

APPENDIX - A

TRANSPORTATION EMISSIONS REDUCTION MEASURES (TERMs) ANALYSIS INSTRUCTIONS

Call for Projects

**For the 2010 Financially Constrained Long Range
Plan (CLRP) and Fiscal Year 2011-2016
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 2010 CLRP and FY 2011 - 2016 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 traffic stream (all vehicle types), such as the Signal Optimization TERM, will continue to be analyzed using a regional composite vehicle emissions factor. Tables 2, 3, and 4 display emissions factors for analysis years 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 commute 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 5, 6, and 7 display emissions factors for commuting vehicle trips for analysis years 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 heavy duty diesel 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 specific vehicle type, 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 8.

Tables 2 through 7 show Cold Start, Running, Hot Soak emissions factors for VOC and NOx for the analysis years 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 8 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 9 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 10 provides the Mobile 6 vehicle classifications. Tables 11, 12, and 13 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 purposes 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

$$\text{Emissions} = \text{Start-up emissions} + \text{Running emissions} + \text{Soak emissions}$$

$$\text{Start-up emissions} = \text{Vehicle Trip Origin} \times \text{Start-up emissions rate (Cold start in Grams/Trip)}$$

$$\text{Running emissions} = \text{VMT} \times \text{Running emissions rate (Grams/Mile)}$$

$$\text{Hot Soak emissions} = \text{Trip Destination} \times \text{Hot Soak emission rate (Grams/Trip)}$$

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: 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	3.0852	3.0852	3.0852	1.5209	1.5638	1.5381
Running (g/mi)	2	3.0852	3.0852	3.0852	1.5209	1.5638	1.5381
Running (g/mi)	3	2.4189	2.4189	2.4189	1.4578	1.5003	1.4748
Running (g/mi)	4	1.5865	1.5865	1.5865	1.3785	1.4212	1.3956
Running (g/mi)	5	1.0870	1.0870	1.0870	1.3311	1.3738	1.3481
Running (g/mi)	6	0.9017	0.8928	0.8981	1.2462	1.2582	1.2510
Running (g/mi)	7	0.7691	0.7539	0.7630	1.1857	1.1756	1.1816
Running (g/mi)	8	0.6698	0.6499	0.6619	1.1403	1.1134	1.1295
Running (g/mi)	9	0.5927	0.5688	0.5832	1.1048	1.0653	1.0890
Running (g/mi)	10	0.5309	0.5041	0.5202	1.0766	1.0266	1.0566
Running (g/mi)	11	0.4889	0.4604	0.4775	1.0324	0.9767	1.0101
Running (g/mi)	12	0.4542	0.4244	0.4423	0.9956	0.9350	0.9713
Running (g/mi)	13	0.4244	0.3937	0.4121	0.9646	0.8997	0.9386
Running (g/mi)	14	0.3992	0.3676	0.3866	0.9378	0.8695	0.9105
Running (g/mi)	15	0.3773	0.3446	0.3642	0.9146	0.8433	0.8860
Running (g/mi)	16	0.3553	0.3271	0.3440	0.8915	0.8336	0.8683
Running (g/mi)	17	0.3361	0.3115	0.3263	0.8713	0.8253	0.8529
Running (g/mi)	18	0.3192	0.2977	0.3106	0.8533	0.8176	0.8390
Running (g/mi)	19	0.3037	0.2854	0.2964	0.8370	0.8110	0.8266
Running (g/mi)	20	0.2900	0.2742	0.2837	0.8224	0.8049	0.8154
Running (g/mi)	21	0.2789	0.2656	0.2736	0.8089	0.7991	0.8050
Running (g/mi)	22	0.2688	0.2578	0.2644	0.7968	0.7937	0.7955
Running (g/mi)	23	0.2595	0.2506	0.2559	0.7856	0.7890	0.7869
Running (g/mi)	24	0.2514	0.2440	0.2484	0.7752	0.7843	0.7788
Running (g/mi)	25	0.2435	0.2380	0.2413	0.7660	0.7802	0.7717
Running (g/mi)	26	0.2365	0.2318	0.2346	0.7584	0.7772	0.7659
Running (g/mi)	27	0.2302	0.2265	0.2287	0.7512	0.7748	0.7606
Running (g/mi)	28	0.2239	0.2212	0.2228	0.7444	0.7722	0.7555
Running (g/mi)	29	0.2186	0.2167	0.2179	0.7383	0.7698	0.7509
Running (g/mi)	30	0.2134	0.2121	0.2129	0.7325	0.7677	0.7466
Running (g/mi)	31	0.2084	0.2074	0.2080	0.7300	0.7668	0.7447
Running (g/mi)	32	0.2039	0.2030	0.2035	0.7273	0.7658	0.7427
Running (g/mi)	33	0.1995	0.1988	0.1992	0.7252	0.7650	0.7411
Running (g/mi)	34	0.1951	0.1950	0.1950	0.7229	0.7643	0.7395
Running (g/mi)	35	0.1916	0.1916	0.1916	0.7208	0.7637	0.7379
Running (g/mi)	36	0.1885	0.1885	0.1885	0.7243	0.7671	0.7414
Running (g/mi)	37	0.1857	0.1857	0.1857	0.7277	0.7703	0.7447
Running (g/mi)	38	0.1828	0.1828	0.1828	0.7310	0.7736	0.7480
Running (g/mi)	39	0.1806	0.1806	0.1806	0.7340	0.7767	0.7511
Running (g/mi)	40	0.1781	0.1781	0.1781	0.7368	0.7794	0.7538
Running (g/mi)	41	0.1757	0.1757	0.1757	0.7435	0.7861	0.7605
Running (g/mi)	42	0.1735	0.1735	0.1735	0.7498	0.7924	0.7669
Running (g/mi)	43	0.1716	0.1716	0.1716	0.7558	0.7987	0.7730
Running (g/mi)	44	0.1694	0.1694	0.1694	0.7618	0.8045	0.7789
Running (g/mi)	45	0.1675	0.1675	0.1675	0.7672	0.8099	0.7843
Running (g/mi)	46	0.1654	0.1654	0.1654	0.7773	0.8197	0.7942
Running (g/mi)	47	0.1635	0.1635	0.1635	0.7866	0.8292	0.8036
Running (g/mi)	48	0.1617	0.1617	0.1617	0.7957	0.8383	0.8127
Running (g/mi)	49	0.1599	0.1599	0.1599	0.8042	0.8472	0.8214
Running (g/mi)	50	0.1585	0.1585	0.1585	0.8128	0.8555	0.8299
Running (g/mi)	51	0.1569	0.1569	0.1569	0.8267	0.8693	0.8437
Running (g/mi)	52	0.1553	0.1553	0.1553	0.8401	0.8826	0.8571
Running (g/mi)	53	0.1539	0.1539	0.1539	0.8528	0.8956	0.8699
Running (g/mi)	54	0.1525	0.1525	0.1525	0.8653	0.9083	0.8825
Running (g/mi)	55	0.1513	0.1513	0.1513	0.8772	0.9200	0.8943
Running (g/mi)	56	0.1505	0.1505	0.1505	0.8965	0.9394	0.9137
Running (g/mi)	57	0.1498	0.1498	0.1498	0.9153	0.9581	0.9324
Running (g/mi)	58	0.1490	0.1490	0.1490	0.9332	0.9760	0.9503
Running (g/mi)	59	0.1485	0.1485	0.1485	0.9508	0.9934	0.9679
Running (g/mi)	60	0.1479	0.1479	0.1479	0.9677	1.0104	0.9848
Running (g/mi)	61	0.1472	0.1472	0.1472	0.9945	1.0376	1.0117
Running (g/mi)	62	0.1470	0.1470	0.1470	1.0208	1.0637	1.0379
Running (g/mi)	63	0.1465	0.1465	0.1465	1.0461	1.0889	1.0632
Running (g/mi)	64	0.1463	0.1463	0.1463	1.0708	1.1133	1.0878
Running (g/mi)	65	0.1458	0.1458	0.1458	1.0944	1.1372	1.1115

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.9825	0.5615
Hot Soak Loss (g/trip end)	0.5932	-
Hot Start (g/trip start, Light Duty Only)	0.1700	0.1240

Table 3: 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	1.6425	1.6425	1.6425	0.4819	0.4882	0.4844
Running (g/mi)	2	1.6425	1.6425	1.6425	0.4819	0.4882	0.4844
Running (g/mi)	3	1.2982	1.2982	1.2982	0.4603	0.4665	0.4628
Running (g/mi)	4	0.8676	0.8676	0.8676	0.4331	0.4393	0.4355
Running (g/mi)	5	0.6096	0.6096	0.6096	0.4168	0.4228	0.4192
Running (g/mi)	6	0.5096	0.5045	0.5076	0.3880	0.3816	0.3854
Running (g/mi)	7	0.4382	0.4291	0.4346	0.3676	0.3523	0.3615
Running (g/mi)	8	0.3850	0.3732	0.3803	0.3523	0.3303	0.3435
Running (g/mi)	9	0.3433	0.3293	0.3377	0.3402	0.3132	0.3294
Running (g/mi)	10	0.3101	0.2945	0.3038	0.3308	0.2995	0.3183
Running (g/mi)	11	0.2860	0.2696	0.2794	0.3161	0.2825	0.3026
Running (g/mi)	12	0.2663	0.2488	0.2593	0.3038	0.2682	0.2896
Running (g/mi)	13	0.2494	0.2313	0.2421	0.2935	0.2563	0.2786
Running (g/mi)	14	0.2350	0.2164	0.2275	0.2847	0.2460	0.2692
Running (g/mi)	15	0.2224	0.2033	0.2148	0.2770	0.2372	0.2611
Running (g/mi)	16	0.2096	0.1926	0.2028	0.2697	0.2352	0.2559
Running (g/mi)	17	0.1978	0.1835	0.1921	0.2632	0.2336	0.2513
Running (g/mi)	18	0.1875	0.1750	0.1825	0.2575	0.2320	0.2473
Running (g/mi)	19	0.1784	0.1675	0.1740	0.2523	0.2307	0.2436
Running (g/mi)	20	0.1703	0.1608	0.1665	0.2477	0.2294	0.2404
Running (g/mi)	21	0.1639	0.1558	0.1607	0.2433	0.2283	0.2373
Running (g/mi)	22	0.1582	0.1513	0.1554	0.2393	0.2273	0.2345
Running (g/mi)	23	0.1528	0.1472	0.1506	0.2360	0.2262	0.2321
Running (g/mi)	24	0.1482	0.1436	0.1464	0.2328	0.2252	0.2297
Running (g/mi)	25	0.1436	0.1400	0.1422	0.2298	0.2244	0.2276
Running (g/mi)	26	0.1395	0.1364	0.1383	0.2271	0.2237	0.2257
Running (g/mi)	27	0.1359	0.1333	0.1349	0.2248	0.2231	0.2241
Running (g/mi)	28	0.1324	0.1304	0.1316	0.2224	0.2227	0.2225
Running (g/mi)	29	0.1288	0.1274	0.1283	0.2204	0.2222	0.2211
Running (g/mi)	30	0.1258	0.1247	0.1253	0.2185	0.2216	0.2197
Running (g/mi)	31	0.1229	0.1222	0.1226	0.2175	0.2213	0.2190
Running (g/mi)	32	0.1201	0.1196	0.1199	0.2165	0.2210	0.2183
Running (g/mi)	33	0.1175	0.1172	0.1174	0.2155	0.2205	0.2175
Running (g/mi)	34	0.1151	0.1150	0.1150	0.2147	0.2203	0.2169
Running (g/mi)	35	0.1129	0.1129	0.1129	0.2139	0.2203	0.2165
Running (g/mi)	36	0.1111	0.1111	0.1111	0.2149	0.2213	0.2175
Running (g/mi)	37	0.1095	0.1095	0.1095	0.2159	0.2222	0.2184
Running (g/mi)	38	0.1078	0.1078	0.1078	0.2167	0.2232	0.2193
Running (g/mi)	39	0.1064	0.1064	0.1064	0.2176	0.2239	0.2201
Running (g/mi)	40	0.1049	0.1049	0.1049	0.2184	0.2248	0.2210
Running (g/mi)	41	0.1036	0.1036	0.1036	0.2203	0.2265	0.2228
Running (g/mi)	42	0.1021	0.1021	0.1021	0.2221	0.2283	0.2246
Running (g/mi)	43	0.1009	0.1009	0.1009	0.2237	0.2298	0.2261
Running (g/mi)	44	0.0996	0.0996	0.0996	0.2253	0.2315	0.2278
Running (g/mi)	45	0.0986	0.0986	0.0986	0.2268	0.2328	0.2292
Running (g/mi)	46	0.0975	0.0975	0.0975	0.2294	0.2356	0.2319
Running (g/mi)	47	0.0965	0.0965	0.0965	0.2318	0.2379	0.2343
Running (g/mi)	48	0.0955	0.0955	0.0955	0.2340	0.2401	0.2364
Running (g/mi)	49	0.0944	0.0944	0.0944	0.2362	0.2425	0.2387
Running (g/mi)	50	0.0935	0.0935	0.0935	0.2383	0.2448	0.2409
Running (g/mi)	51	0.0928	0.0928	0.0928	0.2418	0.2482	0.2444
Running (g/mi)	52	0.0922	0.0922	0.0922	0.2453	0.2515	0.2478
Running (g/mi)	53	0.0916	0.0916	0.0916	0.2484	0.2546	0.2509
Running (g/mi)	54	0.0908	0.0908	0.0908	0.2515	0.2578	0.2540
Running (g/mi)	55	0.0904	0.0904	0.0904	0.2547	0.2607	0.2571
Running (g/mi)	56	0.0902	0.0902	0.0902	0.2590	0.2655	0.2616
Running (g/mi)	57	0.0900	0.0900	0.0900	0.2636	0.2699	0.2661
Running (g/mi)	58	0.0900	0.0900	0.0900	0.2682	0.2742	0.2706
Running (g/mi)	59	0.0899	0.0899	0.0899	0.2721	0.2785	0.2746
Running (g/mi)	60	0.0899	0.0899	0.0899	0.2763	0.2824	0.2788
Running (g/mi)	61	0.0899	0.0899	0.0899	0.2828	0.2888	0.2852
Running (g/mi)	62	0.0899	0.0899	0.0899	0.2888	0.2949	0.2913
Running (g/mi)	63	0.0900	0.0900	0.0900	0.2948	0.3010	0.2973
Running (g/mi)	64	0.0901	0.0901	0.0901	0.3004	0.3066	0.3029
Running (g/mi)	65	0.0903	0.0903	0.0903	0.3060	0.3122	0.3085

Emission Type	VOC	NOx
start, Light Duty Only	0.5192	0.2163
Hot Soak Loss (g/trip end)	0.2842	-
Hot Start (g/trip start, Light Duty Only)	0.0949	0.0504

Table 4: 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	1.5585	1.5585	1.5585	0.3510	0.3510	0.3510
Running (g/mi)	2	1.5585	1.5585	1.5585	0.3510	0.3510	0.3510
Running (g/mi)	3	1.2306	1.2306	1.2306	0.3341	0.3341	0.3341
Running (g/mi)	4	0.8212	0.8212	0.8212	0.3131	0.3131	0.3131
Running (g/mi)	5	0.5757	0.5757	0.5757	0.3003	0.3003	0.3003
Running (g/mi)	6	0.4810	0.4765	0.4792	0.2786	0.2677	0.2742
Running (g/mi)	7	0.4137	0.4058	0.4105	0.2628	0.2445	0.2555
Running (g/mi)	8	0.3630	0.3527	0.3589	0.2513	0.2272	0.2416
Running (g/mi)	9	0.3239	0.3115	0.3190	0.2420	0.2134	0.2306
Running (g/mi)	10	0.2924	0.2783	0.2867	0.2348	0.2027	0.2219
Running (g/mi)	11	0.2697	0.2550	0.2638	0.2238	0.1897	0.2101
Running (g/mi)	12	0.2509	0.2354	0.2447	0.2143	0.1786	0.2000
Running (g/mi)	13	0.2350	0.2190	0.2286	0.2067	0.1696	0.1918
Running (g/mi)	14	0.2215	0.2050	0.2149	0.2000	0.1615	0.1846
Running (g/mi)	15	0.2098	0.1926	0.2029	0.1942	0.1548	0.1784
Running (g/mi)	16	0.1973	0.1821	0.1912	0.1889	0.1540	0.1750
Running (g/mi)	17	0.1863	0.1732	0.1811	0.1840	0.1534	0.1718
Running (g/mi)	18	0.1765	0.1653	0.1720	0.1798	0.1528	0.1690
Running (g/mi)	19	0.1677	0.1580	0.1638	0.1758	0.1524	0.1665
Running (g/mi)	20	0.1600	0.1514	0.1565	0.1727	0.1518	0.1643
Running (g/mi)	21	0.1540	0.1466	0.1511	0.1696	0.1513	0.1623
Running (g/mi)	22	0.1487	0.1427	0.1463	0.1666	0.1508	0.1603
Running (g/mi)	23	0.1436	0.1385	0.1416	0.1640	0.1504	0.1586
Running (g/mi)	24	0.1392	0.1350	0.1375	0.1617	0.1500	0.1570
Running (g/mi)	25	0.1350	0.1317	0.1337	0.1594	0.1495	0.1555
Running (g/mi)	26	0.1312	0.1282	0.1300	0.1574	0.1493	0.1542
Running (g/mi)	27	0.1275	0.1252	0.1266	0.1556	0.1492	0.1530
Running (g/mi)	28	0.1242	0.1222	0.1234	0.1540	0.1488	0.1519
Running (g/mi)	29	0.1208	0.1195	0.1203	0.1524	0.1485	0.1509
Running (g/mi)	30	0.1179	0.1169	0.1175	0.1510	0.1483	0.1499
Running (g/mi)	31	0.1153	0.1144	0.1149	0.1501	0.1481	0.1493
Running (g/mi)	32	0.1128	0.1123	0.1126	0.1493	0.1477	0.1486
Running (g/mi)	33	0.1103	0.1099	0.1101	0.1485	0.1475	0.1481
Running (g/mi)	34	0.1079	0.1078	0.1079	0.1477	0.1473	0.1475
Running (g/mi)	35	0.1056	0.1056	0.1056	0.1471	0.1471	0.1471
Running (g/mi)	36	0.1040	0.1040	0.1040	0.1477	0.1477	0.1477
Running (g/mi)	37	0.1023	0.1023	0.1023	0.1484	0.1484	0.1484
Running (g/mi)	38	0.1010	0.1010	0.1010	0.1490	0.1490	0.1490
Running (g/mi)	39	0.0995	0.0995	0.0995	0.1495	0.1495	0.1495
Running (g/mi)	40	0.0979	0.0979	0.0979	0.1500	0.1500	0.1500
Running (g/mi)	41	0.0965	0.0965	0.0965	0.1511	0.1511	0.1511
Running (g/mi)	42	0.0953	0.0953	0.0953	0.1523	0.1523	0.1523
Running (g/mi)	43	0.0942	0.0942	0.0942	0.1533	0.1533	0.1533
Running (g/mi)	44	0.0930	0.0930	0.0930	0.1542	0.1542	0.1542
Running (g/mi)	45	0.0918	0.0918	0.0918	0.1551	0.1551	0.1551
Running (g/mi)	46	0.0907	0.0907	0.0907	0.1567	0.1567	0.1567
Running (g/mi)	47	0.0897	0.0897	0.0897	0.1581	0.1581	0.1581
Running (g/mi)	48	0.0887	0.0887	0.0887	0.1594	0.1594	0.1594
Running (g/mi)	49	0.0878	0.0878	0.0878	0.1608	0.1608	0.1608
Running (g/mi)	50	0.0870	0.0870	0.0870	0.1621	0.1621	0.1621
Running (g/mi)	51	0.0863	0.0863	0.0863	0.1641	0.1641	0.1641
Running (g/mi)	52	0.0855	0.0855	0.0855	0.1659	0.1659	0.1659
Running (g/mi)	53	0.0851	0.0851	0.0851	0.1675	0.1675	0.1675
Running (g/mi)	54	0.0845	0.0845	0.0845	0.1693	0.1693	0.1693
Running (g/mi)	55	0.0839	0.0839	0.0839	0.1711	0.1711	0.1711
Running (g/mi)	56	0.0841	0.0841	0.0841	0.1735	0.1735	0.1735
Running (g/mi)	57	0.0837	0.0837	0.0837	0.1759	0.1759	0.1759
Running (g/mi)	58	0.0837	0.0837	0.0837	0.1783	0.1783	0.1783
Running (g/mi)	59	0.0836	0.0836	0.0836	0.1805	0.1805	0.1805
Running (g/mi)	60	0.0835	0.0835	0.0835	0.1826	0.1826	0.1826
Running (g/mi)	61	0.0838	0.0838	0.0838	0.1860	0.1860	0.1860
Running (g/mi)	62	0.0837	0.0837	0.0837	0.1893	0.1893	0.1893
Running (g/mi)	63	0.0837	0.0837	0.0837	0.1923	0.1923	0.1923
Running (g/mi)	64	0.0838	0.0838	0.0838	0.1953	0.1953	0.1953
Running (g/mi)	65	0.0839	0.0839	0.0839	0.1983	0.1983	0.1983

Emission Type	VOC	NOx
start, Light Duty Only)	0.4465	0.1524
Hot Soak Loss (g/trip end)	0.2164	-
Hot Start (g/trip start, Light Duty Only)	0.0832	0.0369

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

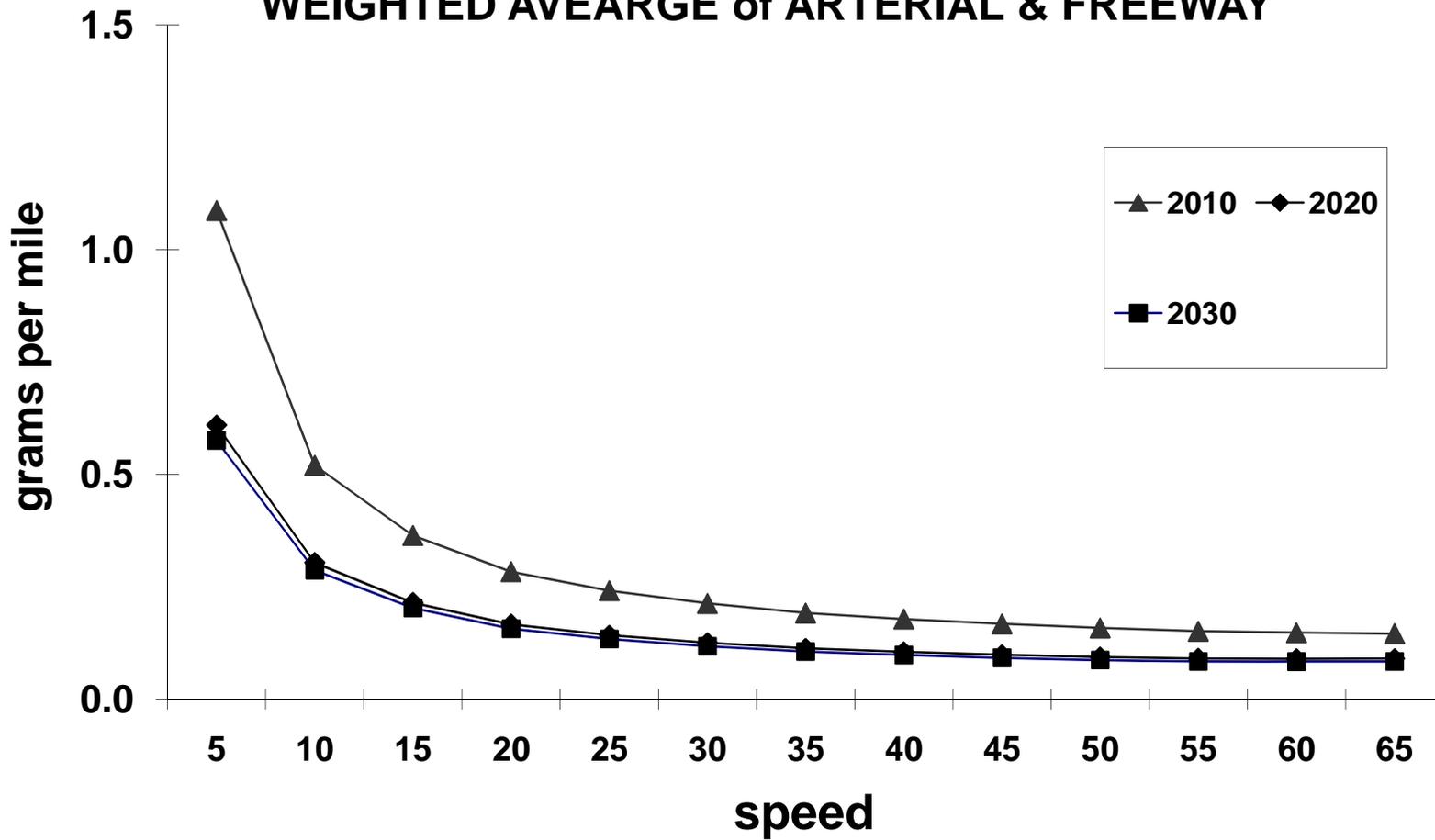


Exhibit - 2
NOx MOBILE6.2 RUNNING EMISSION RATES
TRAFFIC STREAM
FOR 2010, 2020 AND 2030
WEIGHTED AVERAGE of ARTERIAL & FREEWAY

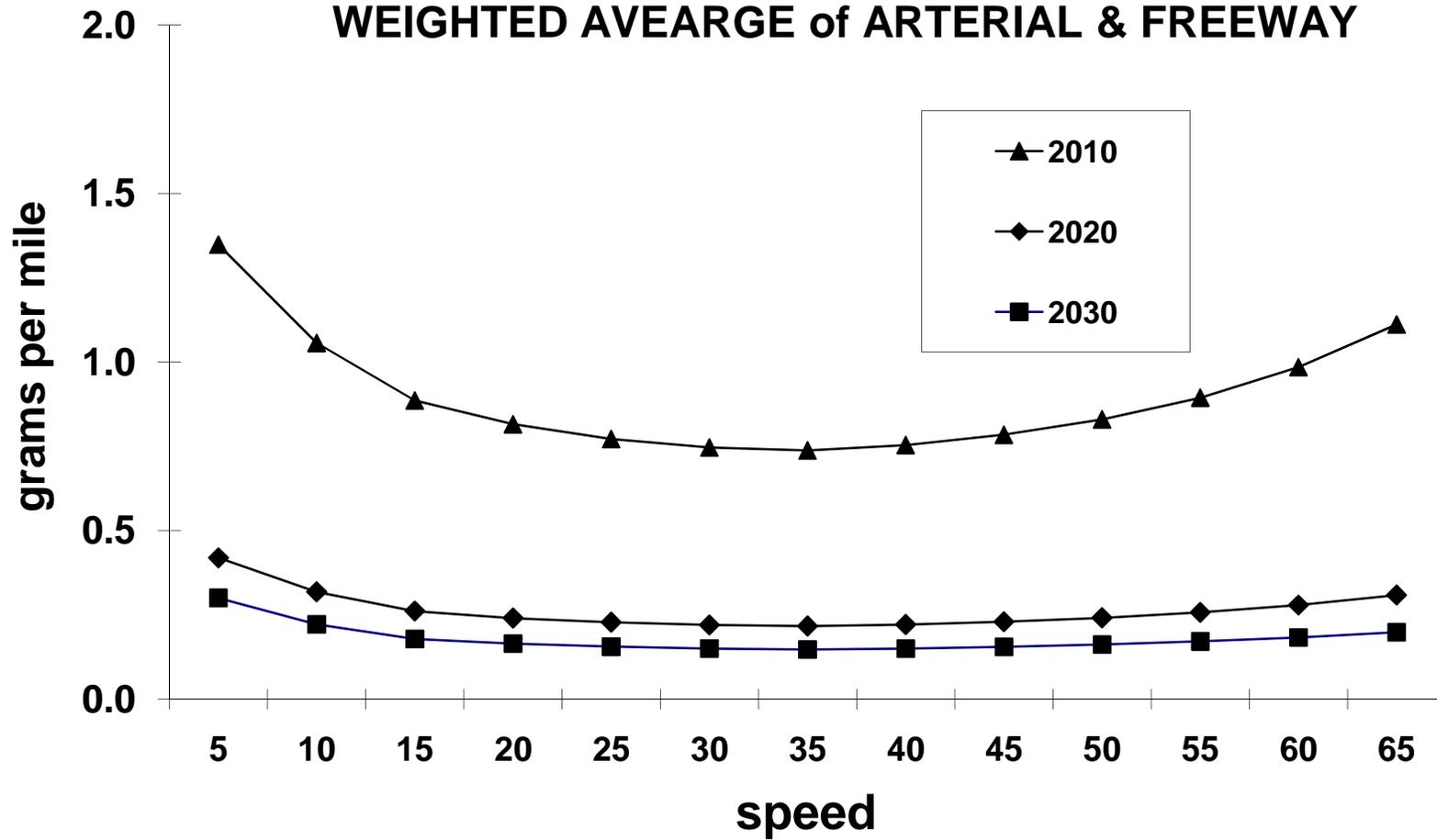


Table 5: 2010 Running, Cold Start, and Hot Soak Average Emissions Factors for "Commute"
TERMS
(Mobile 6.2)

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	3.1693	3.1693	3.1693	0.9193	0.9193	0.9193
Running (g/mi)	2	3.1693	3.1693	3.1693	0.9193	0.9193	0.9193
Running (g/mi)	3	2.4688	2.4688	2.4688	0.8728	0.8728	0.8728
Running (g/mi)	4	1.5934	1.5933	1.5933	0.8149	0.8148	0.8149
Running (g/mi)	5	1.0677	1.0677	1.0677	0.7803	0.7803	0.7803
Running (g/mi)	6	0.8780	0.8684	0.8742	0.7220	0.6883	0.7085
Running (g/mi)	7	0.7426	0.7257	0.7358	0.6803	0.6227	0.6573
Running (g/mi)	8	0.6412	0.6189	0.6323	0.6492	0.5734	0.6189
Running (g/mi)	9	0.5619	0.5360	0.5515	0.6252	0.5351	0.5891
Running (g/mi)	10	0.4988	0.4697	0.4872	0.6055	0.5045	0.5651
Running (g/mi)	11	0.4582	0.4272	0.4458	0.5763	0.4690	0.5334
Running (g/mi)	12	0.4245	0.3923	0.4116	0.5520	0.4393	0.5069
Running (g/mi)	13	0.3959	0.3623	0.3824	0.5315	0.4141	0.4845
Running (g/mi)	14	0.3715	0.3367	0.3576	0.5140	0.3927	0.4655
Running (g/mi)	15	0.3502	0.3147	0.3360	0.4985	0.3739	0.4487
Running (g/mi)	16	0.3296	0.2988	0.3173	0.4850	0.3750	0.4410
Running (g/mi)	17	0.3114	0.2844	0.3006	0.4727	0.3760	0.4340
Running (g/mi)	18	0.2953	0.2720	0.2860	0.4623	0.3768	0.4281
Running (g/mi)	19	0.2806	0.2606	0.2726	0.4526	0.3776	0.4226
Running (g/mi)	20	0.2678	0.2507	0.2610	0.4440	0.3783	0.4177
Running (g/mi)	21	0.2579	0.2433	0.2520	0.4360	0.3785	0.4130
Running (g/mi)	22	0.2487	0.2366	0.2439	0.4287	0.3788	0.4087
Running (g/mi)	23	0.2405	0.2306	0.2365	0.4222	0.3790	0.4049
Running (g/mi)	24	0.2329	0.2249	0.2297	0.4162	0.3792	0.4014
Running (g/mi)	25	0.2258	0.2198	0.2234	0.4103	0.3793	0.3979
Running (g/mi)	26	0.2198	0.2148	0.2178	0.4052	0.3793	0.3948
Running (g/mi)	27	0.2141	0.2100	0.2125	0.4004	0.3793	0.3920
Running (g/mi)	28	0.2087	0.2058	0.2076	0.3959	0.3793	0.3893
Running (g/mi)	29	0.2038	0.2016	0.2029	0.3917	0.3793	0.3867
Running (g/mi)	30	0.1996	0.1979	0.1989	0.3877	0.3793	0.3843
Running (g/mi)	31	0.1948	0.1938	0.1944	0.3851	0.3787	0.3825
Running (g/mi)	32	0.1909	0.1902	0.1906	0.3827	0.3779	0.3808
Running (g/mi)	33	0.1869	0.1864	0.1867	0.3802	0.3772	0.3790
Running (g/mi)	34	0.1830	0.1829	0.1830	0.3780	0.3767	0.3775
Running (g/mi)	35	0.1798	0.1798	0.1798	0.3760	0.3760	0.3760
Running (g/mi)	36	0.1773	0.1773	0.1773	0.3773	0.3773	0.3773
Running (g/mi)	37	0.1749	0.1749	0.1749	0.3788	0.3788	0.3788
Running (g/mi)	38	0.1728	0.1728	0.1728	0.3799	0.3799	0.3799
Running (g/mi)	39	0.1708	0.1708	0.1708	0.3810	0.3810	0.3810
Running (g/mi)	40	0.1688	0.1688	0.1688	0.3822	0.3822	0.3822
Running (g/mi)	41	0.1667	0.1667	0.1667	0.3843	0.3843	0.3843
Running (g/mi)	42	0.1648	0.1648	0.1648	0.3860	0.3860	0.3860
Running (g/mi)	43	0.1630	0.1630	0.1630	0.3877	0.3877	0.3877
Running (g/mi)	44	0.1612	0.1612	0.1612	0.3895	0.3895	0.3895
Running (g/mi)	45	0.1595	0.1595	0.1595	0.3911	0.3911	0.3911
Running (g/mi)	46	0.1576	0.1576	0.1576	0.3930	0.3930	0.3930
Running (g/mi)	47	0.1561	0.1561	0.1561	0.3950	0.3950	0.3950
Running (g/mi)	48	0.1544	0.1544	0.1544	0.3967	0.3967	0.3967
Running (g/mi)	49	0.1529	0.1529	0.1529	0.3986	0.3986	0.3986
Running (g/mi)	50	0.1513	0.1513	0.1513	0.4004	0.4004	0.4004
Running (g/mi)	51	0.1497	0.1497	0.1497	0.4024	0.4024	0.4024
Running (g/mi)	52	0.1484	0.1484	0.1484	0.4045	0.4045	0.4045
Running (g/mi)	53	0.1470	0.1470	0.1470	0.4064	0.4064	0.4064
Running (g/mi)	54	0.1458	0.1458	0.1458	0.4084	0.4084	0.4084
Running (g/mi)	55	0.1444	0.1444	0.1444	0.4103	0.4103	0.4103
Running (g/mi)	56	0.1438	0.1438	0.1438	0.4123	0.4123	0.4123
Running (g/mi)	57	0.1431	0.1431	0.1431	0.4146	0.4146	0.4146
Running (g/mi)	58	0.1425	0.1425	0.1425	0.4167	0.4167	0.4167
Running (g/mi)	59	0.1418	0.1418	0.1418	0.4186	0.4186	0.4186
Running (g/mi)	60	0.1415	0.1415	0.1415	0.4205	0.4205	0.4205
Running (g/mi)	61	0.1409	0.1409	0.1409	0.4230	0.4230	0.4230
Running (g/mi)	62	0.1405	0.1405	0.1405	0.4250	0.4250	0.4250
Running (g/mi)	63	0.1401	0.1401	0.1401	0.4272	0.4272	0.4272
Running (g/mi)	64	0.1398	0.1398	0.1398	0.4293	0.4293	0.4293
Running (g/mi)	65	0.1392	0.1392	0.1392	0.4313	0.4313	0.4313

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty	0.9825	0.5615
Hot Soak Loss (g/trip end)	0.5853	-
Hot Start (g/trip start, Light Duty	0.1700	0.1240

Table 6: 2020 Running, Cold Start, and Hot Soak Average Emissions Factors for "Commute"
TERMs
(Mobile 6.2)

Emission Type	Speed (mph)	Average 2020 Running Emission Factor (g/mi)					
		Arterial	Freeway	Weighted Factor VOC	Arterial	Freeway	Weighted Factor NOx
		VOC			NOx		
				Arterial - 60%, Freeway- 40%			Arterial - 60%, Freeway- 40%
Running (g/mi)	1	1.6873	1.6873	1.6873	0.3663	0.3663	0.3663
Running (g/mi)	2	1.6873	1.6873	1.6873	0.3663	0.3663	0.3663
Running (g/mi)	3	1.3233	1.3233	1.3233	0.3475	0.3475	0.3475
Running (g/mi)	4	0.8685	0.8685	0.8685	0.3241	0.3241	0.3241
Running (g/mi)	5	0.5957	0.5957	0.5957	0.3098	0.3098	0.3098
Running (g/mi)	6	0.4934	0.4875	0.4911	0.2860	0.2723	0.2805
Running (g/mi)	7	0.4200	0.4103	0.4161	0.2691	0.2455	0.2596
Running (g/mi)	8	0.3657	0.3527	0.3605	0.2561	0.2253	0.2437
Running (g/mi)	9	0.3230	0.3077	0.3169	0.2463	0.2096	0.2316
Running (g/mi)	10	0.2890	0.2717	0.2821	0.2383	0.1971	0.2218
Running (g/mi)	11	0.2658	0.2476	0.2585	0.2265	0.1826	0.2089
Running (g/mi)	12	0.2467	0.2276	0.2390	0.2166	0.1706	0.1982
Running (g/mi)	13	0.2304	0.2105	0.2224	0.2083	0.1603	0.1891
Running (g/mi)	14	0.2163	0.1960	0.2082	0.2010	0.1517	0.1813
Running (g/mi)	15	0.2042	0.1833	0.1958	0.1948	0.1443	0.1746
Running (g/mi)	16	0.1920	0.1736	0.1846	0.1892	0.1446	0.1713
Running (g/mi)	17	0.1810	0.1650	0.1746	0.1843	0.1451	0.1686
Running (g/mi)	18	0.1716	0.1576	0.1660	0.1801	0.1453	0.1662
Running (g/mi)	19	0.1629	0.1507	0.1580	0.1762	0.1457	0.1640
Running (g/mi)	20	0.1551	0.1447	0.1510	0.1727	0.1461	0.1620
Running (g/mi)	21	0.1493	0.1406	0.1458	0.1694	0.1461	0.1601
Running (g/mi)	22	0.1442	0.1367	0.1412	0.1667	0.1462	0.1585
Running (g/mi)	23	0.1396	0.1334	0.1371	0.1638	0.1463	0.1568
Running (g/mi)	24	0.1355	0.1301	0.1333	0.1614	0.1463	0.1554
Running (g/mi)	25	0.1312	0.1275	0.1297	0.1592	0.1466	0.1541
Running (g/mi)	26	0.1277	0.1243	0.1264	0.1571	0.1466	0.1529
Running (g/mi)	27	0.1246	0.1218	0.1235	0.1551	0.1466	0.1517
Running (g/mi)	28	0.1215	0.1192	0.1206	0.1534	0.1466	0.1507
Running (g/mi)	29	0.1183	0.1170	0.1178	0.1518	0.1466	0.1497
Running (g/mi)	30	0.1155	0.1145	0.1151	0.1500	0.1467	0.1487
Running (g/mi)	31	0.1133	0.1125	0.1129	0.1489	0.1462	0.1478
Running (g/mi)	32	0.1107	0.1101	0.1105	0.1479	0.1460	0.1472
Running (g/mi)	33	0.1085	0.1081	0.1084	0.1469	0.1457	0.1464
Running (g/mi)	34	0.1065	0.1064	0.1065	0.1460	0.1455	0.1458
Running (g/mi)	35	0.1043	0.1043	0.1043	0.1453	0.1453	0.1453
Running (g/mi)	36	0.1029	0.1029	0.1029	0.1458	0.1458	0.1458
Running (g/mi)	37	0.1016	0.1016	0.1016	0.1464	0.1464	0.1464
Running (g/mi)	38	0.1002	0.1002	0.1002	0.1468	0.1468	0.1468
Running (g/mi)	39	0.0990	0.0990	0.0990	0.1473	0.1473	0.1473
Running (g/mi)	40	0.0978	0.0978	0.0978	0.1478	0.1478	0.1478
Running (g/mi)	41	0.0967	0.0967	0.0967	0.1488	0.1488	0.1488
Running (g/mi)	42	0.0957	0.0957	0.0957	0.1494	0.1494	0.1494
Running (g/mi)	43	0.0945	0.0945	0.0945	0.1501	0.1501	0.1501
Running (g/mi)	44	0.0934	0.0934	0.0934	0.1508	0.1508	0.1508
Running (g/mi)	45	0.0925	0.0925	0.0925	0.1514	0.1514	0.1514
Running (g/mi)	46	0.0916	0.0916	0.0916	0.1523	0.1523	0.1523
Running (g/mi)	47	0.0906	0.0906	0.0906	0.1532	0.1532	0.1532
Running (g/mi)	48	0.0897	0.0897	0.0897	0.1539	0.1539	0.1539
Running (g/mi)	49	0.0887	0.0887	0.0887	0.1546	0.1546	0.1546
Running (g/mi)	50	0.0882	0.0882	0.0882	0.1553	0.1553	0.1553
Running (g/mi)	51	0.0874	0.0874	0.0874	0.1563	0.1563	0.1563
Running (g/mi)	52	0.0869	0.0869	0.0869	0.1571	0.1571	0.1571
Running (g/mi)	53	0.0863	0.0863	0.0863	0.1578	0.1578	0.1578
Running (g/mi)	54	0.0857	0.0857	0.0857	0.1588	0.1588	0.1588
Running (g/mi)	55	0.0853	0.0853	0.0853	0.1597	0.1597	0.1597
Running (g/mi)	56	0.0853	0.0853	0.0853	0.1606	0.1606	0.1606
Running (g/mi)	57	0.0852	0.0852	0.0852	0.1613	0.1613	0.1613
Running (g/mi)	58	0.0851	0.0851	0.0851	0.1622	0.1622	0.1622
Running (g/mi)	59	0.0851	0.0851	0.0851	0.1632	0.1632	0.1632
Running (g/mi)	60	0.0851	0.0851	0.0851	0.1641	0.1641	0.1641
Running (g/mi)	61	0.0851	0.0851	0.0851	0.1650	0.1650	0.1650
Running (g/mi)	62	0.0853	0.0853	0.0853	0.1659	0.1659	0.1659
Running (g/mi)	63	0.0852	0.0852	0.0852	0.1668	0.1668	0.1668
Running (g/mi)	64	0.0855	0.0855	0.0855	0.1676	0.1676	0.1676
Running (g/mi)	65	0.0854	0.0854	0.0854	0.1685	0.1685	0.1685

Emission Type	VOC	NOx
Cold Start (g/trip start, Light Duty Only)	0.5192	0.2162
Hot Soak Loss (g/trip end)	0.2789	0.0000
Hot Start (g/trip start, Light Duty Only)	0.0948	0.0503

Table 7: 2030 Running, Cold Start, and Hot Soak Average Emissions Factors for "Commute"
TERMs
(Mobile 6.2)

Average 2030 Emission Factors (gm/mi)							
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	1.6098	1.6098	1.6098	0.3131	0.3131	0.3131
Running (g/mi)	2	1.6098	1.6098	1.6098	0.3131	0.3131	0.3131
Running (g/mi)	3	1.2615	1.2614	1.2615	0.2969	0.2969	0.2969
Running (g/mi)	4	0.8262	0.8262	0.8262	0.2764	0.2764	0.2764
Running (g/mi)	5	0.5651	0.5651	0.5651	0.2643	0.2643	0.2643
Running (g/mi)	6	0.4678	0.4627	0.4657	0.2437	0.2319	0.2390
Running (g/mi)	7	0.3982	0.3893	0.3946	0.2290	0.2087	0.2209
Running (g/mi)	8	0.3462	0.3344	0.3415	0.2179	0.1912	0.2072
Running (g/mi)	9	0.3057	0.2919	0.3001	0.2093	0.1777	0.1967
Running (g/mi)	10	0.2730	0.2575	0.2668	0.2026	0.1669	0.1883
Running (g/mi)	11	0.2512	0.2350	0.2447	0.1922	0.1546	0.1771
Running (g/mi)	12	0.2329	0.2158	0.2260	0.1837	0.1442	0.1679
Running (g/mi)	13	0.2174	0.1995	0.2102	0.1764	0.1355	0.1601
Running (g/mi)	14	0.2044	0.1859	0.1970	0.1703	0.1279	0.1533
Running (g/mi)	15	0.1929	0.1739	0.1853	0.1648	0.1212	0.1473
Running (g/mi)	16	0.1811	0.1646	0.1745	0.1600	0.1218	0.1447
Running (g/mi)	17	0.1706	0.1562	0.1648	0.1560	0.1220	0.1424
Running (g/mi)	18	0.1613	0.1488	0.1563	0.1524	0.1224	0.1404
Running (g/mi)	19	0.1528	0.1421	0.1485	0.1488	0.1227	0.1384
Running (g/mi)	20	0.1456	0.1361	0.1418	0.1459	0.1230	0.1368
Running (g/mi)	21	0.1402	0.1322	0.1370	0.1431	0.1230	0.1350
Running (g/mi)	22	0.1355	0.1287	0.1328	0.1406	0.1233	0.1336
Running (g/mi)	23	0.1311	0.1254	0.1288	0.1384	0.1233	0.1324
Running (g/mi)	24	0.1271	0.1224	0.1252	0.1363	0.1234	0.1311
Running (g/mi)	25	0.1233	0.1197	0.1219	0.1343	0.1235	0.1300
Running (g/mi)	26	0.1199	0.1169	0.1187	0.1324	0.1235	0.1289
Running (g/mi)	27	0.1167	0.1141	0.1157	0.1308	0.1235	0.1279
Running (g/mi)	28	0.1137	0.1118	0.1129	0.1291	0.1235	0.1268
Running (g/mi)	29	0.1110	0.1094	0.1104	0.1279	0.1235	0.1262
Running (g/mi)	30	0.1086	0.1074	0.1081	0.1263	0.1235	0.1252
Running (g/mi)	31	0.1060	0.1052	0.1057	0.1253	0.1232	0.1244
Running (g/mi)	32	0.1037	0.1033	0.1036	0.1245	0.1229	0.1239
Running (g/mi)	33	0.1017	0.1012	0.1015	0.1237	0.1225	0.1232
Running (g/mi)	34	0.0995	0.0994	0.0995	0.1228	0.1224	0.1227
Running (g/mi)	35	0.0978	0.0978	0.0978	0.1222	0.1222	0.1222
Running (g/mi)	36	0.0962	0.0962	0.0962	0.1226	0.1226	0.1226
Running (g/mi)	37	0.0950	0.0950	0.0950	0.1232	0.1232	0.1232
Running (g/mi)	38	0.0938	0.0938	0.0938	0.1236	0.1236	0.1236
Running (g/mi)	39	0.0924	0.0924	0.0924	0.1241	0.1241	0.1241
Running (g/mi)	40	0.0913	0.0913	0.0913	0.1243	0.1243	0.1243
Running (g/mi)	41	0.0904	0.0904	0.0904	0.1251	0.1251	0.1251
Running (g/mi)	42	0.0892	0.0892	0.0892	0.1258	0.1258	0.1258
Running (g/mi)	43	0.0880	0.0880	0.0880	0.1264	0.1264	0.1264
Running (g/mi)	44	0.0869	0.0869	0.0869	0.1268	0.1268	0.1268
Running (g/mi)	45	0.0858	0.0858	0.0858	0.1277	0.1277	0.1277
Running (g/mi)	46	0.0852	0.0852	0.0852	0.1282	0.1282	0.1282
Running (g/mi)	47	0.0842	0.0842	0.0842	0.1289	0.1289	0.1289
Running (g/mi)	48	0.0832	0.0832	0.0832	0.1297	0.1297	0.1297
Running (g/mi)	49	0.0824	0.0824	0.0824	0.1303	0.1303	0.1303
Running (g/mi)	50	0.0818	0.0818	0.0818	0.1309	0.1309	0.1309
Running (g/mi)	51	0.0814	0.0814	0.0814	0.1317	0.1317	0.1317
Running (g/mi)	52	0.0806	0.0806	0.0806	0.1324	0.1324	0.1324
Running (g/mi)	53	0.0800	0.0800	0.0800	0.1332	0.1332	0.1332
Running (g/mi)	54	0.0796	0.0796	0.0796	0.1340	0.1340	0.1340
Running (g/mi)	55	0.0790	0.0790	0.0790	0.1346	0.1346	0.1346
Running (g/mi)	56	0.0792	0.0792	0.0792	0.1355	0.1355	0.1355
Running (g/mi)	57	0.0790	0.0790	0.0790	0.1363	0.1363	0.1363
Running (g/mi)	58	0.0791	0.0791	0.0791	0.1368	0.1368	0.1368
Running (g/mi)	59	0.0790	0.0790	0.0790	0.1377	0.1377	0.1377
Running (g/mi)	60	0.0791	0.0791	0.0791	0.1385	0.1385	0.1385
Running (g/mi)	61	0.0790	0.0790	0.0790	0.1392	0.1392	0.1392
Running (g/mi)	62	0.0793	0.0793	0.0793	0.1400	0.1400	0.1400
Running (g/mi)	63	0.0791	0.0791	0.0791	0.1408	0.1408	0.1408
Running (g/mi)	64	0.0795	0.0795	0.0795	0.1415	0.1415	0.1415
Running (g/mi)	65	0.0794	0.0794	0.0794	0.1422	0.1422	0.1422

Emission Type	VOC	NOx
start, Light Duty Only)	0.4465	0.1524
Hot Soak Loss (g/trip end)	0.2138	-
start, Light Duty Only)	0.0832	0.0369

Exhibit - 3
VOC MOBILE6.2 RUNNING EMISSION RATES
COMMUTE STREAM
FOR 2010, 2020 AND 2030
WEIGHTED AVERAGE of ARTERIAL & FREEWAY

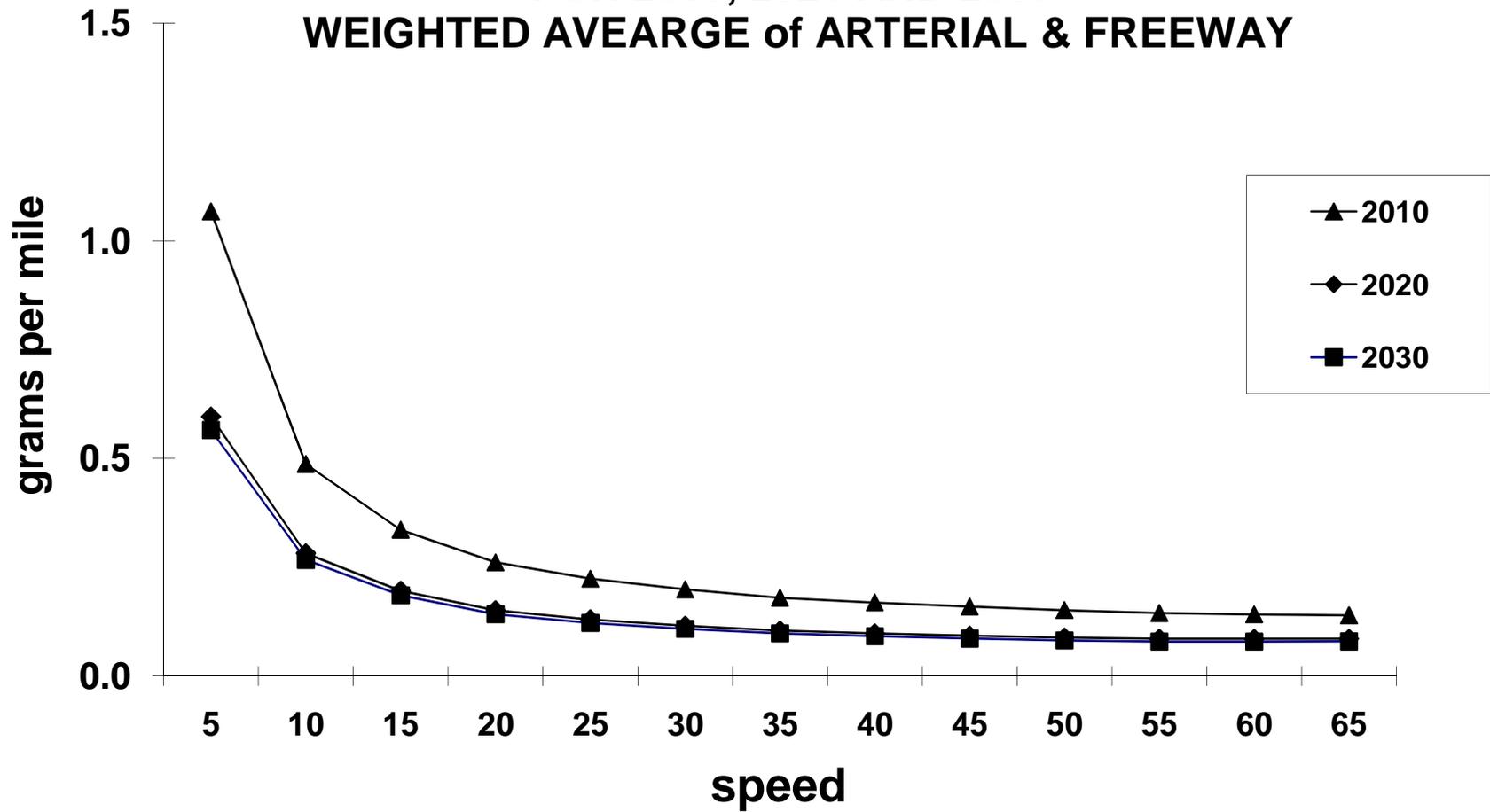
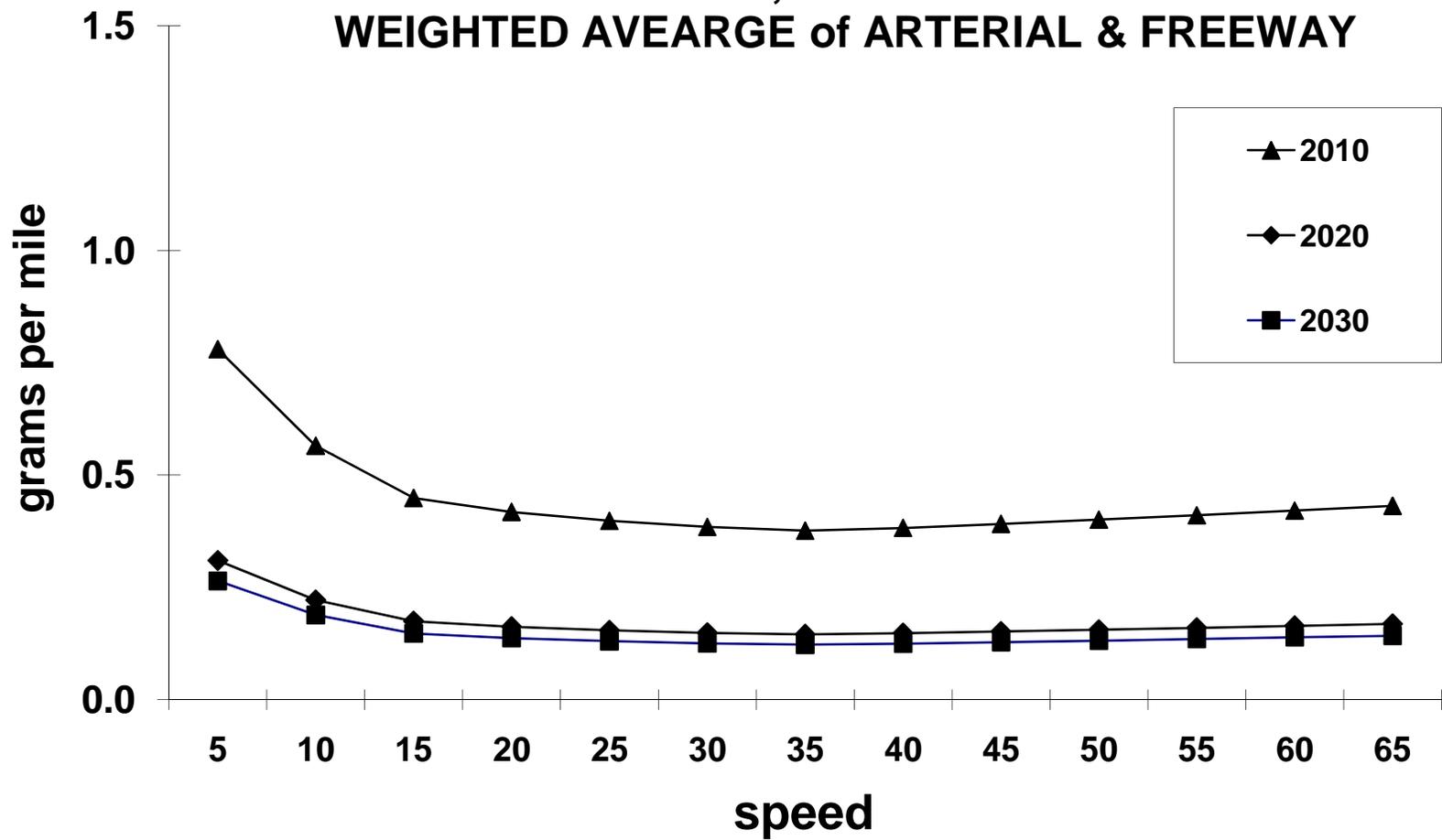


Exhibit - 4
NO_x MOBILE6.2 RUNNING EMISSION RATES
COMMUTE STREAM
FOR 2010, 2020 AND 2030
WEIGHTED AVERAGE of ARTERIAL & FREEWAY



**Table 8: 2010-30 Idling Emission Factors
(Mobile 6.2)
(Under development)**

Also for use in the emissions reduction calculations average weighted speed by time period are shown in Table 9 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 9: 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 10: Mobile 6 Vehicle Classifications		
<i>Number</i>	<i>Abbreviation</i>	<i>Description</i>
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 1 and 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 11- 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 (%)
2010	4,749,592	4,107,246	3,659,827	1.120	642,346	13.50%
2020	5,414,462	4,618,020	4,085,772	1.130	796,442	14.70%
2030	5,930,147	5,066,329	4,477,782	1.130	863,818	14.60%

Table 12- Daily Regional Analysis by Year for all Trip Purposes

YEAR	TOTAL MOTORIZED PERSON	TOTAL AUTO PSN	TOTAL AUTO DRV	TOTAL CAROCC	TOTAL TRANSIT	TRANSIT (%)
2010	25,751,254	24,589,108	19,453,805	1.260	1,162,146	4.50%
2020	29,118,655	27,591,176	21,872,152	1.260	1,527,479	5.20%
2030	31,779,252	30,114,558	23,938,853	1.260	1,664,694	5.20%

*Note: Starting in 2020, all HOV facilities are HOV3+

Table 13- Daily Regional Vehicle Trips by Purpose by Year

	WORK AND NON-WORK AUTO DRV	TRUCKS (Med + Hvy)	MISC + THRU TRIPS	TOTAL VEH. TRIPS	TOTAL VMT
2010	19,454,441	532,235	842,547	22,093,363	160,911,318
2020	21,872,884	618,515	971,960	24,908,164	182,789,481
2030	23,939,474	688,504	1,076,606	27,288,108	197,516,602

Source: 2009 CLRP / FY2010-2015 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:

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

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

$$\text{C. Cost Per Ton} = \text{Cost Per Day} / \text{Tons VOC or NOx Reduced Per Day}$$

Where:

$$\text{Benefit Days per Year} = \begin{cases} 250 & \text{for projects mostly related to work travel (i.e.,} \\ & \text{commuter lots, ridesharing)} \end{cases}$$

$$\begin{cases} 365 & \text{for projects relating to all travel (e.g. roadway signal} \\ & \text{systems)} \end{cases}$$

$$\text{Lifespan}^1 = \begin{cases} 30 & \text{years for park and ride lot (construction)} \\ 100 & \text{years for park and ride lot land (right-of-way)} \\ 20 & \text{years for roadways} \\ 30 & \text{years for bridges} \\ 12 & \text{years for roadway signal systems} \\ 20 & \text{years for rail signalization} \\ 35 & \text{years for structures (i.e., garages)} \\ 12 & \text{years for buses} \\ 35 & \text{years for railcars} \\ 30 & \text{years for locomotives} \\ 10 & \text{years for sidewalks} \end{cases}$$

Travel demand model assumptions:

Average one-way trip length for commute trips = 15.5 miles

Average HBW vehicle occupancy (2009) = 1.12

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.

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 14, 15, 16, & 17.

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

Table-14

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
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
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 15: 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	1.1234	0.8600	0.9457	0.9764
2	1.1234	0.8600	0.9457	0.9764
3	1.0741	0.8194	0.9043	0.9326
4	1.0121	0.7689	0.8524	0.8778
5	0.9750	0.7386	0.8213	0.8450
6	0.8934	0.6732	0.7522	0.7730
7	0.8351	0.6266	0.7030	0.7215
8	0.7915	0.5915	0.6659	0.6830
9	0.7573	0.5642	0.6372	0.6529
10	0.7302	0.5425	0.6142	0.6290
11	0.6936	0.5131	0.5831	0.5966
12	0.6632	0.4890	0.5571	0.5698
13	0.6373	0.4684	0.5354	0.5470
14	0.6150	0.4507	0.5165	0.5274
15	0.5957	0.4354	0.5003	0.5105
16	0.5880	0.4287	0.4937	0.5035
17	0.5810	0.4228	0.4879	0.4973
18	0.5748	0.4176	0.4829	0.4918
19	0.5695	0.4129	0.4782	0.4869
20	0.5644	0.4086	0.4740	0.4823
21	0.5601	0.4048	0.4703	0.4784
22	0.5561	0.4012	0.4669	0.4747
23	0.5523	0.3979	0.4637	0.4713
24	0.5490	0.3950	0.4610	0.4683
25	0.5460	0.3922	0.4584	0.4655
26	0.5432	0.3897	0.4560	0.4630
27	0.5405	0.3874	0.4538	0.4606
28	0.5381	0.3850	0.4518	0.4583
29	0.5358	0.3830	0.4500	0.4563
30	0.5337	0.3811	0.4481	0.4543
31	0.5324	0.3797	0.4471	0.4531
32	0.5313	0.3783	0.4462	0.4519
33	0.5301	0.3771	0.4451	0.4508
34	0.5292	0.3759	0.4442	0.4498
35	0.5282	0.3747	0.4434	0.4488
36	0.5306	0.3765	0.4455	0.4509
37	0.5331	0.3781	0.4478	0.4530
38	0.5353	0.3797	0.4498	0.4549
39	0.5373	0.3810	0.4514	0.4566
40	0.5394	0.3825	0.4533	0.4584
41	0.5429	0.3846	0.4562	0.4612
42	0.5459	0.3866	0.4588	0.4638
43	0.5488	0.3887	0.4612	0.4662
44	0.5515	0.3906	0.4637	0.4686
45	0.5542	0.3926	0.4659	0.4709
46	0.5575	0.3948	0.4688	0.4737
47	0.5605	0.3972	0.4715	0.4764
48	0.5635	0.3992	0.4741	0.4789
49	0.5664	0.4012	0.4766	0.4814
50	0.5692	0.4031	0.4790	0.4838
51	0.5727	0.4055	0.4821	0.4868
52	0.5761	0.4080	0.4849	0.4897
53	0.5793	0.4102	0.4878	0.4924
54	0.5825	0.4122	0.4903	0.4950
55	0.5853	0.4143	0.4930	0.4975
56	0.5889	0.4170	0.4959	0.5006
57	0.5924	0.4192	0.4990	0.5035
58	0.5957	0.4216	0.5019	0.5064
59	0.5988	0.4238	0.5046	0.5091
60	0.6019	0.4260	0.5074	0.5118
61	0.6056	0.4283	0.5104	0.5148
62	0.6088	0.4310	0.5133	0.5177
63	0.6123	0.4331	0.5160	0.5205
64	0.6154	0.4355	0.5190	0.5233
65	0.6185	0.4376	0.5216	0.5259

	Jan-Apr	May-Sep	Oct-Dec	Average
Cold Start (g/trip start, Light Duty Only)	0.8488	0.5979	0.7388	0.7285

**Table 16: 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	0.2499	0.2084	0.2294	0.2292
2	0.2499	0.2084	0.2294	0.2292
3	0.2392	0.1985	0.2195	0.2191
4	0.2256	0.1861	0.2072	0.2063
5	0.2175	0.1788	0.1998	0.1987
6	0.1991	0.1626	0.1828	0.1815
7	0.1860	0.1511	0.1706	0.1692
8	0.1761	0.1424	0.1616	0.1600
9	0.1683	0.1355	0.1545	0.1528
10	0.1622	0.1302	0.1489	0.1471
11	0.1540	0.1230	0.1412	0.1394
12	0.1471	0.1170	0.1348	0.1330
13	0.1412	0.1120	0.1294	0.1275
14	0.1362	0.1075	0.1249	0.1229
15	0.1319	0.1039	0.1209	0.1189
16	0.1302	0.1021	0.1192	0.1172
17	0.1287	0.1007	0.1179	0.1158
18	0.1274	0.0994	0.1166	0.1145
19	0.1262	0.0984	0.1156	0.1134
20	0.1251	0.0973	0.1146	0.1123
21	0.1241	0.0964	0.1137	0.1114
22	0.1233	0.0956	0.1129	0.1106
23	0.1225	0.0948	0.1122	0.1098
24	0.1218	0.0940	0.1115	0.1091
25	0.1211	0.0934	0.1109	0.1085
26	0.1207	0.0928	0.1104	0.1080
27	0.1200	0.0922	0.1099	0.1073
28	0.1195	0.0917	0.1095	0.1069
29	0.1190	0.0912	0.1090	0.1064
30	0.1186	0.0907	0.1085	0.1059
31	0.1183	0.0904	0.1082	0.1056
32	0.1181	0.0901	0.1081	0.1054
33	0.1178	0.0899	0.1079	0.1052
34	0.1176	0.0894	0.1076	0.1049
35	0.1173	0.0892	0.1075	0.1047
36	0.1180	0.0896	0.1081	0.1052
37	0.1186	0.0901	0.1086	0.1058
38	0.1193	0.0905	0.1091	0.1063
39	0.1197	0.0908	0.1097	0.1067
40	0.1203	0.0912	0.1101	0.1072
41	0.1211	0.0918	0.1109	0.1079
42	0.1218	0.0924	0.1116	0.1086
43	0.1225	0.0929	0.1123	0.1092
44	0.1232	0.0933	0.1129	0.1098
45	0.1238	0.0938	0.1136	0.1104
46	0.1247	0.0944	0.1143	0.1111
47	0.1254	0.0950	0.1151	0.1118
48	0.1263	0.0954	0.1157	0.1125
49	0.1269	0.0959	0.1164	0.1131
50	0.1277	0.0966	0.1171	0.1138
51	0.1286	0.0972	0.1179	0.1146
52	0.1294	0.0979	0.1189	0.1154
53	0.1303	0.0985	0.1196	0.1161
54	0.1311	0.0991	0.1203	0.1168
55	0.1319	0.0996	0.1211	0.1175
56	0.1329	0.1003	0.1220	0.1184
57	0.1337	0.1009	0.1228	0.1191
58	0.1346	0.1015	0.1236	0.1199
59	0.1353	0.1020	0.1244	0.1206
60	0.1362	0.1026	0.1251	0.1213
61	0.1371	0.1032	0.1259	0.1221
62	0.1380	0.1039	0.1267	0.1229
63	0.1389	0.1046	0.1277	0.1237
64	0.1397	0.1052	0.1284	0.1244
65	0.1405	0.1058	0.1291	0.1251

	Jan-Apr	May-Sep	Oct-Dec	Average
Cold Start (g/trip start, Light Duty Only)	0.1973	0.1429	0.1795	0.1732

**Table 17: 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	0.2064	0.1778	0.1966	0.1936
2	0.2064	0.1778	0.1966	0.1936
3	0.1976	0.1692	0.1883	0.1850
4	0.1864	0.1586	0.1777	0.1743
5	0.1799	0.1524	0.1713	0.1679
6	0.1645	0.1384	0.1568	0.1532
7	0.1535	0.1286	0.1463	0.1428
8	0.1453	0.1210	0.1385	0.1349
9	0.1390	0.1152	0.1323	0.1288
10	0.1339	0.1107	0.1274	0.1240
11	0.1270	0.1045	0.1209	0.1174
12	0.1212	0.0993	0.1153	0.1119
13	0.1164	0.0949	0.1107	0.1074
14	0.1122	0.0912	0.1068	0.1034
15	0.1086	0.0880	0.1033	0.0999
16	0.1071	0.0865	0.1019	0.0985
17	0.1060	0.0853	0.1008	0.0974
18	0.1048	0.0842	0.0997	0.0962
19	0.1039	0.0833	0.0987	0.0953
20	0.1030	0.0824	0.0979	0.0944
21	0.1022	0.0815	0.0972	0.0937
22	0.1015	0.0809	0.0965	0.0930
23	0.1008	0.0802	0.0959	0.0923
24	0.1003	0.0796	0.0953	0.0917
25	0.0998	0.0790	0.0949	0.0912
26	0.0993	0.0785	0.0944	0.0907
27	0.0988	0.0780	0.0939	0.0902
28	0.0985	0.0776	0.0935	0.0899
29	0.0980	0.0771	0.0933	0.0895
30	0.0977	0.0767	0.0928	0.0891
31	0.0975	0.0764	0.0926	0.0888
32	0.0972	0.0762	0.0924	0.0886
33	0.0971	0.0759	0.0922	0.0884
34	0.0968	0.0757	0.0920	0.0882
35	0.0968	0.0754	0.0919	0.0880
36	0.0973	0.0758	0.0924	0.0885
37	0.0978	0.0761	0.0930	0.0890
38	0.0983	0.0766	0.0934	0.0894
39	0.0988	0.0768	0.0938	0.0898
40	0.0993	0.0771	0.0944	0.0903
41	0.0999	0.0777	0.0951	0.0909
42	0.1005	0.0782	0.0956	0.0914
43	0.1011	0.0784	0.0962	0.0919
44	0.1017	0.0790	0.0968	0.0925
45	0.1023	0.0794	0.0974	0.0930
46	0.1031	0.0799	0.0981	0.0937
47	0.1038	0.0804	0.0988	0.0943
48	0.1044	0.0810	0.0994	0.0949
49	0.1051	0.0813	0.1001	0.0955
50	0.1056	0.0818	0.1006	0.0960
51	0.1066	0.0824	0.1014	0.0968
52	0.1073	0.0829	0.1021	0.0974
53	0.1079	0.0835	0.1029	0.0981
54	0.1087	0.0841	0.1035	0.0988
55	0.1094	0.0845	0.1041	0.0993
56	0.1102	0.0851	0.1049	0.1001
57	0.1109	0.0856	0.1057	0.1007
58	0.1117	0.0861	0.1063	0.1014
59	0.1124	0.0866	0.1071	0.1020
60	0.1131	0.0872	0.1078	0.1027
61	0.1139	0.0878	0.1086	0.1034
62	0.1146	0.0884	0.1092	0.1041
63	0.1154	0.0889	0.1099	0.1047
64	0.1161	0.0894	0.1106	0.1054
65	0.1169	0.0899	0.1114	0.1061

	Jan-Apr	May-Sep	Oct-Dec	Average
Cold Start (g/trip start, Light Duty Only)	0.1376	0.1022	0.1304	0.1234

EXAMPLES OF A COMMUTING VEHICLE TRIP TERM ANALYSIS

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:	0.0000	tons/day
Daily VOC Reductions:	0.0113	tons/day
Cost-Effectiveness (NOx)	25,666	\$/ton
Cost-Effectiveness (VOC)	58,126	\$/ton

Emission Impacts for (2010):

1,300 additional spaces

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

2/3 new trips: $2/3 \times 1300 = 866$ trips

866×31 miles = 26,846 VMT

Daily NOx & VOC emission reductions (2010):

NOx Estimation

Cold Start	0	x	$\frac{0.5615 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0000	tons
Running	26,846	x	$\frac{0.3822 \text{ grams}}{1 \text{ mile}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0113	tons
					Total		0.0113	tons

VOC Estimation

Cold Start + Hot soak	0	x	$\frac{1.5678 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0000	tons
Running	26,846	x	$\frac{1.5678 \text{ grams}}{1 \text{ mile}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0050	tons
					Total		0.0050	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:

$$\text{Direct PM2.5 Emissions} = \text{VMT} \times \text{average of seasonal emissions factors} \times \text{weekly VMT adjustment factor} \times \text{days/year.}$$

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

For the TERMS effective only on weekdays:

$$\text{Direct PM2.5 Emissions} = \text{VMT} \times \text{average of seasonal emissions factors} \times \text{days/year.}$$

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

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	$\frac{0.7285 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	0.95	x	365	=	0.0000 Tons
Running	26,846	x	$\frac{0.4584 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	0.95	x	365	=	4.7038 Tons
Total											4.7038 Tons

For the TERMS effective only on weekdays:

Cold Start	0	x	$\frac{0.7285 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	250	=	0.0000 Tons	
Running	26,846	x	$\frac{0.4584 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	250	=	3.3913 Tons	
Total										3.3913 Tons

Cost-Effectiveness (2010):

Garage cost (assumed): \$2.177 million

$$\text{NOx} = \frac{\$2.177 \text{ million}}{250 \text{ days} \times 30 \text{ yr} \times 0.011 \text{ t/d}} = \$25,666/ \text{ ton}$$

$$\text{VOC} = \frac{\$2.177 \text{ million}}{250 \text{ days} \times 30 \text{ yr} \times 0.0050 \text{ t/d}} = \$58,126/ \text{ ton}$$

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

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 Carrollton

Summary of Impacts (2010)

Daily VT Reduction:	3,000	VT
Daily VMT Reduction:	46,500	VMT
Daily NOx Reductions:	0.0215	tons/day
Daily VOC Reductions:	0.0138	tons/day
Cost-Effectiveness (NOx)	209,831	\$/ton
Cost-Effectiveness (VOC)	325,280	\$/ton

Emission Analysis (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	$\frac{0.5615 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0019	tons
Running	46,500	x	$\frac{0.3822 \text{ grams}}{1 \text{ mile}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0196	tons
					Total		0.0215	tons

VOC Estimation

Cold Start + Hot soak	3000	x	$\frac{1.5678 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0052	tons
Running	46,500	x	$\frac{0.1688 \text{ grams}}{1 \text{ mile}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0087	tons
					Total		0.0138	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):

$$\text{Cost-effectiveness NOx} = \frac{\$1,125,000}{250 \times 0.0215} = 209,831 \text{ \$/ton}$$

$$\text{Cost-effectiveness VOC} = \frac{\$1,125,000}{250 \times 0.0138} = 325,280 \text{ \$/ton}$$

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.

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

For the TERMS effective only on weekdays:

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

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

NOx Emissions as a PM 2.5 Precursor:

For the TERMS effective 365 days:

Cold Start	3000	x	$\frac{0.7285 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	365	=	0.8353 Tons
Running	46,500	x	$\frac{0.4584 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	0.95 x 365	=	8.1474 Tons
Total								=	8.9827 Tons

For the TERMS effective only on weekdays:

Cold Start	3000	x	$\frac{0.7285 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	250	=	0.6023 Tons
Running	46,500	x	$\frac{0.4584 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	250	=	5.8741 Tons
Total								=	6.4764 Tons

Cost-Effectiveness (2010):

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

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:	0.0158	tons/day
Daily VOC Reductions:	0.0102	tons/day
Cost-Effectiveness (NOx)	25,360	\$/ton
Cost-Effectiveness (VOC)	39,312	\$/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	$4,400,000 \text{ (conformity)} \times 0.25 \text{ (HBW)} = 17,600,000$

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

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

$3.55 \% \rightarrow 4.07\% = 0.52\%$ 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:	$2600 \times 0.85 \text{ SOV} = 2210$
VMT reductions:	$2210 \times 15.5 \text{ miles} = 34255$

Daily NOx Emission Reductions (2010)

NOx Estimation

Cold Start	2210	x	$\frac{0.5615 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0014	tons
Running	34,255	x	$\frac{0.3822 \text{ grams}}{1 \text{ mile}}$	x	$\frac{1 \text{ ton}}{907185 \text{ grams}}$	=	0.0144	tons
							Total	0.0158 tons

VOC Estimation

Cold Start + Hot Soak	2210	x	$\frac{1.5678 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	=	0.0038	tons
Running	34,255	x	$\frac{1.5678 \text{ grams}}{1 \text{ mile}}$	x	$\frac{1 \text{ ton}}{907185 \text{ grams}}$	=	0.0064	tons
							Total	0.0102 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	$\frac{\$125,000}{312 \times 0.0158}$	=	25,360	\$/ton
Cost-effectiveness VOC	$\frac{\$125,000}{312 \times 0.0102}$	=	39,312	\$/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.

$$\text{Running } 34255 \times \frac{0.0115 \text{ grams}}{1 \text{ mile}} \times \frac{1 \text{ ton}}{907185 \text{ grams}} \times 0.95 \times 365 \text{ days} = 0.1506 \text{ tons}$$

$$1 \text{ mi} \quad 907,185 \text{ grams}$$

For the TERMS effective only on weekdays:

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

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

NOx Emissions as a PM 2.5 Precursor:

For the TERMS effective 365 days:

Cold Start	2210	x	$\frac{0.7285 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	365	=	0.6154 Tons
Running	34255	x	$\frac{0.4584 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	0.95 x 365	=	6.0019 Tons
Total									6.6173 Tons

For the TERMS effective only on weekdays:

Cold Start	2210	x	$\frac{0.7285 \text{ grams}}{1 \text{ trip}}$	x	$\frac{1 \text{ ton}}{907,185 \text{ grams}}$	x	250	=	0.4437 Tons
Running	34255	x	$\frac{0.4584 \text{ grams}}{1 \text{ mi}}$	x	$\frac{1 \text{ ton}}{907,185}$	x	250	=	4.3273 Tons
Total									4.7709 Tons

Cost-Effectiveness (2010):

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

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 2010, 2020 and 2030. For information purposes the latest 'TERM Tracking Sheet- Part A' is included in the 2009 Constrained Long range Plan (CLRP) and FY 2010-FY2015 Transportation Improvement Program (TIP) is attached.

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	2010-2030						Project Category *
					FULL	SCALED-BACK	UNDER-WAY	REM			2010		2020		2030		
											VOC	NOX	VOC	NOX	VOC	NOX	
9	X	1994-99	MDOT	Park & Ride Lot - MD 210/ MD 373	X				2000	2003	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	-
20	X	1994-99	ALEX	King St. Metrorail access improvements	X					2006	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	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	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	TR
48	X	1995-00	MDOT	MARC Replacement Coaches	X				1999	2004	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	0.0049	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	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	c
54	X	1995-00	VDOT	City of Fairfax Bus Shelters	X				1999	2004	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	0.0038	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					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	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	c
61	X	1995-00	MCG	Bicycle Facilities			X		FY99		0.0016	0.0008	0.0010	0.0004	0.0009	0.0003	c
62	X	1995-00	MCG	Pedestrian Facilities to Metrorail			X				0.0027	0.0034	0.0016	0.0014	0.0014	0.0012	c
63	X	1995-00	MDOT	MARC Replacement Coaches	X				1999	2004	0.0022	0.0050	0.0013	0.0022	0.0012	0.0018	c
64	X	1995-00	MDOT	MARC Expansion Coaches	X				1999	2004	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	0.0060	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	0.0055	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	0.0042	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	0.0011	0.0071	0.0006	0.0031	0.0006	0.0026	c
70	X	1995-00	VDOT	Improved Access to Metrorail Stations (VRE 2 Stn)			X		varies	2000-2012	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	0.0027	0.0042	0.0032	0.0036	0.0029	0.0030	c
72	X	1995-00	DC	Bicycle Facilities		X					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	0.1280	0.2253	0.0762	0.0969	0.0696	0.0822	c
74	X	1995-00	REGION	M-47 Integrated Ridesharing	X					on-going	0.0462	0.0786	0.0274	0.0338	0.0249	0.0286	c
75	X	1995-00	REGION	M-92 Telecommuting Support	X					on-going	0.1069	0.1672	0.0627	0.0718	0.0567	0.0606	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	0.0011	0.0013	0.0006	0.0005	0.0006	0.0005	c
81	X	1996-01	VDOT	Arlington County Metrocheck Program	X				1997	1997 Onwards	0.0011	0.0013	0.0006	0.0005	0.0006	0.0005	c
82	X	1996-01	VDOT	Old Dominion Drive Bike Trail			X		2000	2008	0.0005	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	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	c

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

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NOS	CREDIT TAKEN	TIP CREDITED	AGENCY	PROJECT	IMPLEMENTATION STATUS				ORIGINAL COMPLETION DATE	ACTUAL COMPLETION DATE	2010		2020		2030		Project Category *
					FULL	SCALED-BACK	UNDER-WAY	REM			VOC	NOX	VOC	NOX	VOC	NOX	
90	X	1996-01	REGION	M-47c Employer Outreach / Guaranteed Ride Home	X					on-going	0.3167	0.4862	0.1855	0.2089	0.1673	0.1762	C
91	X	1996-01	REGION	M-70a Bicycle Parking			X		1999		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		0.0027	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					SP (TCM)
106	X	1997-02	VDOT	PRTC Employer Commuting Outreach Program	X					1977 on-going	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	0.0001	0.0000	0.0001	C
108	X	1997-02	MDOT	M-103 Taxicab Replacement in Maryland ²	X				2005	Stopped	0.0797	0.2675	0.1340	0.1827	0.3120	0.4810	SP
109	X	1997-02	REGION	M-70b Employer Outreach for Bicycles	X				1998	on going	0.0005	0.0005	0.0003	0.0002	0.0002	0.0002	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	C
111	X	1998-03	WMATA	Bus Replacement (108 buses)	X				1999	1999	0.0450	0.1617					SP
112	X	1998-03	MCG	Montgomery County Bus Replacement	X					Ongoing	0.0080	0.0270					SP
113	X	1998-03	PG	Prince George's County Bus Replacement	X				1998	Ongoing	0.0010	0.0020					SP
114	X	1998-03	FDC	Frederick County Bus Replacement	X						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	0.0008	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					SP
121	X	1998-03	WMATA	WMATA Bus Replacement (252 buses)	X				2001	2001	0.1060	0.3860					SP
122	X	97 & 98 TIP	REGION	M-101a Mass Marketing Campaign (Consumer)			X			2005	0.0161	0.0274	0.0095	0.0118	0.0087	0.0100	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	0.0044	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	0.0068	-0.0016	0.0040	-0.0005	0.0036	-0.0004	TR
125	X	1999-04	VDOT	Transit Center at 7 Corners	X				2002	2001	0.0005	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					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	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	C
130	X	1996-01	VDOT	M-14: I-66 Feeder Bus Fare Buy Down	X					1998 onward	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	0.0038	0.0136	0.0022	0.0059	0.0020	0.0049	C
132	X	2000-05	MDOT	Signal Systems	X				Varies	on-going	0.0017	0.0000	0.0015	0.0000	0.0009	0.0000	TR
133	X	2000-05	VDOT	250 Spaces at Gambrell/Hoopes Rds. Park and Ride	X				2002	2004	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	0.0027	0.0055	0.0016	0.0023	0.0014	0.0020	C
135	X	2000-05	VDOT	Accotink-Gateway Connector Trail	X				2002	2005	0.0038	0.0042	0.0022	0.0018	0.0020	0.0015	C
136	X	2000-05	VDOT	Columbia Pike Trail	X				2000	Summer 200	0.0033	0.0034	0.0019	0.0014	0.0017	0.0012	C
137	X	2000-05	VDOT	Lee Highway trail	X				2000	2007	0.0016	0.0017	0.0010	0.0007	0.0009	0.0006	C
138	X	2000-05	VDOT	Arlington Bus Shelter Improvements	X				2005	2005	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	C
139	X	2000-05	VDOT	Pentagon Metrostation Improvements	X					2003	0.0044	0.0071	0.0026	0.0031	0.0023	0.0026	C

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

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					FULL	SCALED-BACK	UNDER-WAY	REM			VOC	NOX	VOC	NOX	VOC	NOX	
140	X	2000-05	MDOT	East/West Intersection Improvements			X		2005	2005	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		0.0561	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					SP (TCM)
143	X	2002-07	WMATA	ULSD with CRT filters	X				2006	Jun-06	0.2100	0.0000	0.4300	0.0000	0.4300	0.0000	H (TCM)
144		2003-08	DC	Replace 29 12 Taxicabs with CNG cabs				X	2005	2006	0.0089	0.0157					H
145	X	2003-08	DC	D.C.Incident Response & TrafficManagement System	X				2005	2004	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	0.0091	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	0.0013	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	0.0019	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					SP
150	X	2003-08	DC	Sidewalks in D.C. (\$ 5 million)	X				2005	2004	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					H (TCM)
152	X	2003-08	DC	Circulator /Feeder Bus Routes	X				2005	2003	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	0.0751	0.1083	0.0438	0.0465	0.0394	0.0392	C
155		2003-08	MDOT	Employer Vanpool Program (WWB)				X	2005		0.0018	0.0037					C
156	X	2003-08	MDOT	Green Line Link			X		2005	n/a	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	0.0048	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	0.0344	0.0581	0.0201	0.0250	0.0181	0.0210	C
159	X	2003-08	MDOT	MTA - Bus Service Expansion			X		2005	n/a	0.0078	0.0139	0.0045	0.0060	0.0041	0.0050	C
160	X	2003-08	MDOT	Ride- On - Super Discount			X		2005	n/a	0.0009	0.0013	0.0005	0.0005	0.0005	0.0005	C
161	X	2003-08	Regional	Regional Traveler Information Systems			X		2005		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	0.0154	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		0.0044	0.0092	0.0026	0.0040	0.0025	0.0036	C (TCM)
164	X	2003-08	MCG	Bethesda Shuttle Bus Services	X				2004		0.0030	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	0.0009	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					SP
167	X	2003-08	MCG	Free Bus Service on Selected Routes on I-270	X				2004		0.0010	0.0015	0.0006	0.0006	0.0005	0.0005	C
168	X	2003-08	MCG	Annual Sidewalk Program	X				2004		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	0.0036	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	0.0085	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	0.0055	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	0.0089	0.0130	0.0052	0.0056	0.0047	0.0047	C
173	X	2003-08	MDOT	Neighborhood Sidewalks Improvements (Bike/Pedestrian)	X				2005	2004	0.0031	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	0.0027	0.0013	0.0016	0.0005	0.0014	0.0005	C
175	X	2003-08	MDOT	Maryland bus Transit Service Expansion	X				2005	2004	0.0135	0.0286	0.0079	0.0123	0.0071	0.0103	C

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

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					FULL	SCALED-BACK	UNDER-WAY	REM			VOC	NOX	VOC	NOX	VOC	NOX	
176	X	2003-08	VDOT	Universal Transportation Access Program	X				2005	2005-07	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	0.0006	0.0002	0.0003	0.0002	0.0002	C
178	X	2003-08	VDOT	Mobile Commuter Stores	X				2005	2005	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	0.0007	0.0011	0.0004	0.0005	0.0004	0.0004	C
180	X	2003-08	VDOT	Commuter Choice	X				2005		0.0009	0.0012	0.0005	0.0005	0.0005	0.0004	C
181	X	2003-08	VDOT	Employer Shuttle Services				X	2005		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	0.0013	0.0023					C
185	X	2003-08	VDOT	Metro Shuttle Bus			X		2005	1999-2005	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	0.0015	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							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	0.0108	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	0.0140	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					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					SP
198	X	2003-08	WMATA	60 Engine Replacement (MY 1992 & 1993 MY buses)	X				2004	2004	0.0138	0.0755					SP
199	X	2003-08	WMATA	Car Sharing Program	X				2005	2004	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	0.0012	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			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			SP
204		2003-08	MDOT	Neighborhood Bus Shuttle (5 circulator routes)				X	2005		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	0.0025	0.0053	0.0015	0.0023	0.0013	0.0019	C
206		2003-08	MDOT	Additional Bike Lockers at Metro-Stations				X	2005		0.0127	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	0.0089	0.0147	0.0052	0.0063	0.0047	0.0053	C
208		2003-08	MDOT	CNG Fueling Stations				X	2005		0.1270	0.1170					SP
209		2003-08	MDOT	Gas cap replacements (ROP Credit)				X	2005		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	SP
211	X	2003-08	MDOT	External Bicycle Racks on WMATA Buses (486 MD buses)	X				2005	2002	0.0013	0.0020	0.0008	0.0008	0.0007	0.0007	C (TCM)
212	X	2003-08	MDOT	Bike \ Pedestrian Trail - Anacostia River Walk			X		2005	Ongoing	0.0006	0.0004	0.0003	0.0002	0.0003	0.0001	C
213		2003-08	MDOT	Transit Prioritization - Queue Jumps				X	2005		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	0.0525	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	0.0057	0.0077	0.0033	0.0033	0.0030	0.0028	C
216	X	2003-08	MDOT	Telecommuting Expansion ¹	X				2005	Ongoing	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					H
218	X	2003-08	VDOT	MV-92 Telecommuting Program - Expanded ¹	X				2005	2005	0.0662	0.1143	0.0386	0.0491	0.0347	0.0413	C

TERM TRACKING SHEET
TRANSPORTATION EMISSION REDUCTION MEASURES
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					FULL	SCALED-BACK	UNDER-WAY	REM	COMPLETION	COMPLETION	2010		2020		2030		Project
									DATE	DATE	VOC	NOX	VOC	NOX	VOC	NOX	Category *
219	X	2003-08	VDOT	MV-123 Employer Outreach for Public Sector Employees ²	X				2005	2003	0.0147	0.0210	0.0086	0.0090	0.0077	0.0076	c
220	X	2003-08	REGION	Signal System Optimization	X				2005	2005	0.4155	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	0.0011	0.0003	0.0005	0.0003	0.0004	c
Available Emissions Credits											2.325	4.497	1.406	1.088	1.270	0.756	