Memorandum

April 27, 2010

To: Travel Management Subcommittee

From: Erin Morrow, COG/DTP
Anant Choudhary, COG/DTP

Subject: Individual Transportation-related GHG Reduction Measures

At the February meeting a draft of the "Preliminary Analysis of Potential Transportation-related Greenhouse Gas Reduction Strategies for the Washington, DC Region" was presented. Since that time, one new measure has been completed and two measures were updated based on comments received during the meeting. The analysis of these three measures is attached to this memo. Also attached is a bar chart showing relative cost-effectiveness for previously analyzed measures for discussion.

Attachments:
Improvements to Freight Infrastructure (new)
Eco-Driving (updated)
Traffic Signal Optimization (updated)
Cost-effectiveness Bar Chart

Improvements to Freight Infrastructure

Description

CSX and Norfolk Southern have ambitious and expensive plans to improve rail infrastructure along the East coast which would greatly increase the capacity for freight movement. Both companies received partial TIGER grant funding for portions of their project (none inside the Washington, DC region) and have state funds committed for portions of their projects. This analysis focuses on the CO_2 reductions from shifting freight transported by truck to trains, thereby removing long-haul heavy duty trucks from the roads. There are other potential benefits, such as improvements in commuter rail service, which were deemed too uncertain to quantify at this time.

Analysis Approach

The approach is to use sketch planning analysis to calculate emissions reductions which result from the removal of long-haul heavy duty trucks from area highways. The projected highway benefits were obtained from presentations from the rail companies to the TPB. All data used in this analysis were provided by CSX and Norfolk Southern. No independent data were available. It is assumed that in order to achieve the full effectiveness from the improvements and the benefits forecasted by CSX and Norfolk Southern, the projects would require full completion. It is possible that partial completion would yield benefits in the region, but there were no data provided to complete such an analysis.

The forecasted benefits were provided graphically at the state level (Maryland and Virginia) for major highway corridors by CSX and Norfolk Southern. The maps are included in Attachment A. CSX forecasts benefits for the National Gateway project using cumulative truck-miles reduced from major highways from 2012-2021. The presentation can be found here: http://www.mwcog.org/uploads/committee-documents/kl5bWV5e20090828104956.pdf. Norfolk Southern forecasts trucks removed from major highways annually for the completed (full-build) project. The Crescent Corridor presentation can be found here: http://www.mwcog.org/uploads/committee-documents/bF5aWVpe20091216131659.ppt.

Table 1 shows the data as provided in cumulative truck-miles for the National Gateway project. To calculate truck-miles reduced in the region from the National Gateway project, the truck-miles reduced by corridor were factored by the proportion of highway miles of that corridor in the region to determine VMT reductions.

Table 1

National Gateway (cumulative 2012-2021)

	Cumulative truck-miles reduced	Highway miles in corridor	Highway miles in DC region	Truck VMT reduced in region
I-270	13,440,000	32	32	13,440,000
I-70	83,520,000	88	28	26,574,545
I-95/I-495 (MD)	15,000,000	82	34	6,219,512
I-66	25,000,000	75	35	11,666,667
I-95 (VA)	36,000,000	98	30	11,020,408

Table 2 shows the data provided by Norfolk Southern for annual trucks reduced by corridor when the Crescent Corridor project is completed. The number of trucks was multiplied by the number of highway miles for each of those corridors in the region to determine VMT reductions.

Table 2

Crescent Corridor (Completion)

	Annual trucks reduced	Highway miles in DC region	Truck VMT reduced in region
I-270	27,000	32	864,000
I-95/I-495 (MD)	173,000	34	5,882,000
I-66	104,000	35	3,640,000
I-95 (VA)	182,000	30	5,460,000

Assumptions

- Full completion for both the National Gateway and Crescent Corridor is 2020. The National Gateway project reduction information was presented cumulatively from 2012 to 2021, and staff assumed a linear increase in benefits to estimate annual benefits in 2020. The Crescent Corridor benefits were presented annually for full development. It was assumed that the Crescent Corridor project will be completed by 2020.

- The trucks which would be removed from the highway as a result of the projects would be primarily long-haul and thus would travel the entire length of highway in the region. For example, CSX estimates that 140,000 trucks would be removed from I-270 from 2012-2021. This analysis assumes that all of those trucks are traveling the entire length of I-270.
- The CO2 emissions rate for heavy-duty diesel trucks is 1360.4 g/mi

Summary Impact (2020)

	VMT Reductions in 2020 (million truck-miles)	CO_2 Reductions in 2020 (tons CO_2)
National Gateway	12.3	16,687
Crescent Corridor	15.8	23,762

Attachment A

National Gateway – Maryland Highway Impacts

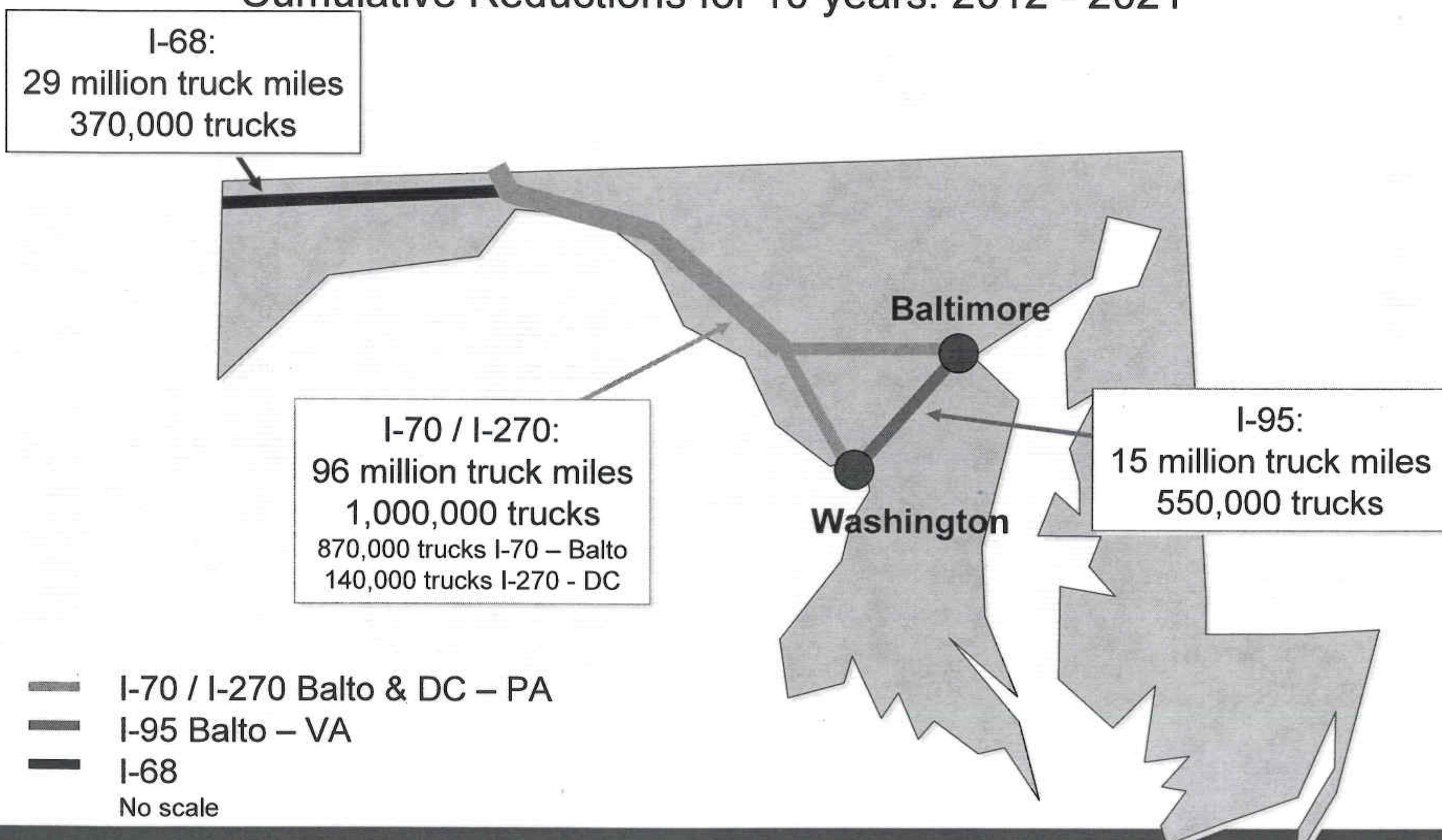
National Gateway – Virginia Highway Impacts

Crescent Corridor – Maryland Highway Impacts

Crescent Corridor – Virginia Highway Impacts

National Gateway - Maryland Highway Impacts

Cumulative Reductions for 10 years: 2012 - 2021

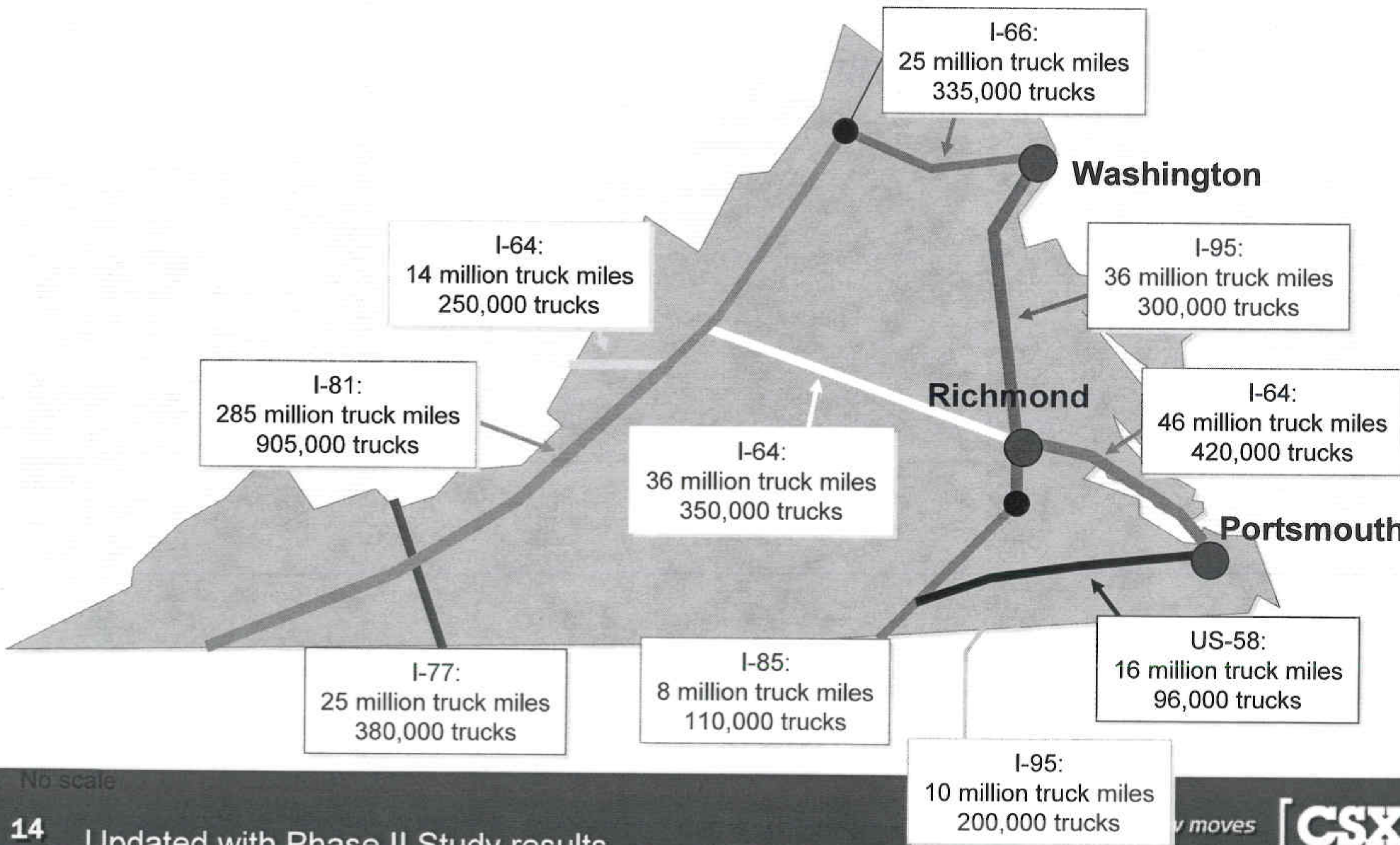


 Updated with Phase II Study results

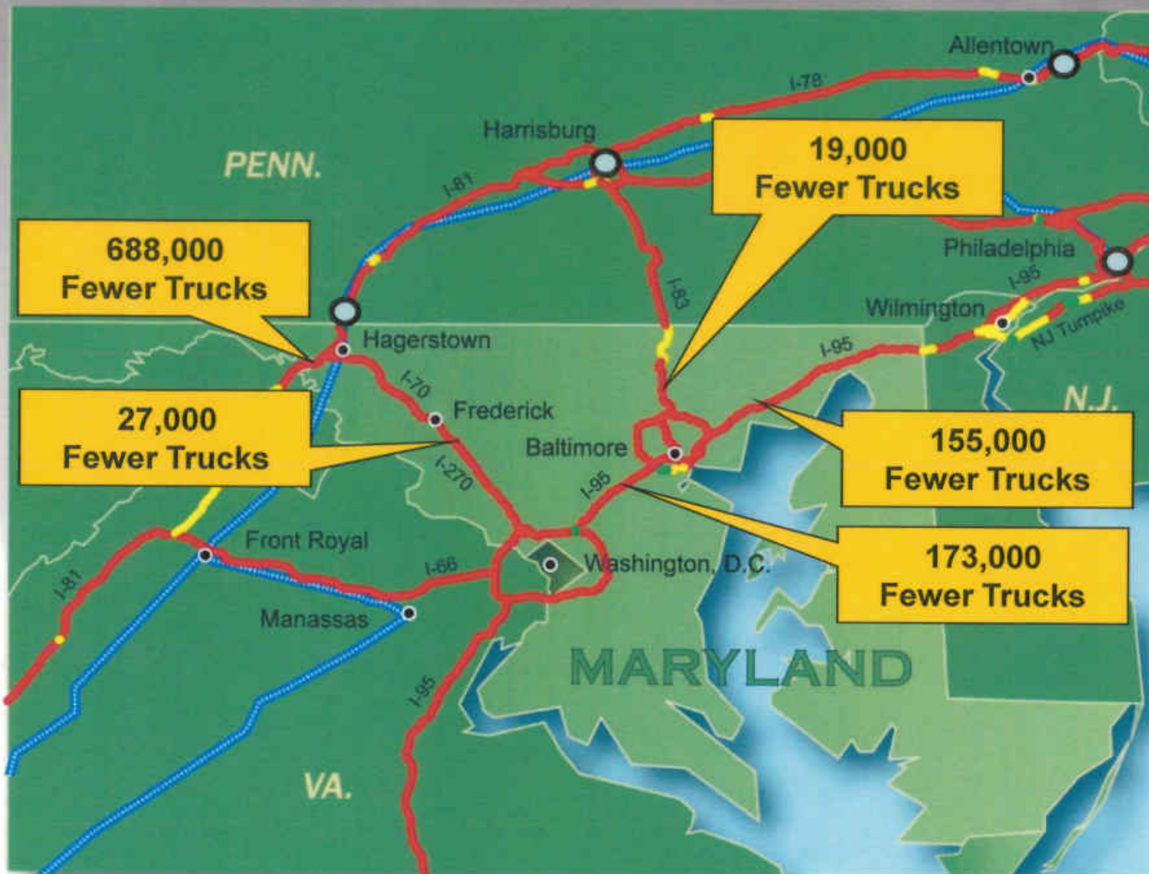
How tomorrow moves CSX

National Gateway - Virginia Highway Impacts

Cumulative Reductions for 10 years: 2012 - 2021



Clean, Green Relief for Congested Roads



Projected 2020 Interstate Highway Congestion

(Source U.S. Department of Transportation) *

- Not Congested (LOS A, B)
- Approaching Congestion (LOS C)
- Congested (LOS D, E, F)
- Norfolk Southern Crescent Corridor

* The DOT estimates that congestion will increase significantly by 2035.

Not all interstate highways or rail lines shown

Crescent Corridor Terminals

Benefits to Maryland

884,000	**Annual Trucks Diverted**
4 Million	**Gallons of Fuel Saved**
46,000	**Reduced Tons of CO_2**
$ 2 Million	**Pavement Savings**
$26 Million	**Congestion Savings**
$ 4 Million	**Safety Savings**

Clean, Green Relief for Congested Roads

Benefits to Virginia

878,000	Annual Trucks Diverted to Rail
35 Million	Gallons of Fuel Saved
385,000 Tons	Reduced Tons of CO_2
$19 Million	Pavement Savings
$99 Million	Congestion Savings
$30 Million	Safety Savings

Eco-driving

Description

Eco-driving covers a wide array of behavior changes where drivers consciously adapt their driving habits to improve their overall fuel economy and maintain their vehicles for optimal performance. Techniques can include accelerating and decelerating smoothly, keeping tires properly inflated, anticipating traffic flow, and reducing idling time. The website www.ecodrivingusa.com has an extensive list of measures.

Analysis Approach

Use sketch planning analysis to calculate emissions reductions which result from more efficient driving. The main assumption used in this measure is that eco-driving can improve LDV fuel economy by 10%. This is based on the results of an experiment done in Denver. For seven months, 400 drivers had accelerometers installed in their vehicles that would record actions, such as slamming on the brakes or excessive idling, that decrease the fuel efficiency by 20%. By being able to review their accelerometer reports on a website, participants were able to improve their gas mileage by 10%. (Los Angeles Times, February 2, 2009).

While onboard monitoring is likely the most effective way of changing driver behavior, most vehicles do not have a monitoring device, although some manufacturers are making a point to advertise those that do. It is possible that customer demand will encourage such monitors to become standard. In the meantime, other methods of educating drivers are available to local governments and a potential regional strategy is outlined in the cost section.

Assumptions

- Drivers who apply eco-driving techniques will see a 10% improvement in their fuel economy, based on the results of the Denver, CO experiment
- Beginning in 2011, 3% of drivers per year will employ eco-driving techniques which result in the 10% improvement in fuel economy.
- This measure focuses only on LDV. HDV eco-driving is assumed as part of the HDV fuel efficiency improvement measure.

Impact

Travel

It is assumed that there will be no change to VT or VMT.

Emissions

	LDV Emissions (tons CO_2)	Reductions from Eco-Driving (tons CO_2)
2010	20,942,367	-
2020	19,299,584	578,988
2030	18,716,503	1,122,990

Cost

The cost for an eco-driving program would depend on the strategies employed. For this measure, to achieve the 10% reduction per driver, the following package of measures is assumed: a mass market public education and public out-reach campaign ($15,000,000 years 1-3, $10,000,000 years 4-10, $5,000,000 years 11-20), an addition to the drivers' education curriculum ($1,000,000/year), driver training for public fleet drivers ($500,000 years 1-3, $300,000 years 4-20), and a one-time incentive for private fleet operators ($1,000,000 year 1). There is also assumed to be a $200,000/year administrative cost.

Cost –effectiveness

The cost-effectiveness for the first year of emissions reductions (2011) is $265/ton CO_2. The cost-effectiveness for years 2020 and 2030 are $20/ton CO_2 and $6/ton CO_2, respectively.

Note: *The upfront cost is high to increase awareness and the benefits are realized at a later time.*

National Capital Region Transportation Planning Board

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Memorandum

Date: April 27, 2010

To: Travel Management Subcommittee

From: Anant Choudhary
Transportation Engineer

Subject: Update on revised estimate for VOC, NOx & CO_2 emissions benefits from the TERM 'Signal Optimization'

This memorandum provides an update on the revised VOC, NOx & CO_2 emissions reduction estimate for the adopted TERM 'Signal Optimization' using the most current data on the optimized signals in the region.

The TERM 'Signal Optimization' was adopted in July 2002 and its accrued emissions benefits (VOC & NOx) are shown in the TERM Tracking Sheet included in the past conformity documents. The 2002-05 emissions benefits were estimated using the 2002 data on optimized signals. A goal of optimizing 2000 signals was considered in the year 2002 analysis. In the subsequent years the emissions benefits were factored by using the emissions ratios obtained from the traffic stream emissions rates and the resulting emissions were reported in the TERM Tracking Sheet.

The Status Report on the Signal Optimization presented to the March 18, 2009 TPB committee (Agenda Item-12), reports that there are about 5400 signalized intersections in the region, and about 3000 signals have been optimized under the program. This indicates that compared to 2002 data on optimized signals, there is an increase in the number of optimized signals in the region by about 1000 signals. (Table-1) This necessitates a revision to the past emissions benefits to reflect the benefits available from the increased number of optimized signals in the region using the most current data. Also the earlier analysis was carried out using the 2002 emissions factors which also need to be revised using the 2010 emissions factors.

The prior analysis used results from the two corridor studies prepared: (1) by the District of Columbia Department of Transportation for the 16th Street corridor from Eastern Avenue, NW to P Street NW, and (2) by Maryland State Highway Administration for MD 650 (New Hampshire Avenue) from MD 212 to Peabody Street in the District. Delay reductions and operating speed improvements were obtained from the Synchro model and were field verified. Then, emissions benefits were estimated using emissions factor differential for the before and after average speeds from the Mobile6.2 model and VMT information. In the analysis AM speed improved from 8.3 to 14 mph and PM speed improved from 13.5 to 18 mph. It was assumed that the speed improvements throughout the region will be similar.

At the April 21, 2009 Travel Management Subcommittee, DTP staff recommended a revision to the methodology used in the previous analysis, as the previous analysis was based on studies carried out for the two corridors as noted above, and since we now have average speed information on a number of corridors from the annual travel time survey which can be used in the revised analysis.

The data from the annual travel time survey includes average speed, number of signals, distances and this is supported by the traffic volume data from the state DOT reports. For the VOC & NOx emissions estimation the arterial traffic stream emissions rates were used and for CO_2 benefits emission factors developed by UC Davis were used. Staff has assumed that average speed will improve by 5 mph (as indicated by Synchro model) after signal are optimized in the corridors. Using the volume, distance and emissions rates differential for 5 mph, staff estimated emissions benefits for all the corridors in the arterial travel time study. Then the estimated benefit per signal is obtained by dividing the total benefits by the number of signals along the corridors. The regional benefit is then obtained by multiplying the number of signal optimized.

The attachment shows the analysis and revised estimate for the VOC, NOx & CO_2 using the latest data on number of signals optimized in the region and using the traffic stream emissions factors for arterial.

The VOC, NOx & CO_2 emissions benefits using the revised method and 2009 data are as below.

2010 Revised Benefits

(It is assumed that the benefits from the signal optimization will deteriorate 50% over time)

NOx emissions benefit for 3000 signals	**0.6427**	**tons/day**
VOC emissions benefit for 3000 signals	**0.7561**	**tons/day**
CO_2 emissions benefit for 3000 signals	**772**	**tons/day**

Table 1. 2006 – 2008 Regional Signal Optimization Reported Results
All figures are approximate.

Total Signalized Intersections	Total Signals Optimized or Checked/Adjusted				Signals Not Analyzed or Checked 2006 to 2008		Signals for which No Report Received	
	Signals Optimized 2006 to 2008 (by Computer Analysis Methods)		Signals Checked and If Necessary Adjusted 2006 to 2008 (by Methods Other than Computer Analysis)					
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
5,400	3,000	56%	1,300	24%	1,000	18%	100	2%
	4,300 – 80%							

Source: Agenda Information Item-12, March 18, 2009 TPB meeting

Signal Optimization TERM
Revised Analysis

	2010			2020			2030		
	VOC	NOx	CO2	VOC	NOx	CO2	VOC	NOx	CO2
Emissions Benefits tons/day (DC, MD, VA for 1119 signals)	0.5641	0.4794	575.78	0.3277	0.1592	575.78	0.3115	0.1213	575.78
Emissions Benefits per signals	0.0005	0.0004	0.5145	0.00029	0.00014	0.5145	0.00028	0.00011	0.5145
2010 Benefits for 3000 signals (50% deterioration is assumed)	0.7561	0.6427	772	0.4393	0.2134	772	0.4176	0.1625	772
Annual Benefit (250 days) t/yr for 3000 signals	189.03	160.67	192,955	109.83	53.35	192,955	104.39	40.64	192,955

Following assumptions are made in the above analysis
All the signals from the routes segments surveyed in the Arterial Travel Times Studies have been optimized (50% deterioration is assumed)
An average of 5 mph speed improvement would be gained from signal optimization
About 75% of traffic is through traffic

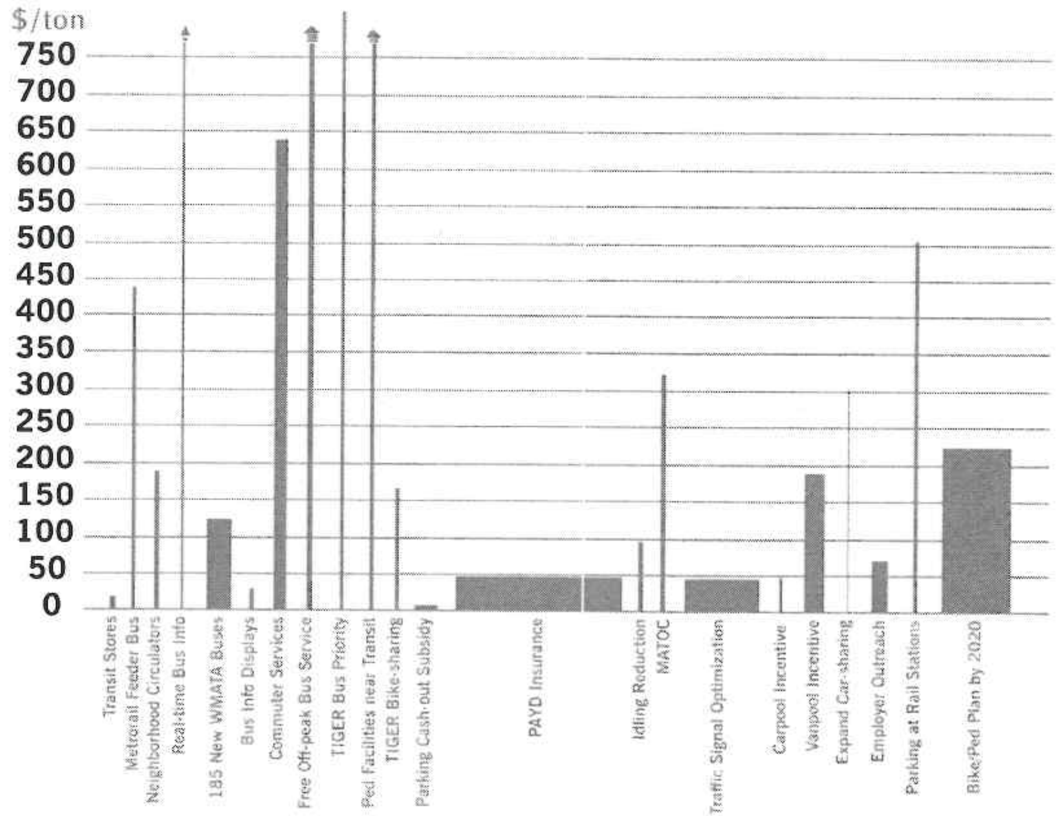
Signal Optimization TERM - Revised Analysis
(Arterial Travel Time Survey Corridors)

State	Year	Route	Average Speed (Both direction)	Speed Increase Post Optimization	Length	Facility type	# of signals	Traffic volume (average) (Factored for 75% through traffic)	2010 VOC Emissions Benefits	2010 NOx Emissions Benefits	2010 CO2 Emissions Benefits	2020 VOC Emissions Benefits	2020 NOx Emissions Benefits	2030 VOC Emissions Benefits	2030 NOx Emissions Benefits
MD	2006	MD 117	24.9	29.9	6.8	II/SU	15	9619	0.0022	0.0024	2.02	0.0013	0.0008	0.0012	0.0006
MD	2006	MD 197	31.05	36.1	14.7	II/SU	22	14494	0.0047	0.0013	2.73	0.0028	0.0006	0.0027	0.0006
MD	2006	MD 198	28.65	33.7	5.0	II/SU	6	23993	0.0031	0.0020	2.11	0.0018	0.0008	0.0017	0.0006
MD	2006	MD 355 -1	18.1	23.1	8.7	II/SU	36	26484	0.0152	0.0172	17.33	0.0088	0.0055	0.0084	0.0040
MD	2006	MD 355-2	14.75	19.8	6.6	II/SU	32	34018	0.0216	0.0228	24.59	0.0129	0.0073	0.0123	0.0053
VA	2006	VA 123 - 1	20.05	25.1	5.9	II/SU	13	22875	0.0069	0.0084	7.92	0.0040	0.0027	0.0037	0.0020
VA	2006	VA 123 - 2	16.95	22.0	7.6	II/SU	28	26250	0.0148	0.0164	17.00	0.0087	0.0052	0.0083	0.0038
VA	2006	VA 123 - 3	31.95	37.0	14.2	II/SU	23	21750	0.0062	-0.0001	3.33	0.0036	0.0002	0.0036	0.0003
VA	2006	US 15	37.9	42.9	12.5	III/SU	5	26625	0.0041	-0.0091	0.86	0.0026	-0.0026	0.0025	-0.0016
VA	2006	US 50 - 1	25.55	30.6	13	II/IM	20	39000	0.0157	0.0159	13.71	0.0093	0.0054	0.0089	0.0041
VA	2006	US 50 - 2	17.9	22.9	10	I/SU & II/IM	32	50250	0.0331	0.0375	37.80	0.0192	0.0119	0.0182	0.0088
DC	2006	Wisconsin	13.1	18.1	4.1	IV/U	40	19388	0.0092	0.0098	11.24	0.0054	0.0032	0.0051	0.0024
DC	2006	Pennsylvania Ave	8	13.0	1.1	IV/U	14	14700	0.0044	0.0031	4.51	0.0024	0.0010	0.0023	0.0008
DC	2006	Independence Ave	8	13.0	0.6	IV/U	18	15150	0.0025	0.0018	2.53	0.0014	0.0006	0.0013	0.0004
	2006	I Street Nw	5.6	10.6		IV/U	9	11475	0.0000	0.0000	0.00	0.0000	0.0000	0.0000	0.0000
DC	2006	H St. NW	7.9	12.9	0.7	IV/U	8	12300	0.0023	0.0017	2.40	0.0013	0.0006	0.0012	0.0004
DC	2006	15th St. NW	8	13.0	0.8	IV/U	5	11700	0.0025	0.0018	2.61	0.0014	0.0006	0.0013	0.0005
DC	2006	17th St. NW	9.1	14.1	0.7	IV/U	5	12975	0.0019	0.0017	2.20	0.0011	0.0006	0.0010	0.0004
DC	2006	16th St	17.85	22.9	6.3	IV/U	44	25200	0.0104	0.0118	11.89	0.0060	0.0037	0.0057	0.0028
DC	2006	L St	5.8	10.8	1.1	IV/U	14	10013	0.0050	0.0026	4.12	0.0027	0.0009	0.0026	0.0007
					120		**389**		**0.1658**	**0.1489**	**170.90**	**0.0967**	**0.0488**	**0.0920**	**0.0369**

	2007	Route													
MD	2007	MD Route 4	35.2	40.2	11.5	I/SU	15	34500	0.0059	-0.0070	2.36	0.0035	-0.0020	0.0034	-0.0013
MD	2007	MD Route 144	21.2	26.2	2.2	II/SU	9	0	0.0000	0.0000	0.00	0.0000	0.0000	0.0000	0.0000
MD	2007	MD Route 450	26.3	31.3	12.8	II/SU	37	14610	0.0058	0.0059	5.06	0.0034	0.0020	0.0033	0.0015
MD	2007	MD Route 586	21.7	26.7	5.4	II/SU	9	32712	0.0075	0.0089	8.06	0.0043	0.0028	0.0041	0.0021
VA	2007	VA 7 - Segment 1	13.7	18.7	11	I/SU	10	32250	0.0373	0.0394	44.12	0.0221	0.0127	0.0211	0.0095
VA	2007	VA 7 - Segment 2	22.6	27.6	3.3	II/SU or I/SU	15	20175	0.0026	0.0030	2.67	0.0015	0.0010	0.0014	0.0007
VA	2007	VA 7 - Segment 3	29.4	34.4	11	I/SU	15	49125	0.0141	0.0092	9.51	0.0082	0.0034	0.0077	0.0028
VA	2007	VA Route 28	30.8	35.8	17.1	I/SU	17	65250	0.0245	0.0070	14.30	0.0145	0.0032	0.0139	0.0030
VA	2007	VA Route 120	18.9	23.9	8.1	II/SU	30	13125	0.0061	0.0072	7.06	0.0035	0.0023	0.0033	0.0017
VA	2007	VA 234 - Segment 1	24.6	29.6	33	II/SU	12	24000	0.0263	0.0292	24.50	0.0156	0.0098	0.0149	0.0073
VA	2007	VA 234 - Segment 2	39.1	44.1	10.3	II/SU	17	24000	0.0031	-0.0076	0.42	0.0018	-0.0021	0.0018	-0.0013
DC	2007	Canal/M St	16.9	21.9	3.7	IV/U	12	19988	0.0055	0.0061	6.30	0.0032	0.0019	0.0031	0.0014
DC	2007	Georgia Ave - Segment 1	14.9	19.9	3.3	IV/U	23	19763	0.0063	0.0066	7.14	0.0037	0.0021	0.0036	0.0015
DC	2007	Georgia Ave/7th St	9.9	14.9	3.4	IV/U	39	12188	0.0070	0.0074	8.73	0.0040	0.0025	0.0038	0.0019
DC	2007	Louisiana/Constitution Ave	12.1	17.1	2.4	IV/U	21	7838	0.0024	0.0026	3.03	0.0014	0.0008	0.0013	0.0006
DC	2007	Pennsylvania/Branch Ave	11.2	16.2	3.7	III/IM	23	30563	0.0167	0.0176	20.82	0.0095	0.0058	0.0090	0.0043
					142		**304**		**0.1711**	**0.1355**	**164.09**	**0.1005**	**0.0463**	**0.0956**	**0.0359**

State	Year	Route	Average Speed (Both direction)	Speed Increase Post Optimization	Length	Facility type	# of signals	Traffic volume (average) (Factored for 75% through traffic)	2010 VOC Emissions Benefits	2010 NOx Emissions Benefits	2010 CO2 Emissions Benefits	2020 VOC Emissions Benefits	2020 NOx Emissions Benefits	2030 VOC Emissions Benefits	2030 NOx Emissions Benefits
		Route													
VA	2008	FFX Co. Pkwy - 1	22.1	27.1	8.7	I/SU	10	36000	0.0132	0.0157	14.23	0.0076	0.0050	0.0073	0.0038
VA	2008	FFX Co. Pkwy - 2	39.6	44.6	12.5	I/SU	8	36000	0.0053	-0.0151	0.42	0.0031	-0.0041	0.0030	-0.0025
VA	2008	US 29 - Seg 1	15.1	20.1	7.9	II/IM	30	16125	0.0123	0.0129	13.95	0.0073	0.0041	0.0070	0.0030
VA	2008	US 29 - Seg 2	13.6	18.6	7.5	II/SU	27	22125	0.0174	0.0183	20.50	0.0103	0.0059	0.0098	0.0044
VA	2008	US 29 - Seg 3	22.0	27.0	6.6	I/SU	13	26250	0.0074	0.0087	7.92	0.0043	0.0028	0.0040	0.0021
VA	2008	US 1 - Seg 2	18.8	23.8	11.7	II/IM	27	28500	0.0192	0.0227	22.14	0.0111	0.0072	0.0105	0.0052
VA	2008	US 1 - Seg 1	22.8	27.8	8.3	II/IM	38	36375	0.0119	0.0138	12.18	0.0068	0.0045	0.0065	0.0033
MD	2008	MD 97 (Georgia Av.) - Seg	20.1	25.1	5.4	I/SU or II/SU	16	45818	0.0126	0.0153	14.43	0.0072	0.0049	0.0068	0.0036
MD	2008	MD 97 (Georgia Av.) - Seg 1	13.9	18.9	4.3	II/SU	18	32825	0.0147	0.0156	17.41	0.0087	0.0050	0.0083	0.0037
MD	2008	MD 5	35.1	40.1	12.0	I/SU	17	14405	0.0026	-0.0030	1.03	0.0015	-0.0009	0.0015	-0.0006
MD	2008	MD 28	31.0	36.0	6.5	II/SU	13	26458	0.0038	0.0011	2.20	0.0022	0.0005	0.0021	0.0005
MD	2008	MD 193 (University Blvd)	21.2	26.2	4.3	II/SU	17	21740	0.0044	0.0052	4.87	0.0025	0.0017	0.0024	0.0013
MD	2008	Randolph Road	21.3	26.3	9.3	II/SU	28	0	0.0000	0.0000	0.00	0.0000	0.0000	0.0000	0.0000
DC	2008	14th St.	9.4	14.4	1.0	IV/U	12	27750	0.0062	0.0053	6.99	0.0034	0.0018	0.0033	0.0013
DC	2008	Conn. Ave.	14.8	19.8	4.0	IV/U & III/U	33	18188	0.0070	0.0074	7.97	0.0042	0.0024	0.0040	0.0017
DC	2008	K St./NY Ave.	8.2	13.2	4.6	IV/U & III/U	35	52125	0.0648	0.0464	66.84	0.0358	0.0155	0.0338	0.0118
DC	2008	Military Rd.	14.9	19.9	2.6	IV/U	13	14475	0.0037	0.0039	4.17	0.0022	0.0012	0.0021	0.0009
DC	2008	Penn. Ave.	9.8	14.8	0.9	IV/U	13	16763	0.0026	0.0027	3.18	0.0015	0.0009	0.0014	0.0007
DC	2008	**16th St**	14.8	19.8	6.3	IV/U	44	25200	0.0152	0.0161	17.30	0.0091	0.0051	0.0087	0.0037
DC	2008	**L St**	7.9	12.9	1.1	IV/U	14	10013	0.0030	0.0021	3.07	0.0016	0.0007	0.0016	0.0005
					125		**426**		**0.2271**	**0.1950**	**240.79**	**0.1306**	**0.0641**	**0.1239**	**0.0485**
				Total length	**388**	miles	**1119**	**Total**	**0.5641**	**0.4794**	**575.78**	**0.3277**	**0.16**	**0.3115**	**0.12**

Cost -effectiveness



1 million tons of cumulative reduction 2010-2030

(width of bar indicates 20 year CO_2 reduction effectiveness)

Assumes current federal/local action