	0.133	0.1334
Running (g/mi)	53	0.079	0.079	0.0791	0.134	0.134	0.1343
Running (g/mi)	54	0.078	0.078	0.0784	0.135	0.135	0.1352
Running (g/mi)	55	0.078	0.078	0.0781	0.136	0.136	0.1358
Running (g/mi)	56	0.078	0.078	0.0782	0.137	0.137	0.1367
Running (g/mi)	57	0.078	0.078	0.0782	0.138	0.138	0.1375
Running (g/mi)	58	0.078	0.078	0.0782	0.138	0.138	0.1383
Running (g/mi)	59	0.078	0.078	0.0784	0.139	0.139	0.1392
Running (g/mi)	60	0.078	0.078	0.0782	0.140	0.140	0.1398
Running (g/mi)	61	0.079	0.079	0.0787	0.141	0.141	0.1408
Running (g/mi)	62	0.079	0.079	0.0788	0.142	0.142	0.1416
Running (g/mi)	63	0.079	0.079	0.0789	0.142	0.142	0.1423
Running (g/mi)	64	0.079	0.079	0.0790	0.143	0.143	0.1433
Running (g/mi)	65	0.079	0.079	0.0791	0.144	0.144	0.1439

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.4640	0.1565
Hot Soak Loss (g/trip end)	0.2055	-
Hot Start (g/trip start, Light Duty Only)	0.0855	0.0383

Exhibit - 3
VOC MOBILE6.2 RUNNING EMISSION RATES
COMMUTE STREAM
FOR 2009, 2010, 2020 AND 2030
WEIGHTED AVEARGE of ARTERIAL & FREEWAY
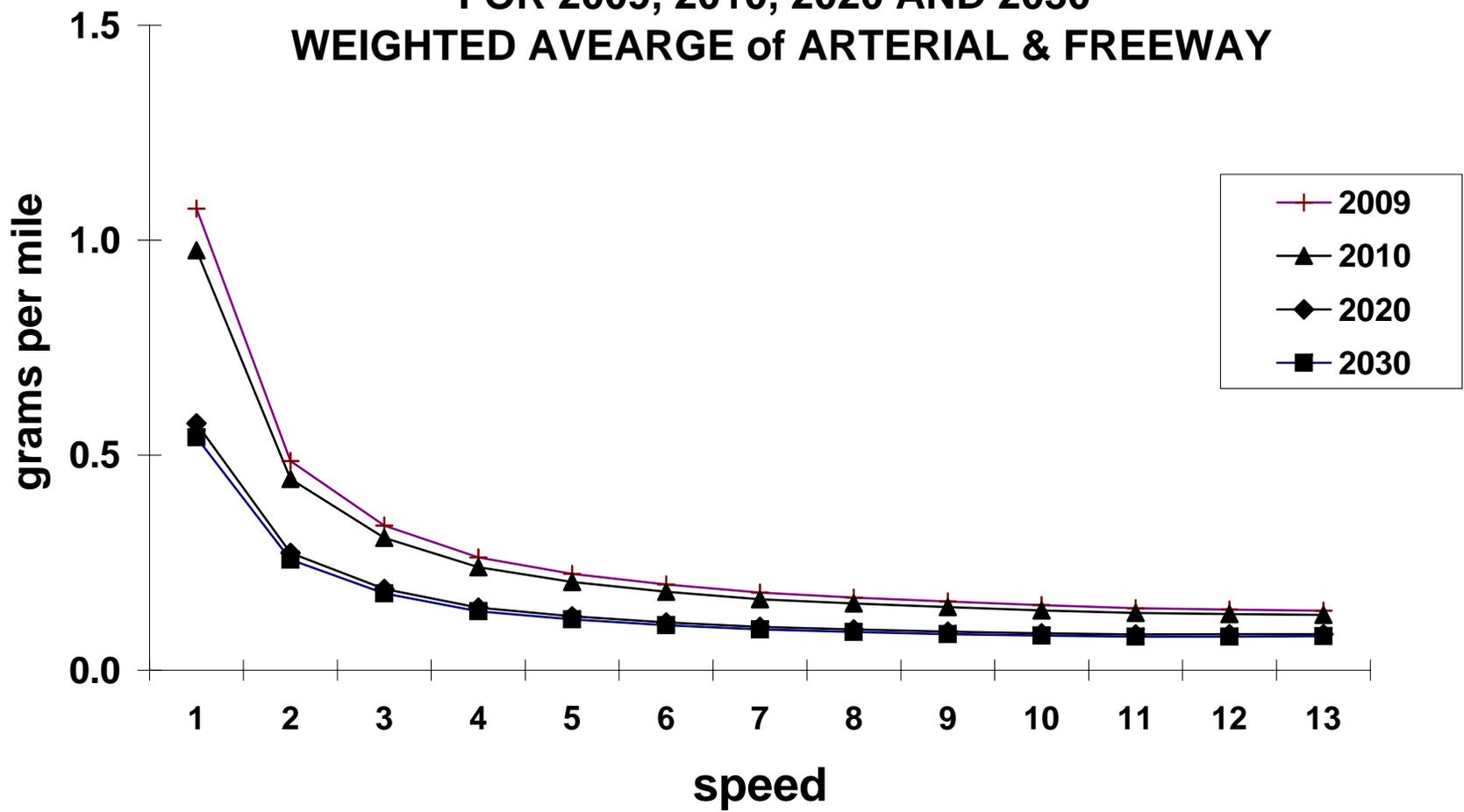
Exhibit - 4
NOx MOBILE6.2 RUNNING EMISSION RATES
COMMUTE STREAM
FOR 2009, 2010, 2020 AND 2030
WEIGHTED AVEARGE of ARTERIAL & FREEWAY
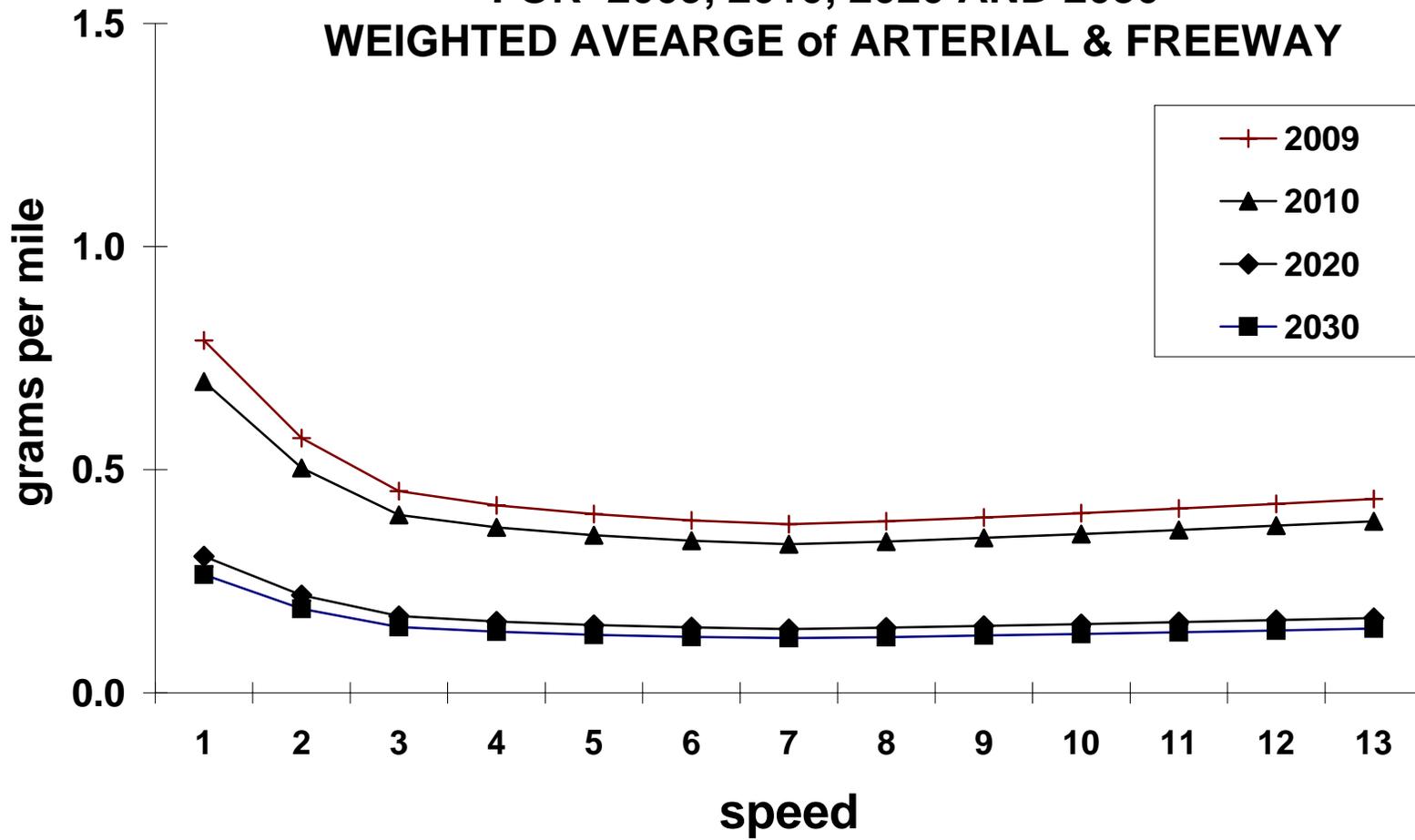
Table - 10 Idling Emissions Factors

(Mobile 6.2)

Vehicle Type	2010			2020			2030		
	VOC (g/hr)	NOx (g/hr)	PM2.5 (g/hr)	VOC (g/hr)	NOx (g/hr)	PM2.5 (g/hr)	VOC (g/hr)	NOx (g/hr)	PM2.5 (g/hr)
LDGV	1.1688	2.3925	-	0.5313	0.9000	-	0.4563	0.7300	-
LDGT12	1.2500	2.1900	-	0.7175	0.8813	-	0.6850	0.7863	-
LDGT34	1.9950	3.0913	-	0.9838	1.3038	-	0.8650	1.1038	-
HDGV	14.3938	4.5063	-	6.1063	1.1400	-	5.1125	0.3263	-
LDDV	0.6225	0.8638	-	0.2925	0.1625	-	0.2575	0.1113	-
LDDT	1.7250	2.0675	-	0.4288	0.3100	-	0.3775	0.2413	-
HDDV	3.1125	32.1350	0.9841	1.8663	6.5875	0.9237	1.6975	1.9863	0.9237
MC	20.2563	1.5825	-	20.2288	1.5825	-	20.2288	1.5825	-
Avg. for all vehicles	1.8401	4.2763	-	1.0011	1.3492	-	0.9213	0.9040	-

Notes:

1- NOx & VOC Average rates for all vehicles is weighted by the VMT percentages

2- EPA Mobile 6 guidance provides instructions for estimating PM2.5 idling rates only for heavy duty vehicles

3- PM average shown in the above table are based on the average of three jurisdictions. (District of Columbia, Fairfax County, Montgomery County)

Also for use in the emissions reduction calculations average weighted speed by time period are shown in Table 13 below. The 24 hour regional average weighted speed is 41 miles per hour and should be used for TERMs affecting the entire traffic stream, where site-specific speed data are not available. Please express reductions of VOC and NOx for all years in both kilograms per day and tons per day using a conversion factor of .0011 (# of kg reduced x .0011 = # of tons reduced).

Table 11: Average Weighted Speeds by Hour

Time	Speed (mph)
12-1	48
1-2	49
2-3	49
3-4	49
4-5	48
5-6	45
6-7	41
7-8	38
8-9	39
9-10	41
10-11	43
11-12	42
12-1 PM	40
1-2 PM	42
2-3 PM	42
3-4 PM	41
4-5 PM	40
5-6 PM	39
6-7 PM	40
7-8 PM	42
8-9 PM	43
9-10 PM	44
10-11 PM	45
11-12 MID	45
24 Hour Avg	41

Table 12: Mobile 6 Vehicle Classifications		
Number	*Abbreviation*	*Description*
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDGV2b	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1and 2 (0-6,000 lbs. GVWR)
16	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

General Assumptions

The detailed assumptions for the each TERMs varies as per the nature of the TERM. However, some of the assumptions are common to the all the TERMs. Such assumptions included 2010 travel conditions, regional average emissions factors, regional average one way trip length of 15.5 miles etc.

Following tables shows regional data (VT & VMT by purpose, year) obtained from the travel demand model and some of the generic assumptions are the being used for the TERM analysis.

Table 13- Daily Regional Home Based Work Purpose Mode Analysis by Year

YEAR	HBW MOTORIZED PERSON	TOTAL HBW AUTO PSN	TOTAL HBW AUTO DRV	HBW CAROCC	HBW TRANSIT	HBW TRANSIT (%)
2002	4,206,415	3,615,426	3,216,654	1.120	590,989	14.00%
2009	4,772,858	4,124,520	3,670,545	1.120	648,338	13.60%
2010	4,851,013	4,203,391	3,709,888	1.130	647,622	13.40%
2020	5,520,205	4,753,117	4,158,222	1.140	767,088	13.90%
2030	5,996,319	5,155,786	4,508,419	1.140	840,533	14.00%

Table 14- Daily Regional Analysis by Year for all Trip Purposes

YEAR	TOTAL MOTORIZED PERSON	TOTAL AUTO PSN	TOTAL AUTO DRV	TOTAL CAROCC	TOTAL TRANSIT	TRANSIT (%)
2002	22,920,300	21,861,379	17,213,549	1.270	1,058,921	4.60%
2009	25,907,167	24,752,086	19,577,073	1.260	1,155,081	4.50%
2010	26,308,384	25,143,074	19,850,071	1.270	1,165,310	4.40%
2020	29,745,815	28,327,800	22,392,813	1.270	1,418,015	4.80%
2030	32,165,139	30,618,315	24,273,695	1.260	1,546,824	4.80%

Note: Starting in 2010, all HOV facilities are HOV3+

Table 15- Daily Regional Vehicle Trips by Purpose by Year

YEAR	WORK AND NON-WORK AUTO DRV	TRUCKS (Med + Hvy)	MISC + THRU TRIPS	TOTAL VEH. TRIPS	TOTAL VMT
2002	17,214,123	473,046	725,932	19,551,790	146,488,410
2009	19,577,642	533,716	828,730	22,213,151	161,839,018
2010	19,850,741	543,141	845,071	22,530,781	165,420,513
2020	22,393,442	621,888	972,961	25,447,683	187,484,318
2030	24,274,327	686,483	1,076,608	27,626,025	199,201,305

Source: 2007 CLRP / FY2008-2013 TIP CLRP air quality conformity document

Cost-Effectiveness Estimation Procedure

The staff has gathered cost information from the various agencies and cost figures are in today's dollars. The TERMs project cost is expressed in terms of TIP cost and cost per year. The total cost of project thus includes capital cost, operating cost and maintenance cost. The TIP cost consists of capital cost, and three year of operating cost and maintenance cost. For the cost-effectiveness annualized cost has been used. The annualized cost is total cost per year. The following formula shows the procedure.

Consistency between programming agencies in assumptions and methodology for effectiveness estimations is critical for meaningful comparison of different projects around the region. Therefore, please use the following guidelines when calculating the cost-effectiveness of your TERM projects. When determining the cost-effectiveness, capital costs, operating costs, and revenues should be considered. Projects should be expressed in dollars per ton of reduction for both VOC and NOx. Please use the following series of formulas to compute cost-effectiveness:

A. Total Project Cost = Capital Costs + Operating Costs - (Revenues + Resale Value, if relevant/significant)

B. Cost Per Day = $\dfrac{\text{Total Project Cost}}{\text{Benefit Days per Year X Lifespan}}$

C. Cost Per Ton = Cost Per Day / Tons VOC or NOx Reduced Per Day

Where:

Benefit Days per Year = 250 for projects mostly related to work travel (i.e., commuter lots, ridesharing)

365 for projects relating to all travel (e.g. roadway signal systems)

Lifespan[1] = 30 years for park and ride lot (construction)
100 years for park and ride lot land (right-of-way)
20 years for roadways
30 years for bridges
12 years for roadway signal systems
20 years for rail signalization
35 years for structures (i.e., garages)
12 years for buses
35 years for railcars
30 years for locomotives
10 years for sidewalks

Travel demand model assumptions:

---

[1] These lifespan values were provided by various transit and highway agencies and consultants. If lifespan values necessary for the cost/benefit calculation of any TERM projects are not provided, please contact Daivamani Sivasailam at (202) 962-3226.

Average one-way trip length for commute trips = 15.5 miles
Average HBW vehicle occupancy (2009) = 1.12

Section II

The EPA guidance on fine particulate matter (PM 2.5) emissions requires the region to estimate direct PM 2.5 and NOx emissions as a PM2.5 precursor. In addition these emissions estimations are required on an annual basis and not on a daily basis as in the case of ozone precursors. Direct PM2.5 emission rates are constant for all speeds and are expressed in grams/mile. Direct PM 2.5 has no start-up, soak or other evaporative emissions associated with them. However, PM2.5 NOx precursor is similar to ozone precursor NOx, and has start-up emissions in addition to running emissions.

The recommended methodology to estimate annual direct PM2.5 and NOx emissions as a PM2.5 precursor is to use an average of the three seasonal emission rates (Jan–April, May–September, & October-December) and apply these average rates to annual VT and VMT to estimate the annual direct PM2.5 and precursor NOx emissions. Direct PM2.5 emissions rates and average seasonal precursor NOx emissions rates for the analysis years 2010, 2020, & 2030 are shown in Tables 18, 19, 20, & 21

Examples of commuter TERM analysis with PM2.5 and NOx emissions as PM2.5 precursors are shown on the following pages.

Table-16

Direct PM2.5 Emissions Factors

Scenario	Season	Speed	Facility	Total PM
2010 PM25 - Auto Access	Jan-Apr	35.0	Arterial	0.0115
	May-Sep	35.0	Arterial	0.0115
	Oct-Dec	35.0	Arterial	0.0114
			Average	**0.0115**

Scenario	Season	Speed	Facility	Total PM
2020 PM25 - Auto Access	Jan-Apr	35.0	Arterial	0.0113
	May-Sep	35.0	Arterial	0.0113
	Oct-Dec	35.0	Arterial	0.0113
			Average	**0.0113**

Scenario	Season	Speed	Facility	Total PM
2030 PM25 - Auto Access	Jan-Apr	35.0	Arterial	0.0113
	May-Sep	35.0	Arterial	0.0113
	Oct-Dec	35.0	Arterial	0.0113
			Average	**0.0113**

Table 17: PM2.5 Precursor NOx - 2010 Running, Cold Start
Average Emissions Factors for Commute TERMs (Mobile 6.2)
(Seasonal Average)

Speed	Weighted Factor Jan-Apr NOx (grams/mile)	Weighted Factor May-Sep NOx (grams/mile)	Weighted Factor Oct-Dec NOx (grams/mile)	Average of Seasonal Factors (grams/mile)
1	0.9968	0.7555	0.8367	**0.8630**
2	0.9968	0.7555	0.8367	**0.8630**
3	0.9532	0.7201	0.8006	**0.8246**
4	0.8988	0.6757	0.7548	**0.7764**
5	0.8659	0.6492	0.7274	**0.7475**
6	0.7931	0.5914	0.6660	**0.6835**
7	0.7410	0.5501	0.6219	**0.6377**
8	0.7018	0.5189	0.5891	**0.6033**
9	0.6714	0.4949	0.5632	**0.5765**
10	0.6472	0.4755	0.5429	**0.5552**
11	0.6143	0.4495	0.5151	**0.5263**
12	0.5868	0.4280	0.4920	**0.5023**
13	0.5637	0.4097	0.4725	**0.4820**
14	0.5439	0.3940	0.4557	**0.4645**
15	0.5266	0.3805	0.4412	**0.4494**
16	0.5197	0.3746	0.4353	**0.4432**
17	0.5135	0.3694	0.4302	**0.4377**
18	0.5080	0.3648	0.4257	**0.4328**
19	0.5033	0.3606	0.4215	**0.4285**
20	0.4988	0.3568	0.4178	**0.4245**
21	0.4948	0.3535	0.4145	**0.4209**
22	0.4914	0.3504	0.4115	**0.4178**
23	0.4880	0.3475	0.4089	**0.4148**
24	0.4851	0.3448	0.4063	**0.4121**
25	0.4824	0.3426	0.4040	**0.4097**
26	0.4798	0.3402	0.4019	**0.4073**
27	0.4776	0.3382	0.4001	**0.4053**
28	0.4754	0.3361	0.3982	**0.4032**
29	0.4734	0.3343	0.3966	**0.4014**
30	0.4716	0.3327	0.3950	**0.3998**
31	0.4704	0.3314	0.3940	**0.3986**
32	0.4693	0.3302	0.3931	**0.3975**
33	0.4684	0.3291	0.3923	**0.3966**
34	0.4674	0.3280	0.3915	**0.3956**
35	0.4666	0.3272	0.3907	**0.3948**
36	0.4690	0.3286	0.3929	**0.3968**
37	0.4711	0.3302	0.3948	**0.3987**
38	0.4732	0.3313	0.3965	**0.4003**
39	0.4752	0.3330	0.3983	**0.4022**
40	0.4772	0.3342	0.4000	**0.4038**
41	0.4800	0.3362	0.4026	**0.4063**
42	0.4829	0.3382	0.4048	**0.4086**
43	0.4858	0.3401	0.4072	**0.4110**
44	0.4881	0.3415	0.4096	**0.4131**
45	0.4906	0.3434	0.4116	**0.4152**
46	0.4936	0.3455	0.4143	**0.4178**
47	0.4966	0.3474	0.4167	**0.4202**
48	0.4994	0.3494	0.4191	**0.4226**
49	0.5022	0.3512	0.4213	**0.4249**
50	0.5045	0.3530	0.4235	**0.4270**
51	0.5077	0.3551	0.4263	**0.4297**
52	0.5108	0.3573	0.4292	**0.4324**
53	0.5138	0.3594	0.4315	**0.4349**
54	0.5168	0.3614	0.4340	**0.4374**
55	0.5195	0.3634	0.4364	**0.4398**
56	0.5227	0.3656	0.4392	**0.4425**
57	0.5259	0.3677	0.4421	**0.4452**
58	0.5292	0.3698	0.4446	**0.4479**
59	0.5320	0.3718	0.4471	**0.4503**
60	0.5347	0.3738	0.4496	**0.4527**
61	0.5382	0.3761	0.4525	**0.4556**
62	0.5411	0.3784	0.4552	**0.4582**
63	0.5440	0.3804	0.4577	**0.4607**
64	0.5472	0.3821	0.4603	**0.4632**
65	0.5501	0.3842	0.4627	**0.4657**

	Jan-Apr	May-Sep	Oct-Dec	Average
Cold Start (g/trip start, Light Duty Only)	0.7816	0.5441	0.6700	**0.6652**

Table 18: PM2.5 Precursor NOx - 2020 Running, Cold Start Average Emissions Factors for Commute TERMs (Mobile 6.2) (Seasonal Average)

Speed	Weighted Factor Jan-Apr NOx (grams/mile)	Weighted Factor May-Sep NOx (grams/mile)	Weighted Factor Oct-Dec NOx (grams/mile)	Average of Seasonal Factors (grams/mile)
1	0.2483	0.2042	0.2288	**0.2271**
2	0.2483	0.2042	0.2288	**0.2271**
3	0.2377	0.1946	0.2191	**0.2171**
4	0.2243	0.1826	0.2068	**0.2046**
5	0.2163	0.1754	0.1996	**0.1971**
6	0.1979	0.1594	0.1823	**0.1799**
7	0.1846	0.1480	0.1703	**0.1676**
8	0.1747	0.1395	0.1611	**0.1584**
9	0.1671	0.1328	0.1539	**0.1513**
10	0.1610	0.1275	0.1483	**0.1456**
11	0.1526	0.1204	0.1405	**0.1378**
12	0.1456	0.1144	0.1341	**0.1314**
13	0.1398	0.1094	0.1287	**0.1260**
14	0.1348	0.1051	0.1240	**0.1213**
15	0.1305	0.1014	0.1199	**0.1173**
16	0.1288	0.0998	0.1185	**0.1157**
17	0.1273	0.0984	0.1170	**0.1143**
18	0.1260	0.0972	0.1158	**0.1130**
19	0.1248	0.0961	0.1147	**0.1119**
20	0.1236	0.0951	0.1137	**0.1108**
21	0.1227	0.0941	0.1129	**0.1099**
22	0.1219	0.0934	0.1121	**0.1091**
23	0.1211	0.0927	0.1113	**0.1083**
24	0.1203	0.0919	0.1107	**0.1077**
25	0.1198	0.0913	0.1099	**0.1070**
26	0.1191	0.0906	0.1095	**0.1064**
27	0.1186	0.0902	0.1090	**0.1059**
28	0.1181	0.0896	0.1086	**0.1054**
29	0.1177	0.0892	0.1081	**0.1050**
30	0.1172	0.0887	0.1077	**0.1045**
31	0.1169	0.0883	0.1074	**0.1042**
32	0.1167	0.0880	0.1073	**0.1040**
33	0.1164	0.0877	0.1070	**0.1037**
34	0.1162	0.0874	0.1068	**0.1035**
35	0.1160	0.0871	0.1066	**0.1032**
36	0.1167	0.0876	0.1072	**0.1038**
37	0.1173	0.0881	0.1078	**0.1044**
38	0.1179	0.0885	0.1084	**0.1049**
39	0.1185	0.0889	0.1089	**0.1054**
40	0.1189	0.0892	0.1094	**0.1058**
41	0.1198	0.0898	0.1102	**0.1066**
42	0.1206	0.0904	0.1109	**0.1073**
43	0.1214	0.0909	0.1117	**0.1080**
44	0.1220	0.0914	0.1124	**0.1086**
45	0.1227	0.0919	0.1130	**0.1092**
46	0.1235	0.0926	0.1137	**0.1099**
47	0.1244	0.0931	0.1145	**0.1107**
48	0.1252	0.0937	0.1153	**0.1114**
49	0.1260	0.0942	0.1159	**0.1120**
50	0.1267	0.0948	0.1166	**0.1127**
51	0.1276	0.0954	0.1176	**0.1135**
52	0.1286	0.0961	0.1184	**0.1143**
53	0.1294	0.0967	0.1192	**0.1151**
54	0.1302	0.0973	0.1199	**0.1158**
55	0.1310	0.0979	0.1208	**0.1166**
56	0.1319	0.0987	0.1216	**0.1174**
57	0.1329	0.0993	0.1224	**0.1182**
58	0.1338	0.1000	0.1234	**0.1191**
59	0.1345	0.1006	0.1241	**0.1198**
60	0.1354	0.1012	0.1249	**0.1205**
61	0.1364	0.1019	0.1259	**0.1214**
62	0.1373	0.1025	0.1268	**0.1222**
63	0.1382	0.1031	0.1275	**0.1229**
64	0.1391	0.1037	0.1283	**0.1237**
65	0.1398	0.1043	0.1291	**0.1244**

	Jan-Apr	May-Sep	Oct-Dec	Average
Cold Start (g/trip start, Light Duty Only)	0.1968	0.1414	0.1806	**0.1729**

Table 19: PM2.5 Precursor NOx - 2030 Running, Cold Start Average Emissions Factors for Commute TERMs (Mobile 6.2) (Seasonal Average)

Speed	Weighted Factor Jan-Apr NOx (grams/mile)	Weighted Factor May-Sep NOx (grams/mile)	Weighted Factor Oct-Dec NOx (grams/mile)	Average of Seasonal Factors (grams/mile)
1	0.2093	0.1773	0.1994	**0.1953**
2	0.2093	0.1773	0.1994	**0.1953**
3	0.2003	0.1690	0.1909	**0.1867**
4	0.1893	0.1586	0.1803	**0.1760**
5	0.1826	0.1522	0.1740	**0.1696**
6	0.1668	0.1384	0.1590	**0.1547**
7	0.1556	0.1283	0.1483	**0.1441**
8	0.1473	0.1209	0.1403	**0.1362**
9	0.1408	0.1150	0.1340	**0.1299**
10	0.1355	0.1103	0.1290	**0.1249**
11	0.1284	0.1042	0.1223	**0.1183**
12	0.1225	0.0990	0.1166	**0.1127**
13	0.1175	0.0945	0.1118	**0.1079**
14	0.1132	0.0907	0.1077	**0.1039**
15	0.1096	0.0875	0.1042	**0.1004**
16	0.1081	0.0861	0.1028	**0.0990**
17	0.1068	0.0850	0.1015	**0.0978**
18	0.1057	0.0838	0.1006	**0.0967**
19	0.1047	0.0829	0.0996	**0.0958**
20	0.1038	0.0820	0.0987	**0.0948**
21	0.1032	0.0812	0.0980	**0.0941**
22	0.1023	0.0805	0.0974	**0.0934**
23	0.1017	0.0798	0.0967	**0.0927**
24	0.1011	0.0793	0.0961	**0.0921**
25	0.1006	0.0787	0.0956	**0.0916**
26	0.1002	0.0781	0.0952	**0.0911**
27	0.0997	0.0777	0.0947	**0.0907**
28	0.0992	0.0772	0.0943	**0.0903**
29	0.0988	0.0768	0.0939	**0.0898**
30	0.0985	0.0764	0.0936	**0.0895**
31	0.0982	0.0761	0.0934	**0.0892**
32	0.0980	0.0759	0.0932	**0.0890**
33	0.0978	0.0756	0.0930	**0.0888**
34	0.0976	0.0752	0.0927	**0.0885**
35	0.0974	0.0751	0.0925	**0.0884**
36	0.0981	0.0753	0.0931	**0.0888**
37	0.0986	0.0759	0.0937	**0.0894**
38	0.0991	0.0763	0.0942	**0.0898**
39	0.0996	0.0766	0.0947	**0.0903**
40	0.1000	0.0771	0.0952	**0.0908**
41	0.1008	0.0774	0.0959	**0.0914**
42	0.1015	0.0779	0.0966	**0.0920**
43	0.1021	0.0784	0.0972	**0.0926**
44	0.1028	0.0789	0.0978	**0.0932**
45	0.1034	0.0794	0.0984	**0.0937**
46	0.1041	0.0798	0.0991	**0.0944**
47	0.1049	0.0804	0.0998	**0.0950**
48	0.1056	0.0809	0.1004	**0.0956**
49	0.1063	0.0814	0.1011	**0.0963**
50	0.1070	0.0819	0.1018	**0.0969**
51	0.1078	0.0826	0.1026	**0.0976**
52	0.1085	0.0831	0.1034	**0.0984**
53	0.1093	0.0838	0.1041	**0.0991**
54	0.1101	0.0841	0.1049	**0.0997**
55	0.1108	0.0847	0.1055	**0.1003**
56	0.1116	0.0853	0.1063	**0.1010**
57	0.1124	0.0859	0.1071	**0.1018**
58	0.1133	0.0865	0.1079	**0.1025**
59	0.1141	0.0870	0.1086	**0.1032**
60	0.1148	0.0875	0.1093	**0.1039**
61	0.1155	0.0881	0.1100	**0.1045**
62	0.1163	0.0888	0.1108	**0.1053**
63	0.1173	0.0893	0.1116	**0.1061**
64	0.1180	0.0899	0.1124	**0.1068**
65	0.1186	0.0904	0.1131	**0.1074**

	Jan-Apr	May-Sep	Oct-Dec	Average
Cold Start (g/trip start, Light Duty Only)	0.1410	0.1042	0.1340	**0.1264**

Example-1: Construction of 1300 additional Parking Spaces at a Metro Station

Description: 1,300 parking spaces will be constructed at a Metro station. The garages at Metrorail stations are currently experiencing full utilization of all existing parking capacity on a daily basis.

Analysis Tool: Sketch Planning

Assumptions:

- To build 1,300 additional parking spaces at a Metro station to increase capacity at a station. Cost to construct the garage is assumed to be $2.117 million dollars. Life span: 30 years
- New trips generated due to additional parking spaces will be 2/3 of new spaces.
- Average one-way trip length reduced will be 15.5 miles.
- No cold start benefit, as autos will drive to station.
- NOx & VOC estimation using Mobile 6.2 Emissions factors.

Summary Impacts (2010):

Daily VT Reduction:	0	VT
Daily VMT Reduction:	26,846	VMT
Daily NOx Reductions:	0.0100	tons/day
Daily VOC Reductions:	0.0046	tons/day
Cost-Effectiveness (NOx)	28,917	$/ton
Cost-Effectiveness (VOC)	63,282	$/ton

Emission Impacts for (2010):

1,300 additional spaces

Trip length: 15.5 mile x 2 = 31 mi round trip

2/3 new trips: 2/3 x 1300 = 866 trips

866 x 31 miles = 26,846 VMT

Daily NOx & VOC emission reductions (2010):

NOx Estimation

Cold Start $\quad 0 \quad \times \dfrac{0.518 \text{ grams}}{1 \text{ trip}} \times \dfrac{1 \text{ ton}}{907{,}185 \text{ grams}} = 0.0000 \quad$ tons

Running $\quad 26{,}846 \quad \times \dfrac{0.3392 \text{ grams}}{1 \text{ mile}} \times \dfrac{1 \text{ ton}}{907185 \text{ grams}} = 0.0108 \quad$ tons

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ Total $\qquad$ 0.0100 $\qquad$ tons

VOC Estimation

Cold Start + Hot soak $\quad 0 \quad \times \dfrac{1.5015 \text{ grams}}{1 \text{ trip}} \times \dfrac{1 \text{ ton}}{907{,}185 \text{ grams}} = 0.0000 \quad$ tons

Running $\quad 26{,}846 \quad \times \dfrac{0.155 \text{ grams}}{1 \text{ mile}} \times \dfrac{1 \text{ ton}}{907185 \text{ grams}} = 0.0046 \quad$ tons

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ Total $\qquad$ 0.0046 $\qquad$ tons

Methodology for PM2.5 emissions estimation:

Direct PM2.5

Direct PM2.5 emissions factors are available for three seasons (Jan-April, May-Sept., Oct.-Dec). Estimation of direct PM2.5 emissions can be carried out on a seasonal or an annual basis. As PM2.5 seasonal emission factors do not vary significantly, the average of these four seasonal factors is used to estimate annual PM emissions. Please refer Table -14.

The travel demand model and postprocessor use average annual weekday traffic (AAWDT) for analysis. Hence for the analysis of TERMs which are effective 7-days a week, VT and VMT for such TERMs need to be adjusted to reflect average daily traffic (AADT). A factor of 0.95 is used to convert AAWDT volume to AADT volume. For the TERMs that affect only commuter traffic (effective only on weekdays) no adjustment is needed as the VT and VMT reflect average weekday traffic. The formulae for annual direct PM2.5 estimation for these TERMs are shown as below.

For the TERMs effective 365 days:

Direct PM2.5 Emissions = VMT x average of seasonal emissions factors x weekly VMT adjustment factor x days/year.

Running $\quad 26{,}846 \quad \times \dfrac{0.0115 \text{ grams}}{1 \text{ mi}} \times \dfrac{1 \text{ ton}}{907{,}185 \text{ grams}} \times 0.95 \times 365 \text{ days} = 0.1180 \text{ tons}$

For the TERMs effective only on weekdays:

Direct PM2.5 Emissions = VMT x average of seasonal emissions factors x days/year.

Running $\quad 26{,}846 \quad \times \dfrac{0.0115 \text{ grams}}{1 \text{ mi}} \times \dfrac{1 \text{ ton}}{907{,}185 \text{ grams}} \times 250 \text{ days} = 0.0851 \text{ Tons}$

NOx Emissions as a PM 2.5 Precursor:

As conformity assessment criteria for the PM2.5 standards include NOx emissions as a PM 2.5 precursor, we are also required to estimate NOx emissions on seasonal/annual basis. For TERM analysis we follow the annual approach similar to the PM2.5 emission estimation as described above. Emission factors corresponding to 40 mph speed are used to estimate cold start and running NOx precursor emissions. Tables 15-17 show the average of the NOx seasonal emissions factors for years 2010, 2020 and 2030.

For the TERMs effective 365 days:

Cold Start	0	x	$\frac{0.6652 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x 0.95 x	365	=	0.0000 Tons
Running	26,846	x	$\frac{0.4038 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x 0.95 x	365 =		4.1435 Tons
					Total				4.1435 Tons

For the TERMs effective only on weekdays:

Cold Start	0	x	$\frac{0.6652 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	250	=	0.0000 Tons
Running	26,846	x	$\frac{0.4038 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	250	=	2.9874 Tons
					Total				2.9874 Tons

Cost-Effectiveness (2010):

Garage cost (assumed): $2.177 million

$$\text{NOx} = \frac{\$2.177 \text{ million}}{250 \text{ days x 30 yr x 0.010 t/d}} = \$28,910/ \text{ton}$$

$$\text{VOC} = \frac{\$2.177 \text{ million}}{250 \text{ days x 30 yr x 0.046 t/d}} = \$63,282 / \text{ton}$$

$$\text{PM2.5} = \frac{\$2.177 \text{ million}}{30 \text{ yr x 0.1180 t/yr}} = \$615,000/ \text{ton}$$

Example-2: Implement 10 Neighborhood Circulator Bus Service to Metrorail

Description:
The circulator bus service would operate over an expanded period from 5:30 am to 10:00 am and from 3:00 pm to 8:00 pm on weekdays.

Analysis Tool: Sketch Planning

Assumptions:

- Sketch planning is used as an analysis tool
- Two buses per neighborhood will be required at a cost of $150,000 per bus, with a useful life of 12 years.
- Anticipated ridership is 150 riders per day per circulator, for a total of 1500 additional transit riders per day.
- Average trip length = 15.5 miles
- The stations where circulator service could be implemented include:

  - ✓ Cheverly station
  - ✓ Deanwood station
  - ✓ Minnesota Ave. station
  - ✓ Vienna/Fairfax – GMU station
  - ✓ Dunn Loring – Merrifield station
  - ✓ Greenbel station
  - ✓ Van Dorn Street station
  - ✓ Addison Road station
  - ✓ Glenmont station
  - ✓ Rhode Island Ave. station
  - ✓ New Carrolton

Summary of Impacts (2010)

Daily VT Reduction:	3,000	VT
Daily VMT Reduction:	46,500	VMT
Daily NOx Reductions:	0.0191	tons/day
Daily VOC Reductions:	0.0129	tons/day
Cost-Effectiveness (NOx)	235,604	$/ton
Cost-Effectiveness (VOC)	348,560	$/ton

Emission Analyis (2010)

Anticipated ridership = 150 riders/day/circulator

150 * 10 = 1500 additional riders
1 rider = 2 trips
1,500 * 2 = 3000 VT

VMT: 3000 x 15.5 = 46500 VMT

Daily Emissions Reduction

NOx Estimation

Cold Start	3000	x	$\dfrac{0.5181 \text{ grams}}{1 \text{ trip}}$	x	$\dfrac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0017	tons
Running	46,500	x	$\dfrac{0.3392 \text{ grams}}{1 \text{ mile}}$	x	$\dfrac{1 \text{ ton}}{907185 \text{ grams}}$	=	0.0174	tons
					Total		0.0191	tons

VOC Estimation

Cold Start + Hot soak	3000	x	$\dfrac{1.5015 \text{ grams}}{1 \text{ trip}}$	x	$\dfrac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0050	tons
Running	46,500	x	$\dfrac{0.1550 \text{ grams}}{1 \text{ mile}}$	x	$\dfrac{1 \text{ ton}}{907185 \text{ grams}}$	=	0.0079	tons
					Total		0.0129	tons

Cost Analysis:

Annual Operating Costs ($100,000/bus): $1,000,000
Capital Costs: $150,000/bus x 10 = $ 1,500,000
Annualized cost: $1,000,000 + $1,500,000/12 = $1,125,000
TIP Cost (2006-2011): $1,000,000 x 5 + $1,500,000 = $6,500,000

Cost-Effectiveness (2010):

Cost-effectiveness NOx	$\dfrac{\$1,125,000}{250 \quad \text{x} \quad 0.0191}$	=	235,604	$/ton
Cost-effectiveness VOC	$\dfrac{\$1,125,000}{250 \quad \text{x} \quad 0.0129}$	=	348,560	$/ton

Direct PM2.5

For the TERMs effective 365 days:

Direct PM2.5 Emissions = VMT x average of seasonal emissions factors x weekly VMT adjustment factor x days/year.

Running 46,500 x $\dfrac{0.0115 \text{ grams}}{1 \text{ mi}}$ x $\dfrac{1 \text{ ton}}{907,185 \text{ grams}}$ x 0.95 x 365 days = 0.2044 tons

For the TERMs effective only on weekdays:

Direct PM2.5 Emissions = VMT x average of seasonal emissions factors x days/year.

Running 46,500 x $\underline{\text{0.0115 grams}}$ x $\underline{\quad\text{1 ton}\quad}$ x 250 days = 0.1474 Tons
                           1 mi   907,185 grams

NOx Emissions as a PM 2.5 Precursor:

For the TERMs effective 365 days:

Cold Start 3000 x $\underline{\text{0.6652 grams}}$ x $\underline{\quad\text{1 ton}\quad}$ x 365 = 0.7628 Tons
                          1 trip   907,185 grams
Running 46,500 x $\underline{\text{0.4038 grams}}$ x $\underline{\quad\text{1 ton}\quad}$ x 0.95 x 365 = 7.1769 Tons
                          1 mi   907,185
                                       Total   7.9397 Tons

For the TERMs effective only on weekdays:

Cold Start 3000 x $\underline{\text{0.6652 grams}}$ x $\underline{\quad\text{1 ton}\quad}$ x 250 = 0.5499 Tons
                          1 trip   907,185 grams
Running 46,500 x $\underline{\text{0.4038 grams}}$ x $\underline{\quad\text{1 ton}\quad}$ x 250 = 5.1477 Tons
                          1 mi   907,185
                                       Total   5.7224 Tons

Cost-Effectiveness (2010):

PM2.5 = $\dfrac{\$1.125 \text{ million}}{30 \text{ yr x } 0.2044 \text{ t/yr}}$ = $5,504,000/ton

Example-3: Bus Information Displays with Maps at Bus Stops

Description:
This measure would provide more information at 2,000 Metrobus locations.
Note: WMATA is implementing this TERM

Assumptions

- Sketch planning is used as an analysis tool
- Decrease in waiting time: 2.5 minutes
- Average daily bus ridership: 500,000
- Average daily local bus ridership: 124,000
- Program would be launched in 2008 and continue through 2009
- Average trip length: 15.5 miles

Summary Impact

Daily VT Reduction:	2,210	VT
Daily VMT Reduction:	34,255	VMT
Daily NOx Reductions:	0.0141	tons/day
Daily VOC Reductions:	0.0095	tons/day
Cost-Effectiveness (NOx)	28,474	$/ton
Cost-Effectiveness (VOC)	42,126	$/ton

Emission Analysis

Local bus average daily Ridership   124,000

Average daily WMATA bus ridership   500,000

Average daily regional bus ridership   500,000 + 124,000 = 624,000

Total daily person trips   4,400,000 (conformity) x 0.25 (HBW) = 17,600,000

Regional bus mode share percentage = 624,000/17,600,000 = 3.55 %

Assumed benefit from the system = 2.5 minute decrease in wait time.

3.55 % → 4.07%   = 0.52% increase in bus mode share due to decrease in wait time

(Source: William Allen, Mode Choice Model Sensitivity Analysis, April 1993)

WMATA Buses: 500,000 (0.52%) = 2600 new trips
VT reductions: 2600 x 0.85 SOV = 2210

VMT reductions: 2210 x 15.5 miles = 34255

Daily NOx Emission Reductions (2010)

Nox Estimation

Cold Start	2210	x	$\dfrac{0.5181 \text{ grams}}{1 \text{ trip}}$	x	$\dfrac{1 \text{ ton}}{907{,}185 \text{ grams}}$	=	0.00123	tons
Running	34,255	x	$\dfrac{0.3392 \text{ grams}}{1 \text{ mile}}$	x	$\dfrac{1 \text{ ton}}{907185 \text{ grams}}$	=	0.0128	tons
					Total		0.0141	tons

VOC Estimation

Cold Start + Hot Soak	2210	x	$\dfrac{1.5015 \text{ grams}}{1 \text{ trip}}$	x	$\dfrac{1 \text{ ton}}{907{,}185 \text{ grams}}$	=	0.0037	tons
Running	34,255	x	$\dfrac{0.1550 \text{ grams}}{1 \text{ mile}}$	x	$\dfrac{1 \text{ ton}}{907185 \text{ grams}}$	=	0.0059	tons
					Total		0.0095	tons

Cost Analysis

Cost per box = $120.00
Number of boxes = 2000
Cost for 2000 display boxes = $240,000
Capital cost per car – $30,000
Operating Cost for car to change schedule = $40,000
Life of car – 6 years
Annualized cost – $240,000 / 3 years + $30,000/6 years + $40,000 = $125,000
TIP Cost: $240,000 + $30,000 + $40,000 x 2 = $350,000

Cost-Effectiveness (2010)

Cost-effectiveness NOx	$\dfrac{\$125{,}000}{312 \quad x \quad 0.0141}$			=	28,470	$/ton
Cost-effectiveness VOC	$\dfrac{\$125{,}000}{312 \quad x \quad 0.0095}$			=	42,126	$/ton

Direct PM2.5

For the TERMs effective 365 days:

Direct PM2.5 Emissions = VMT x average of seasonal emissions factors x weekly VMT
adjustment factor x days/year.

Running   34255   x $\dfrac{0.0115 \text{ grams}}{1 \text{ mi}}$ x $\dfrac{1 \text{ ton}}{907{,}185 \text{ grams}}$ x   0.95   x   365 days   =   0.1506 tons

For the TERMs effective only on weekdays:

Direct PM2.5 Emissions =   VMT   x   average of seasonal emissions factors   x   days/year.

Running   34255   x $\dfrac{0.0115 \text{ grams}}{1 \text{ mi}}$ x $\dfrac{1 \text{ ton}}{907{,}185 \text{ grams}}$ x   250 days   =   0.1086 Tons

NOx Emissions as a PM 2.5 Precursor:

For the TERMs effective 365 days:

Cold Start   2210   x $\dfrac{0.6652 \text{ grams}}{1 \text{ trip}}$ x $\dfrac{1 \text{ ton}}{907{,}185 \text{ grams}}$ x   365   =   0.5619 Tons

Running   34255   x $\dfrac{0.4038 \text{ grams}}{1 \text{ mi}}$ x $\dfrac{1 \text{ ton}}{907{,}185}$ x   0.95   x   365   =   5.2870 Tons

                                                    Total   5.8489 Tons

For the TERMs effective only on weekdays:

Cold Start   2210   x $\dfrac{0.6652 \text{ grams}}{1 \text{ trip}}$ x $\dfrac{1 \text{ ton}}{907{,}185 \text{ grams}}$ x   250   =   0.4051   Tons

Running   34255   x $\dfrac{0.4038 \text{ grams}}{1 \text{ mi}}$ x $\dfrac{1 \text{ ton}}{907{,}185}$ x   250   =   3.8118   Tons

                                                    Total   4.2170   Tons

Cost-Effectiveness (2010):

PM2.5   = $\dfrac{\$125{,}000}{0.1506 \text{ t/yr}}$ =   \$830,010/ ton

APPENDIX - B

TERM REPORTING INSTRUCTIONS

TERM REPORTING

Federal regulations require the timely implementation of TERMs (CMAQ funded, non-CMAQ funded and NOx mitigation measures). If the implementation of programmed TERMs falls behind schedule the regulations state "that all State and local agencies with influence over approvals of funding for TERMs [should give] maximum priority to approval or funding of TERMs over other projects within their control". To address these requirements, please provide a brief statement describing the status of each TERM programmed in previous TIPs. This applies to those projects not yet fully implemented and reported in the 'TERM Tracking Sheet' developed as part of the CLRP and TIP. Please include any changes in the scheduling or implementation of these TERMs. Your submissions will be used to update the 'TERM Tracking Sheet' for analysis years 2009, 2010, 2020 and 2030. For information purposes the latest 'TERM Tracking Sheet' included in 2008 Constrained Long range Plan (CLRP) and FY 2009-FY2014 Transportation Improvement Program (TIP) is attached.

* Project Category: TR - Traffic Stream, C - Commute, H - Heavy Duty Vehicles (Engine Technology), SP- Specific Vehicle Type, TCM - Transportation Control Measures

NOs	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	IMPLEMENTATION STATUS FULL	SCALED-BACK	UNDER-WAY	REM	ORIGINAL COMPLETION DATE	ACTUAL COMPLETION DATE	2009 VOC	2009 NOX	2010 VOC	2010 NOX	2020 VOC	2020 NOX	2030 VOC	2030 NOX	Project Category *
9	X	1994-99	MDOT	Park & Ride Lot - MD 210/ MD 373	X				2000	2003	0.0006	0.0014	0.0005	0.0013	0.0003	0.0005	0.0003	0.0005	C
19	X	1994-99	PRTC	VRE Woodbridge Parking Expansion (add 500 spaces)	X					2002-2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
20	X	1994-99	ALEX	King St. Metrorail access improvements	X					2006	0.0012	0.0014	0.0011	0.0013	0.0006	0.0005	0.0006	0.0005	C
38	X	1995-00	MDOT	Signal Systems - MD 85 Executive Way to MD 355	X				1996	Pre 2000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	TR
39	X	1995-00	MDOT	Signal Systems - MD 355 ,I-70 ramps to Grove Rd.	X				1996	n/a	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	TR
44	X	1995-00	MDOT	Signal Systems - MD 410, 62nd Ave. to Riverdale Rd.	X				1996	2002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	TR
48	X	1995-00	MDOT	MARC Replacement Coaches	X				1999	2004	0.0006	0.0014	0.0005	0.0013	0.0003	0.0005	0.0003	0.0005	C (TCM)
49	X	1995-00	MDOT	MARC Expansion Coaches	X				1999	2004	0.0054	0.0133	0.0049	0.0118	0.0029	0.0050	0.0026	0.0043	C (TCM)
51	X	1995-00	VDOT	Alexandria Telecommuting Pilot Program	X					2000 & 2001	0.0000	0.0000	0.0000	0.0000			0.0000	0.0000	C
52	X	1995-00	VDOT	Fairfax County Bus Shelter (Fairfax Co. TDM program)			X		2000	2001	0.0000	0.0000	0.0000	0.0000			0.0000	0.0000	C
54	X	1995-00	VDOT	City of Fairfax Bus Shelters	X				1999	2004	0.0000	0.0005	0.0000	0.0004	0.0000	0.0002	0.0000	0.0002	C (TCM)
56	X	1995-00	VDOT	Cherry Hill VRE Access			X			Jul-08	0.0042	0.0114	0.0038	0.0101	0.0022	0.0043	0.0020	0.0036	C (TCM)
58	X	1995-00	WMATA	Bus Replacement (172 buses)	X				1998	1998	0.0690	0.2520	0.0690	0.2520					SP (TCM)
59	X	1995-00	MCG	Shady Grove West Park and Ride			X		2010		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	C
60	X	1995-00	MCG	White Oak Park and Ride			X		2010		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	C
61	X	1995-00	MCG	Bicycle Facilities			X		FY99		0.0018	0.0009	0.0016	0.0008	0.0010	0.0004	0.0009	0.0003	C
62	X	1995-00	MCG	Pedestrian Facilities to Metrorail			X				0.0030	0.0038	0.0027	0.0034	0.0016	0.0014	0.0014	0.0012	C
63	X	1995-00	MDOT	MARC Replacement Coaches	X				1999	2004	0.0024	0.0057	0.0022	0.0050	0.0013	0.0022	0.0012	0.0018	C
64	X	1995-00	MDOT	MARC Expansion Coaches	X				1999	2004	0.0191	0.0494	0.0176	0.0436	0.0103	0.0187	0.0092	0.0158	C (TCM)
66	X	1995-00	VDOT	Commuter Lots - District Wide	X				varies	1995, 2001	0.0066	0.0157	0.0060	0.0139	0.0035	0.0059	0.0032	0.0050	C
67	X	1995-00	VDOT	I-66 and Stringfellow Rd. Park and Ride	X				2000	2000 end	0.0060	0.0095	0.0055	0.0084	0.0032	0.0036	0.0029	0.0030	C
68	X	1995-00	VDOT	Lake Ridge Park and Ride (now called Tacketts Mill lot)	X					1999/2000	0.0000	0.0047	0.0000	0.0042	0.0000	0.0018	0.0000	0.0015	C
69	X	1995-00	VDOT	Bicycle Trails and Facilities (Arlington & Fairfax Co - 7 locations)			X		varies	2007	0.0012	0.0081	0.0011	0.0071	0.0006	0.0031	0.0006	0.0026	C
70	X	1995-00	VDOT	Improved Acceess to Metrorail Stations (VRE 2 Stn)			X		varies	2000-2012	0.0001	0.0002	0.0003	0.0004	0.0002	0.0002	0.0001	0.0002	C
71	X	1995-00	VDOT	I-66 HOV access at Monument Dr.	X					1997	0.0060	0.0095	0.0027	0.0042	0.0032	0.0036	0.0029	0.0030	C
72	X	1995-00	DC	Bicycle Facilities		X					0.0143	0.0095	0.0132	0.0084	0.0077	0.0036	0.0069	0.0030	C
73	X	1995-00	REGION	COG Regional Ridesharing Support	X					on-going	0.0739	0.1322	0.0679	0.1169	0.0403	0.0502	0.0367	0.0426	C
74	X	1995-00	REGION	M-47 Integrated Ridesharing	X					on-going	0.0396	0.0698	0.0364	0.0617	0.0216	0.0265	0.0196	0.0224	C
75	X	1995-00	REGION	M-92 Telecommuting Support	X					on-going	0.0661	0.1097	0.0608	0.0969	0.0358	0.0417	0.0324	0.0352	C
77		1996-01	VDOT	Duke Street Pedestrian Bridge	X				2005	2007			n/a	n/a	n/a	n/a	n/a	n/a	-
79	X	1996-01	VDOT	Fairfax County Bus Shelters (30 shelters with project #85)			X		1999	Summer 200	0.0012	0.0014	0.0011	0.0013	0.0006	0.0005	0.0006	0.0005	C
81	X	1996-01	VDOT	Arlington County Metrocheck Program	X				1997	1997 Onwards	0.0012	0.0014	0.0011	0.0013	0.0006	0.0005	0.0006	0.0005	C
82	X	1996-01	VDOT	Old Dominion Drive Bike Trail			X		2000	2008	0.0006	0.0005	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	C
83	X	1996-01	WMATA	Bus Replacement (see line 58, above)	X					1998	Credit taken in line 58, above								SP
85	X	1996-01	VDOT	Fairfax County Bus Shelters (30 shelters with project #79)	X				1999	2001	0.0006	0.0005	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	C

TERM TRACKING SHEET
TRANSPORTATION EMISSION REDUCTION MEASURES
Part A - Daily Ozone Precursor Emissions

* Project Category: TR - Traffic Stream, C - Commute, H - Heavy Duty Vehicles (Engine Technology), SP- Specific Vehicle Type, TCM - Transportation Control Measures

NOs	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	IMPLEMENTATION STATUS				ORIGINAL COMPLETION DATE	ACTUAL COMPLETION DATE	2009		2010		2020		2030		Project Category *
					FULL	SCALED-BACK	UNDER-WAY	REM			VOC	NOX	VOC	NOX	VOC	NOX	VOC	NOX	
90	X	1996-01	REGION	M-47c Employer Outreach / Guaranteed Ride Home	X					on-going	0.5083	0.8164	0.4676	0.7218	0.2740	0.3101	0.2473	0.2616	C
91	X	1996-01	REGION	M-70a Bicycle Parking			X		1999		0.0042	0.0033	0.0038	0.0029	0.0022	0.0013	0.0020	0.0011	C
92	X			M-92 Telecommuting Support [1]	Combined with item #75														C
95	X	1997-02	MCG	Germantown Transit Center	X				2005		0.0030	0.0090	0.0027	0.0080	0.0016	0.0034	0.0014	0.0029	C (TCM)
102	X	1997-02	PG	Prince George's County Bus Replacement	X				1998	1998	0.0030	0.0090	0.0030	0.0090					SP (TCM)
106	X	1997-02	VDOT	PRTC Employer Commuting Outreach Program	X					1977 on-going	0.0012	0.0002	0.0011	0.0002	0.0006	0.0001	0.0006	0.0001	C
107	X	1997-02	VDOT	PRTC Multimodal Strategic Marketing Implementation Plan	X					1977 on-going	0.0000	0.0002	0.0000	0.0002	0.0000	0.0001	0.0000	0.0001	C
108	X	1997-02	MDOT	M-103 Taxicab Replacement in Maryland [2]	x				2005	Stopped	0.0797	0.2675	0.0797	0.2675	0.1340	0.1827	0.3120	0.4810	SP
109	X	1997-02	REGION	M-70b Employer Outreach for Bicycles	X				1998	on going	0.0013	0.0018	0.0012	0.0016	0.0007	0.0007	0.0006	0.0006	C
110		1997-02	VDOT	M-77b Vanpool Incentive Programs in Virginia				X	1999	delayed	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	C
111	X	1998-03	WMATA	Bus Replacement (108 buses)	X				1999	1999	0.0450	0.1617	0.0450	0.1617					SP
112	X	1998-03	MCG	Montgomery County Bus Replacement	X					Ongoing	0.0080	0.0270	0.0080	0.0270					SP
113	X	1998-03	PG	Prince George's County Bus Replacement	X				1998	Ongoing	0.0010	0.0020	0.0010	0.0020					SP
114	X	1998-03	FDC	Frederick County Bus Replacement	X						0.0010	0.0000	0.0010	0.0000					SP
117	X	1998-03	VDOT	Arlington County Four Mile Run Bike Trail			X		1999	2009	-	-	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	C
118	X	1998-03	VDOT	Northern Virginia Turn Bays	X				2000	1998	0.0006	0.0009	0.0006	0.0008	0.0003	0.0003	0.0003	0.0002	TR
119	X	1998-03	VDOT	Fairfax City Bus Replacement	X				2001	2003	n/a	n/a	n/a	n/a					SP
121	X	1998-03	WMATA	WMATA Bus Replacement (252 buses)	X				2001	2001	0.1060	0.3860	0.1060	0.3860					SP
122	X	97 & 98 TIP	REGION	M-101a Mass Marketing Campaign (Consumer)			X			2005	0.0402	0.0647	0.0370	0.0572	0.0217	0.0246	0.0196	0.0208	C
123	X	1999-04	MDOT	Various Park and Ride Lots(I-270/MD124, 450 & I-170/MD-75, 54 spaces)		X			2001/1999	2001	0.0048	0.0171	0.0044	0.0151	0.0026	0.0065	0.0023	0.0055	C
124	X	1999-04	MDOT	Signal Systems (197/MD-198, MD-382 TO US-301,US301)	X				2000	2002	0.0074	-0.0019	0.0068	-0.0016	0.0040	-0.0005	0.0036	-0.0004	TR
125	X	1999-04	VDOT	Transit Center at 7 Corners	X				2002	2001	0.0006	0.0009	0.0005	0.0008	0.0003	0.0004	0.0003	0.0003	C
126	X	1999-04	VDOT	Falls Church Clean Diesel Bus Service	X				2000	2003	0.0040	0.0050	0.0040	0.0050					SP
127	X	1999-04	VDOT	VA 234 Bike Trail			X		2001	2008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	C
128	X	1999-04	VDOT	PRTC Ridesharing	X				on-going	2000 ongoing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	C
130	X	1996-01	VDOT	M-14: I-66 Feeder Bus Fare Buy Down	X					1998 onward	0.0149	0.0261	0.0137	0.0231	0.0080	0.0099	0.0072	0.0084	C
131	X	2000-05	MDOT	Various park and Ride Lots	x				2002	2003	0.0041	0.0154	0.0038	0.0136	0.0022	0.0059	0.0020	0.0049	C
132	X	2000-05	MDOT	Signal Systems	X				Varies	on-going	0.0018	0.0000	0.0017	0.0000	0.0015	0.0000	0.0009	0.0000	TR
133	X	2000-05	VDOT	250 Spaces at Gambrill/Hooes Rds. Park and Ride	X				2002	2004	0.0042	0.0085	0.0038	0.0076	0.0022	0.0032	0.0020	0.0027	C
134	X	2000-05	VDOT	300 Spaces at Backlick Rd	X				2003	2007	0.0030	0.0062	0.0027	0.0055	0.0016	0.0023	0.0014	0.0020	C
135	X	2000-05	VDOT	Accotink-Gateway Connector Trail	X				2002	2005	0.0042	0.0047	0.0038	0.0042	0.0022	0.0018	0.0020	0.0015	C
136	X	2000-05	VDOT	Columbia Pike Trail			X		2000	Summer 2009			0.0033	0.0034	0.0019	0.0014	0.0017	0.0012	C
137	X	2000-05	VDOT	Lee Highway trail			X		2000	2007	0.0018	0.0019	0.0016	0.0017	0.0010	0.0007	0.0009	0.0006	C
138	X	2000-05	VDOT	Arlington Bus Shelter Improvements	X				2005	2005	0.0006	0.0005	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	C
139	X	2000-05	VDOT	Pentagon Metrostation Improvements	X					2003	0.0048	0.0081	0.0044	0.0071	0.0026	0.0031	0.0023	0.0026	C

* Project Category: TR - Traffic Stream, C - Commute, H - Heavy Duty Vehicles (Engine Technology), SP- Specific Vehicle Type, TCM - Transportation Control Measures

NOs	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	IMPLEMENTATION STATUS FULL	SCALED-BACK	UNDER-WAY	REM	ORIGINAL COMPLETION DATE	ACTUAL COMPLETION DATE	2009 VOC	2009 NOX	2010 VOC	2010 NOX	2020 VOC	2020 NOX	2030 VOC	2030 NOX	Project Category *
140	X	2000-05	MDOT	East/West Intersection Improvements			X		2005	2005	0.0245	0.0119	0.0225	0.0105	0.0132	0.0045	0.0118	0.0038	C
141	X	2001-06	Feds	Federal Transit/Ridesharing subsidy	X				on-going		0.0610	0.0907	0.0561	0.0802	0.0327	0.0344	0.0294	0.0290	C
142	X	2002-07	WMATA	100 CNG buses	X				2002		0.0000	0.1358	0.0000	0.1358					SP (TCM)
143	X	2002-07	WMATA	ULSD with CRT filters	X				2006	Jun-06	0.2100	0.0000	0.2100	0.0000	0.4300	0.0000	0.4300	0.0000	H (TCM)
144		2003-08	DC	Replace 23 12 Taxicabs with CNG cabs				X	2005	2006	0.0089	0.0157	0.0089	0.0157					H
145	X	2003-08	DC	D.C.Incident Response & TrafficManagement System	X				2005	2004	0.0170	0.0468	0.0156	0.0403	0.0092	0.0127	0.0100	0.0168	TR
146	X	2003-08	DC	Bicycle Lane in D. C. (35 Mile)			X		2005	2008	0.0099	0.0085	0.0091	0.0075	0.0053	0.0032	0.0048	0.0027	C (TCM)
147	X	2003-08	DC	Bicycle Racks in D. C. (500)	X				2005	2004	0.0014	0.0010	0.0013	0.0008	0.0007	0.0004	0.0007	0.0003	C (TCM)
148	X	2003-08	DC	External Bicycle Racks on WMATA Buses in D. C. (600)	X				2005	2003	0.0020	0.0031	0.0019	0.0027	0.0011	0.0012	0.0010	0.0010	C (TCM)
149		2003-08	DC	CNG Rental Cars (18)				X	2005		0.0000	0.0002	0.0000	0.0002					SP
150	X	2003-08	DC	Sidewalks in D.C. ($ 5 million)	X				2005	2004	0.0374	0.0556	0.0344	0.0492	0.0201	0.0211	0.0180	0.0178	C
151	X	2003-08	DC	CNG Refuse Haulers (2)	X				2005	2004	0.0001	0.0020	0.0001	0.0020					H (TCM)
152	X	2003-08	DC	Circulator /Feeder Bus Routes	X				2005	2003	0.0136	0.0201	0.0125	0.0177	0.0073	0.0076	0.0066	0.0064	C
153	X	2003-08	MDOT	Commuter Tax Credit	X				2005	n/a	0.0816	0.1225	0.0751	0.1083	0.0438	0.0465	0.0394	0.0392	C
155		2003-08	MDOT	Employer Vanpool Program (WWB)			X		2005		0.0019	0.0041	0.0018	0.0037					C
156	X	2003-08	MDOT	Green Line Link			X		2005	n/a	0.0027	0.0047	0.0025	0.0041	0.0014	0.0018	0.0013	0.0015	C
157	X	2003-08	MDOT	Park & Ride Lots - Southern Maryland			X		2005	2005	0.0052	0.0109	0.0048	0.0096	0.0028	0.0041	0.0025	0.0035	C
158	X	2003-08	MDOT	Prince George's County- Bus Exp			X		2005	n/a	0.0374	0.0657	0.0344	0.0581	0.0201	0.0250	0.0181	0.0210	C
159	X	2003-08	MDOT	MTA - Bus Service Expansion			X		2005	n/a	0.0085	0.0157	0.0078	0.0139	0.0045	0.0060	0.0041	0.0050	C
160	X	2003-08	MDOT	Ride- On - Super Discount			X		2005	n/a	0.0010	0.0014	0.0009	0.0013	0.0005	0.0005	0.0005	0.0005	C
161	X	2003-08	Regional	Regional Traveler Information Systems			X		2005		0.1067	0.6106	0.0984	0.5250	0.0579	0.1656	0.0522	0.1156	TR
162	X	2003-08	MDOT	Universal Transportation Access (MD + WMATA)			X		2005	n/a	0.0168	0.0249	0.0154	0.0220	0.0090	0.0095	0.0081	0.0080	C
163	X	2003-08	MCG	Construction of 1300 additional Parking Spaces at Grosvenor Metro Garage	X					2004	0.0048	0.0105	0.0044	0.0092	0.0026	0.0040	0.0025	0.0036	C (TCM)
164	X	2003-08	MCG	Bethesda Shuttle Bus Services	X					2004	0.0032	0.0048	0.0030	0.0042	0.0017	0.0018	0.0016	0.0015	C
165	X	2003-08	MCG	External Bicycle Racks on Ride-On Buses in Montgomery County	X					2004	0.0006	0.0010	0.0006	0.0009	0.0003	0.0004	0.0003	0.0003	C
166	X	2003-08	MCG	New CNG Powered Light Duty Vehicle fleet in the County	X					2004	0.0000	0.0001	0.0000	0.0001					SP
167	X	2003-08	MCG	Free Bus Service on Selected Routes on I-270	X					2004	0.0011	0.0017	0.0010	0.0015	0.0006	0.0006	0.0005	0.0005	C
168	X	2003-08	MCG	Annual Sidewalk Program	X					2004	0.0178	0.0265	0.0164	0.0234	0.0096	0.0101	0.0086	0.0085	C
169		2003-08	MDOT	Bethesda Breeze/International Express Metrobus				X	2005	Removed	0.0039	0.0053	0.0036	0.0047	0.0021	0.0020	0.0019	0.0017	C
170		2003-08	MDOT	Bethesda-8, Silver Spring Downtown Dasher and Prince Georges Co. Shuttles at 3 PNR lot				X	2005	Removed	0.0092	0.0104	0.0085	0.0092	0.0049	0.0040	0.0044	0.0033	C
171		2003-08	MDOT	Proposed Transportation Management District in Montgomery County (Rockville and Gaithersburg)				X	2005	Removed	0.0060	0.0078	0.0055	0.0069	0.0032	0.0030	0.0029	0.0025	C
172	X	2003-08	MDOT	Sidewalks (Bikes/Pedestrian) at / near Rail Stations	X				2005	2002	0.0097	0.0147	0.0089	0.0130	0.0052	0.0056	0.0047	0.0047	C
173	X	2003-08	MDOT	Neighborhood Sidewalks Improvements (Bike/Pedestrian)	X				2005	2004	0.0034	0.0017	0.0031	0.0015	0.0018	0.0006	0.0016	0.0005	C
174	X	2003-08	MDOT	Neighborhood Conservation Program - Neighborhood Sidewalks Improvements (Bikes/Pedestrian)		X			2005	Ongoing	0.0030	0.0014	0.0027	0.0013	0.0016	0.0005	0.0014	0.0005	C
175	X	2003-08	MDOT	Maryland bus Transit Service Expansion	X				2005	2004	0.0147	0.0323	0.0135	0.0286	0.0079	0.0123	0.0071	0.0103	C

* Project Category: TR - Traffic Stream, C - Commute, H - Heavy Duty Vehicles (Engine Technology), SP- Specific Vehicle Type, TCM - Transportation Control Measures

NOs	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	IMPLEMENTATION STATUS FULL	SCALED-BACK	UNDER-WAY	REM	ORIGINAL COMPLETION DATE	ACTUAL COMPLETION DATE	2009 VOC	NOX	2010 VOC	NOX	2020 VOC	NOX	2030 VOC	NOX	Project Category *
176	X	2003-08	VDOT	Universal Transportation Access Program	X				2005	2005-07	0.0012	0.0019	0.0011	0.0017	0.0007	0.0007	0.0006	0.0006	C
177	X	2003-08	VDOT	Interactive Rideshare & Kiosk Initiative			X		2008 onward		0.0004	0.0007	0.0004	0.0006	0.0002	0.0003	0.0002	0.0002	C
178	X	2003-08	VDOT	Mobile Commuter Stores	X				2005	2005	0.0022	0.0039	0.0021	0.0035	0.0012	0.0015	0.0011	0.0013	C
179	X	2003-08	VDOT	Telework Incentive Program (Telework VA)[1]	X				2005	Fall 2006	0.0008	0.0012	0.0007	0.0011	0.0004	0.0005	0.0004	0.0004	C
180	X	2003-08	VDOT	Commuter Choice	X				2005		0.0010	0.0014	0.0009	0.0012	0.0005	0.0005	0.0005	0.0004	C
181	X	2003-08	VDOT	Employer Shuttle Services				X	2005		0.0119	0.0166	0.0109	0.0147	0.0064	0.0063	0.0057	0.0053	C
184	X	2003-08	VDOT	Van Start / Van Save	X				2005	till 2006	0.0015	0.0026	0.0013	0.0023					C
185	X	2003-08	VDOT	Metro Shuttle Bus			X		2005	1999-2005	0.0012	0.0026	0.0011	0.0023	0.0007	0.0010	0.0006	0.0008	C
187	X	2003-08	VDOT	VRE Mid-Day Train Service	X				2005	2002	0.0016	0.0029	0.0015	0.0026	0.0009	0.0011	0.0008	0.0009	C
190	X	2003-08	VDOT	Employer Vanpool Program (Bridge deck)	X				2005	2004 - 2008	0.0010	0.0019							C
191	X	2003-08	VDOT	Town of Leesburg P&R Lot			X		2005	early 2009			0.0018	0.0035	0.0011	0.0015	0.0010	0.0013	C
192	X	2003-08	VDOT	District-wide P&R Lots	X				2005	2001-2005	0.0118	0.0224	0.0108	0.0198	0.0063	0.0085	0.0057	0.0072	C
193	X	2003-08	VDOT	Additional Parking at 4 Metro stations	X				2005	2005	0.0152	0.0334	0.0140	0.0295	0.0082	0.0127	0.0073	0.0107	C
196	X	2003-08	WMATA	64 CNG Buses (Purchased in 2001)	X				2005	2004	0.0021	0.0870	0.0021	0.0870					SP (TCM)
197	X	2003-08	WMATA	250 CNG Buses (175 buses by Dec. 2004; 75 buses by mid 2006)	X				2005	Jun-06	0.0083	0.3400	0.0083	0.3400					SP
198	X	2003-08	WMATA	60 Engine Replacement (MY 1992 & 1993 MY buses)	X				2004	2004	0.0138	0.0755	0.0138	0.0755					SP
199	X	2003-08	WMATA	Car Sharing Program	X				2005	2004	0.0008	0.0018	0.0008	0.0016	0.0004	0.0007	0.0004	0.0006	C
200	X	2003-08	WMATA	Bikes Racks on WMATA Buses in VA (372 Bike Racks)	X				2005	2004	0.0013	0.0019	0.0012	0.0017	0.0007	0.0007	0.0006	0.0007	C (TCM)
202		2003-08	MDOT	Fleet Replacement (state auto fleet, gas to hybrid, 250 vehicles)				X	2005		0.0055	0.0133	0.0055	0.0133	0.0055	0.0133			SP
203	X	2003-08	MDOT	Replace 55 Montgomery County 10 yr. old buses w/ new CNG buses			X		2005	Ongoing	0.0459	0.1628	0.0459	0.1628	0.0459	0.1628			SP
204		2003-08	MDOT	Neighborhood Bus Shuttle (5 circulator routes)				X	2005		0.0078	0.0122	0.0072	0.0108	0.0042	0.0046	0.0038	0.0039	C
205	X	2003-08	MDOT	New Surface Parking at Transit Centers (500 spaces)			X		2005	2005	0.0027	0.0060	0.0025	0.0053	0.0015	0.0023	0.0013	0.0019	C
206		2003-08	MDOT	Additional Bike Lockers at Metro-Stations				X	2005		0.0138	0.0209	0.0127	0.0185	0.0074	0.0079	0.0067	0.0067	C
207	X	2003-08	MDOT	Bike Facilities at PnR Lots or other similar location			X		2005	2005	0.0097	0.0166	0.0089	0.0147	0.0052	0.0063	0.0047	0.0053	C
208		2003-08	MDOT	CNG Fueling Stations				X	2005		0.1270	0.1170	0.1270	0.1170					SP
209		2003-08	MDOT	Gas cap replacements (ROP Credit)				X	2005		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	SP
210		2003-08	MDOT	Gas can turnover (ROP Credit)				X	2005		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	SP
211	X	2003-08	MDOT	External Bicycle Racks on WMATA Buses (486 MD buses)	X				2005	2002	0.0015	0.0022	0.0013	0.0020	0.0008	0.0008	0.0007	0.0007	C (TCM)
212		2003-08	MDOT	Bike \ Pedestrian Trail - Anacostia River Walk			X		2005	Ongoing	0.0006	0.0005	0.0006	0.0004	0.0003	0.0002	0.0003	0.0001	C
213		2003-08	MDOT	Transit Prioritization - Queue Jumps				X	2005		0.0032	0.0037	0.0030	0.0033	0.0017	0.0014	0.0016	0.0012	C
214	X	2003-08	MDOT	Commuter Choice Benefit/Tax Credit - Marketing Expansion	X				2005	Ongoing	0.0570	0.0860	0.0525	0.0761	0.0306	0.0327	0.0275	0.0275	C
215	X	2003-08	MDOT	Improvements to Pedestrian Access in TOD areas (4 locations)			X		2005	Ongoing	0.0062	0.0087	0.0057	0.0077	0.0033	0.0033	0.0030	0.0028	C
216	X	2003-08	MDOT	Telecommuting Expansion[1]	X				2005	Ongoing	0.0673	0.1210	0.0620	0.1070	0.0362	0.0460	0.0325	0.0387	C
217		2003-08	MDOT	Replace older Diesel Engine in Public Sector vehicles				X	2005		0.0237	0.1300	0.0237	0.1300					H
218	X	2003-08	VDOT	MV-92 Telecommuting Program - Expanded[1]	X				2005	2005	0.0719	0.1292	0.0662	0.1143	0.0386	0.0491	0.0347	0.0413	C

* Project Category: TR - Traffic Stream, C - Commute, H - Heavy Duty Vehicles (Engine Technology), SP- Specific Vehicle Type, TCM - Transportation Control Measures

NOs	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	IMPLEMENTATION STATUS				ORIGINAL COMPLETION DATE	ACTUAL COMPLETION DATE	2009		2010		2020		2030		Project Category *
					FULL	SCALED-BACK	UNDER-WAY	REM			VOC	NOX	VOC	NOX	VOC	NOX	VOC	NOX	
219	X	2003-08	VDOT	MV-123 Employer Outreach for Public Sector Employees [2]	X				2005	2003	0.0160	0.0237	0.0147	0.0210	0.0086	0.0090	0.0077	0.0076	C
220	X	2003-08	REGION	Signal System Optimization	X				2005	2005	0.4505	0.1707	0.4155	0.1468	0.2445	0.0463	0.2204	0.0323	TR
221		2007-12	MDOT	Two P & R Lots in Frederick County (70 spaces)	X				2007	2008	0.0006	0.0012	0.0006	0.0011	0.0003	0.0005	0.0003	0.0004	C
				Available Emissions Credits							2.598	5.059	2.441	4.676	1.475	1.165	1.332	0.821	

TRANSPORTATION EMISSION REDUCTION MEASURES (CLRP Projects Only)
Part A - Daily Ozone Precursor Emissions

Project Category: TR - Traffic Stream, C - Commute, H - Engine Technology (Heavy Dudy Vehicles), SP- Specific Vehicle Type

NOs	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	FULL	SCALED-BACK	UNDER-WAY	REM	PROJECTED COMPLETION DATE	ACTUAL COMPLETION DATE	2010 VOC	2010 NOx	2020 VOC	2020 NOx	2030 VOC	2030 NOx	Project Category
221	X	1995-00 TIP	REGION	M-24 Speed Limit Adherence					2010		-0.0146	0.5364	-0.0042	0.2365	0.0010	0.0739	TR
222		1996-01 TIP	MGC	Rock Spring Park Pedestrian Amenities				X			0.0010	0.0040	0.0000	0.0000	0.0000	0.0000	-
223	X	1996-01 TIP	MGC	Olney Transit Center Park and Ride					2015		0.0020	0.0080	0.0009	0.0030	0.0003	0.0007	C
224	X	1996-01 TIP	MGC	Damascus Park and Ride						2003	0.0010	0.0040	0.0004	0.0015	0.0001	0.0003	C
225	X	1996-01 TIP	DC	M-103 Taxicab Replacement (DC)					2015		0.0000	0.0000	0.1745	0.3000	0.3490	0.6000	H
226	X	STADIUM ANALYSIS		M-103 Taxicab Replacement (MD)				X	2008		0.0000	0.0000	0.1560	0.2400	0.1560	0.2400	H
227	X	1997-02 TIP	MDOT	Shady Grove West Transit Center Park and Ride				X			0.0000	0.0100	0.0000	0.0038	0.0000	0.0009	C
228	X	1997-02 TIP	MGC	Olney Transit Center Park and Ride					2015		0.0000	0.0000	0.0004	0.0012	0.0003	0.0007	C
229	X	1997-02 TIP	MGC	White Oak Park and Ride					2008		0.0000	0.0200	0.0000	0.0076	0.0000	0.0017	C
230	X	1997-02 TIP	MGC	Damascus Park and Ride						2003	0.0000	0.0000	0.0002	0.0005	0.0001	0.0003	C
231	X	1997-02 TIP	MGC	Four Corners Transit Center					2015		0.0000	0.0010	0.0000	0.0004	0.0000	0.0001	C
232		1997-02 TIP	MGC	Burtonsville Transit Center				X			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-
233	X	1997-02 TIP	MGC	Silver Spring Transit Access							0.0000	0.0010	0.0000	0.0003	0.0000	0.0002	C
234	X	1997-02 TIP	MGC	Shady Grove Parking Construction						2003	0.0050	0.0190	0.0021	0.0072	0.0007	0.0017	C

PLAN TOTAL							-0.0066	0.5894	0.1743	0.5583	0.3516	0.6804

GRAND TOTAL (Current Measures + CLRP plan)							2.435	5.265	1.649	1.723	1.683	1.501

DEFINITIONS: Project Numbers implemented fully prior to 2000 were removed from the TERM Tracking Sheet

CREDIT TAKEN (X means emissions reduction credits taken):
TIP - Emissions credits are taken for projects being implemented, according to the progress reporting schedules provided by
the implementing agencies (contained in Appendix J of Conformity Document). No credit has been taken for projects in which only some components of the
measure have been implemented.
CLRP - Credit is taken for each of these elements of the CLRP according to the schedule provided by the implementing agency.

IMPLEMENTATION STATUS:
FULL = project is completed as planned at the time of analysis.
SCALED BACK = project is completed, but at a different level than assumed at the time of analysis (i.e., purchased 50 buses instead of 100)
UNDERWAY = project is not complete, but is close enough that credit may be taken (i.e., under construction, NOT just out for bid)
REMOVED = project no longer expected to be implemented or constructed

COMPLETION DATE:
PROJECTED = project completion date originally expected (i.e., at time of emissions analysis)
ACTUAL = actual year project was open for use, or expected to be open for use if under construction

REMOVED
projects   Emissions credits are not counted in toal available emissions credits
1   Line items 218, 216, 179, 92 are all credited as part of M-92 Regional Telecommute Support TERM, line item # 75
2   Line item 108 & 219 credits are taken only for year 2010