ITEM #5

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS
COMMUTER CONNECTIONS PROGRAM

TRANSPORTATION EMISSION REDUCTION MEASURE (TERM)
ANALYSIS REPORT
FY 2006-2008

Prepared for:

National Capital Region Transportation Planning Board
Metropolitan Washington Council of Governments
777 North Capitol Street, NE, Suite 300
Washington, DC 20002-4239

Prepared by:

LDA Consulting
Washington, DC
202-548-0205

In association with:

CIC Research, Inc., San Diego, CA
ESTC, San Diego, CA
Center for Urban Transportation Research, Tampa, FL

Draft - Revised
January 27, 2009

EXECUTIVE SUMMARY

BACKGROUND

This report presents the results of an evaluation of five Transportation Emission Reduction Measures (TERMs), voluntary Transportation Demand Management (TDM) measures implemented by the National Capital Region Transportation Planning Board's (TPB) Commuter Connections program at the Metropolitan Washington Council of Governments (COG) to support the Washington, DC metropolitan region's air quality conformity determination and congestion management process. This interim evaluation documents transportation and air quality impacts for the three-year period between July 1, 2005 and June 30, 2008, for the following TERMs:

- Maryland and Virginia Telework – Provides information and assistance to commuters and employers to further in-home and telecenter-based telework programs.
- Guaranteed Ride Home – Eliminates a barrier to use of alternative modes by providing free rides home in the event of an unexpected personal emergency or unscheduled overtime to commuters who use alternative modes.
- Employer Outreach – Provides regional outreach services to encourage large, private-sector and non-profit employers voluntarily to implement commuter assistance strategies that will contribute to reducing vehicle trips to worksites, including the efforts of jurisdiction sales representatives to foster new and expanded trip reduction programs.
- Mass Marketing – Involves a large-scale, comprehensive media campaign to inform the region's commuters of services available from Commuter Connections as one way to address commuters' frustration about the commute.
- InfoExpress Kiosks – This is a project that is part of the Integrated Rideshare TERM and involves self-service electronic kiosks located in the District of Columbia and in northern Virginia that offer information on commute options and allow for remote submittal of ridematch and GRH registration applications.

COG's National Capital Transportation Planning Board (TPB), the designated Metropolitan Planning Organization (MPO) for the Washington, DC metropolitan region, adopted these TERMs, among others, as part of the regional Transportation Improvement Program (TIP) to help the region reach emission reduction targets that would maintain a positive air quality conformity determination for the region and to meet federal requirements for the congestion management process. It is also important to note that the regional travel demand model was calibrated and validated against the year 2000 traffic counts and regional emission credits are only taken for TERM benefits that occurred after the year 2000 in the regional TERM tracking sheet and may not be consistent with results in this report.

COG/TPB's Commuter Connections program, which also operates an ongoing regional rideshare program, is the central administrator of the TERMs noted above. Commuter Connections elected to include a vigorous evaluation element in the implementation plan for each of the adopted TERMs to develop information to be used to guide sound decision-making about the TERMs. This report summarizes the results of the TERM evaluation activities and presents the transportation and air quality impacts of the TERMs and the Commuter Operations Center (COC).

This evaluation represents a quite comprehensive evaluation for these programs. It should be noted that the evaluation still remains conservative in the sense that it includes credit only for impacts that can be

reasonably documented with accepted measurement methods and tools. However, we also note that many of the calculations used survey data from surveys that are subject to statistical error rates.

A primary purpose of this evaluation was to develop useful and meaningful information for regional transportation and air quality decision-makers, COG staff, COG program funding agencies, and state and local commute assistance program managers to guide sound decision-making about the TERMs. The results of this evaluation will provide valuable information for regional air quality conformity and the region's congestion management process, improve the structure and implementation procedures of the TERMs themselves, and to refine future data collection methodologies and tools.

SUMMARY OF RESULTS

The objective of the evaluation is to estimate reductions in vehicle trips (VT), vehicle miles traveled (VMT), and tons of Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOC) resulting from implementation of each TERM and compare the impacts against the goals established for the TERMs. The impact results for these measures are shown in Table A for each TERM individually. Results for all TERMs collectively and for the Commuter Operations Center (COC) are presented in Table B.

As shown in Tables A, the TERMs combined fell about four percent short of the goal for vehicle trips reduced (shortfall of 3,477 trips reduced), and six percent below the goal for VMT reduced (net of -117,963 VMT reduced). The impacts for emissions reduced were about 13% under the goals.

But when the COC results were added to the TERM impacts, the combined impacts exceeded the combined goals. The totals for all Commuter Connections programs, compared to the goals, were: +6,228 daily vehicle trips reduced, +244,741 daily VMT reduced, and +0.018 daily tons of NOx reduced. The combined impacts for VOC reduced were slightly under the goal, by – 0.028 tons reduced.

Two of the five TERMs, Telework and InfoExpress Kiosks, met their individual impact goals. Impacts for Maryland and Virginia Telework were about twice the goal for the TERM. And the InfoExpress Kiosk project met its goal. The COC basic service and COC-Software Upgrades also exceeded their goals by substantial margins.

Estimated impacts for Employer Outreach were about eight percent under the goals for this TERM, due primarily to a change in the calculation method used in 2008, which applied more conservative assumptions about the impacts of financial incentives on employees' travel behavior. Impacts for Guaranteed Ride Home were about 31% below the goals for this program. Mass Marketing also missed its estimated target, by a substantial amount. The reasons for the shortfalls from the goals vary by TERM and are discussed in individual report sections on each TERM.

Table A
Summary of Daily Impact Results for Individual TERMs (7/05– 6/08) and Comparison to Goals

TERM	Participation [1]	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Maryland and Virginia Telework [2]					
2008 Goal		11,830	241,208	0.122	0.072
Impacts (7/05 – 6/08)	49,027	21,866	413,703	0.211	0.126
Net Credit or (Deficit)		**10,036**	**172,495**	**0.089**	**0.054**
Guaranteed Ride Home					
2008 Goal	36,992	12,593	355,135	0.177	0.097
Impacts (7/05 – 6/08)	25,164	8,680	227,428	0.106	0.056
Net Credit or (Deficit)	**(11,828)**	**(3,913)**	**(127,707)**	**(0.071)**	**(0.041)**
Employer Outreach – all employers participating [3]					
2008 Goal	581	64,644	1,065,851	0.549	0.343
Impacts (7/05 – 6/08)	852	59,163	969,174	0.443	0.266
Net Credit or (Deficit)	271	**(5,481)**	**(96,677)**	**(0.106)**	**(0.077)**
Employer Outreach – new / expanded employer services since July 2005 [3]					
2008 Goal	96	8,618	140,622	0.072	0.046
Impacts (7/05 – 6/08)	194	22,510	372,406	0.178	0.102
Net Credit or (Deficit)	**98**	**13,892**	**231,784**	**0.106**	**0.056**
Employer Outreach for Bicycling [3]					
2008 Goal	61	130	567	0.001	0.001
Impacts (7/05 – 6/08)	122	188	1,127	0.001	0.001
Net Credit or (Deficit)	**61**	**58**	**560**	**0.000**	**0.000**
Mass Marketing					
2008 Goal	11,023	7,758	141,231	0.072	0.044
Impacts (7/05 – 6/08)	5,464	2,577	69,274	0.032	0.017
Net Credit or (Deficit)	**(5,559)**	**(5,181)**	**(71,957)**	**(0.040)**	**(0.027)**
InfoExpress Kiosks [4]					
2008 Goal		1,778	46,755	0.023	0.013
Impacts (7/05 – 6/08)	8,627	2,840	52,638	0.027	0.016
Net Credit or (Deficit)		**1,062**	**5,883**	**0.004**	**0.003**

1) Participation refers to number of commuters participating, except for the Employer Outreach TERM. For this TERM, participation equals the number of employers participating.

2) Impact represents portion of regional telecommuting attributable to TERM-related activities. Total telecommuting credited for conformity is higher than reported for the TERM.

3) Impacts for Employer Outreach - all employers participating includes impacts for Employer Outreach – new / expanded employer services since July 2005 and for Employer Outreach for Bicycling.

4) InfoExpress Kiosks TERM is part of the Integrated Rideshare TERM.

Table B
Summary of TERM and COC Results (7/05 – 6/08) and Comparison to Goals

TERM	Participation [1]	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
TERMS (all TERMs collectively)					
2008 Goal		98,603	1,850,180	0.943	0.569
Impacts (7/05 – 6/08)		95,126	1,732,217	0.819	0.481
Net Credit or (Deficit)		**(3,477)**	**(117,963)**	**(0.124)**	**(0.088)**
Commuter Operations Center – Basic Services [2]					
2008 Goal	152,356	10,399	296,635	0.147	0.081
Impacts (7/05 – 6/08)	185,639	17,951	575,237	0.256	0.126
Net Credit or (Deficit)	33,283	**7,552**	**278,602**	**0.109**	**0.045**
Commuter Operations Center – Software Upgrades [2]					
2008 Goal		2,370	62,339	0.031	0.017
Impacts (7/05 – 6/08)		4,523	146,441	0.064	0.032
Net Credit or (Deficit)		**2,153**	**84,102**	**0.033**	**0.015**
All TERMS plus COC					
2008 Goal		111,372	2,209,154	1.121	0.667
Impacts (7/05 – 6/058)		117,600	2,453,895	1.139	0.639
Net Credit or (Deficit)		**6,228**	**244,741**	**0.018**	**(0.028)**

1) Participation refers to number of commuters participating, except for the Employer Outreach TERM. For this TERM, participation equals the number of employers participating.

2) Impacts for Commuter Operations Center – software Upgrades are in addition to the impacts for the Commuter Operations Center – Basic Services. This project was part of the Integrated Rideshare TERM.

Table C, on the following page, presents annual emission reduction results for PM 2.5, PM 2.5 pre-cursor NOx, and CO2 emissions (Greenhouse Gas Emissions - GHG) for each TERM and for the COC. COG/TPB did not establish specific targets for these impacts for the Commuter Connections TERMs. But COG has begun to measure these impacts for other TERMs, thus these results are provided.

As shown, the TERMs collectively reduce 5.3 annual tons of PM 2.5, 198.9 annual tons of PM 2.5 pre-cursor NOx, and 208,986 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 7.4 annual tons of PM 2.5, 274.5 annual tons of PM 2.5 pre-cursor NOx, and 291,608 annual tons of CO2 (greenhouse gas emissions).

Table C
Summary of Annual PM 2.5 and CO2 (Greenhouse Gas) Emission Results for Individual TERMs

TERM	Annual Tons PM 2.5 Reduced	Annual Tons PM 2.5 Precursor NOx Reduced	Annual Tons CO2 Reduced
Maryland and Virginia Telework [1)]	1.3	50.0	51,953
Guaranteed Ride Home	0.7	25.2	27,112
Employer Outreach – all employers [2)]	2.9	109.7	115,099
Employer Outreach – new / expanded Employers [2)]	1.1	42.2	44.313
Employer Outreach for Bicycling	0.0	0.2	142
Mass Marketing	0.2	7.6	8,212
InfoExpress Kiosks	0.2	6.4	6,610
TERMS (all TERMs collectively)	5.3	198.9	208,986
Commuter Operations Center – basic services (not including Software Upgrades)	1.7	60.4	65,953
Commuter Operations Center – Software Upgrades	0.4	15.2	16,669
All TERMs plus Commuter Operations Center	7.4	274.5	291,608

1) Impact represents portion of regional telecommuting attributable to TERM-related activities. Total telecommuting credited for conformity is higher than reported for the TERM.

2) Impacts for new / expanded employer programs and Employer Outreach for Bicycling are included in the Employer Outreach – all employers.

Finally, Table D shows comparisons of daily reductions in vehicle trips, VMT, NOx, and VOC from the 2005 TERM analysis to results of the 2008 results. Note that, as described in the footnotes to the table, the calculation for many of the TERMs changed from 2005 to 2008, as TERMs were restructured. For example, the 2008 Employer Outreach TERM impacts for 2008 were calculated using more conservative coefficients in the COMMUTER model. This resulted in lower impacts per participating employee. As another example, the 2008 Mass Marketing TERM included Bike to Work Day impacts. In 2005, BTW Day was captured under the Employer Outreach for Bicycling TERM. For these reasons, the comparisons between 2005 and 2008 will not be completely equivalent.

Table D
Summary of Results for Individual TERMs 7/05– 6/08 Compared to 7/02 – 6/05

TERM	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Maryland and Virginia Telework [1]				
July 2005 – June 2008	21,866	413,703	0.211	0.126
July 2002 – June 2005	11,129	226,913	0.187	0.097
Change [2]	10,737	186,790	0.024	0.029
Guaranteed Ride Home				
July 2005 – June 2008	8,680	227,428	0.106	0.056
July 2002 – June 2005	11,647	334,088	0.239	0.105
Change [2]	(2,967)	(106,660)	(0.133)	(0.049)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2005 – June 2008	59,163	969,174	0.443	0.266
July 2002 – June 2005	81,150	1,339,818	1.036	0.526
Change [2]	(21,987)	(370,644)	(0.593)	(0.260)
Employer Outreach for Bicycling [4]				
July 2005 – June 2008	188	1,127	0.001	0.001
July 2002 – June 2005	343	3,431	0.003	0.002
Change [2]	(155)	(2,304)	(0.002)	(0.001)
Mass Marketing [4]				
July 2005 – June 2008	2,577	69,274	0.032	0.017
July 2002 – June 2005	7,299	132,861	0.101	0.050
Change [2]	(4,722)	(63,587)	(0.069)	(0.033)
InfoExpress Kiosks				
July 2005 – June 2008	2,840	52,638	0.027	0.016
July 2002 – June 2005	3,197	62,655	0.052	0.027
Change [2]	(357)	(10,017)	(0.025)	(0.011)
All TERMs				
July 2005 – June 2008	95,126	1,732,217	0.819	0.481
July 2002 – June 2005	119,190	2,220,582	1.705	0.845
Change [2]	(24,064)	(488,365)	(0.886)	(0.364)
Commuter Operations Center (Basic Services + Software Upgrades) [5]				
July 2005 – June 2008	22,473	721,678	0.320	0.158
July 2002 – June 2005	12,160	363,013	0.259	0.115
Change [2]	10,313	358,665	0.061	0.043

1) 2005 impacts included credit for Metropolitan Washington Telework Centers
2) Change in emissions is due in part to reduction in emission factors from 2005 to 2008.
3) 2008 impacts calculated using more conservative model coefficients, resulting in lower per employee impact
4) 2005 impacts included Bike-to-Work Day impacts; in 2008, BTW was included in Mass Marketing TERM
5) 2005 and 2008 impacts included Integrated Rideshare Software Upgrades; this was separate component in 2005

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SECTION 1 INTRODUCTION

PURPOSE OF THE REPORT

This report presents the results of an evaluation of five Transportation Emission Reduction Measures (TERMs), voluntary Transportation Demand Management (TDM) measures implemented by the National Capital Region Transportation Planning Board's (TPB) Commuter Connections program at the Metropolitan Washington Council of Governments (COG) to support the Washington, DC metropolitan region's air quality conformity determination and the region's congestion management process. This evaluation documents transportation and air quality impacts for the 36-month period between July 1, 2005 and June 30, 2008, for the following TERMs:

- Maryland and Virginia Telework – Provides information and assistance to commuters and employers to further in-home and telecenter-based telework programs.
- Guaranteed Ride Home – Eliminates a barrier to use of alternative modes by providing free rides home in the event of an unexpected personal emergency or unscheduled overtime to commuters who use alternative modes.
- Employer Outreach – Provides regional outreach services to encourage large, private-sector and non-profit employers voluntarily to implement commuter assistance strategies that will contribute to reducing vehicle trips to worksites, including the efforts of jurisdiction sales representatives to foster new and expanded trip reduction programs. The Employer Outreach for Bicycling TERM also is part of this analysis.
- Mass Marketing – Involves a large-scale, comprehensive media campaign to inform the region's commuters of services available from Commuter Connections as one way to address commuters' frustration about the commute.
- InfoExpress Kiosks – Involves self-service electronic kiosks located in the District of Columbia and in northern Virginia that offer information on commute options and allow for remote submittal of ridematch and GRH registration applications. The InfoExpress Kiosk project is part of the Integrated Rideshare TERM.

The TPB, the designated Metropolitan Planning Organization (MPO) for the Washington, DC metropolitan region, adopted these TERMs in the regional Transportation Improvement Program (TIP) to help the region reach emission reduction targets that would maintain a positive air quality conformity determination for the region and to meet federal requirements for the congestion management process. The United States Environmental Protection Agency has designated the Washington, DC metropolitan region as a "moderate" ozone non-attainment area. No regional mandates have been adopted that would require the reduction of nitrogen oxides (NOx) or the implementation of any specific mitigation measure. But the COG/TPB Travel Management Subcommittee developed and analyzed regional TERMs and the TPB adopted these TERMs in annual TIPs.

COG/TPB's Commuter Connections program, which operates an ongoing regional rideshare program, was given responsibility for implementation of the five regional Transportation Demand Management (TDM) TERMs that are described in this report. Commuter Connections is the central administrator of the TERMs, but works with partner organizations, such as local jurisdiction commuter programs and transportation management associations (TMAs) to implement them. Commuter Connections directly provides some client services, such as the regional rideshare database matching service, which are most cost-effectively provided by a central agency. But other services are offered by local organizations and

coordinated regionally by the Commuter Connections Subcommittee, a coordinating body comprised of state and local government agencies in the region, several large federal employers, a number of TMAs, and other partner organizations.

At the early stages of implementation of the TERMs, the Commuter Connections Subcommittee elected to include a vigorous evaluation element in the implementation plan for each of the adopted TERMs. The purpose of the evaluation was to develop timely, useful, and meaningful information to be used by regional transportation and air quality decision-makers, COG staff, COG program funders, and state and local commute assistance program managers to guide sound decision-making about the TERMs.

This report summarizes the results of the TERM evaluation activities and presents the transportation and air quality impacts of the TERMs. The report also documents impacts of the commuter assistance activities of the Commuter Operations Center, which COG operates to provide a basic level of commuter information and ridesharing assistance services throughout the Washington metropolitan region. Results from this report will be included in the region's conformity analysis determination and documented in the region's congestion management process.

In June 1997, a consultant team was retained to assist Commuter Connections to define an evaluation methodology. This methodology was used for the first triennial evaluation of five TERMs. In 2001, 2004, and 2007, the consultants, along with Commuter Connections, expanded and enhanced the methodologies, data collection tools, and data sources to expand the coverage, corroborate assumptions, and enhance the reliability of the evaluation estimates. Section 3 presents highlights of the changes made to the methodology in this updated framework. Readers who desire additional details on the methodology are directed to the report entitled, "Commuter Connections' Transportation Demand Management Evaluation Project: Transportation Emission Reduction Measures (TERMs) Revised Evaluation Framework, July 2005 – June 2008." This document is available from COG's Information Center or on-line at www.commuterconnections.org.

The data collection activities recommended in the Evaluation Framework report were undertaken by COG/TPB staff or by data collection consultants retained by COG. This report summarizes the results of the evaluation activities and analysis. The report also summarizes the transportation and air quality impacts of commuter assistance activities of the Commuter Operations Center, which COG/TPB operates to provide a basic level of commuter information and ridesharing assistance services throughout the Washington region. The COC is not an adopted TERM, but is included in this analysis because its operation supports the operation of most of the regional Commuter Connections TERMs.

ORGANIZATION OF THE REPORT

This TERM Analysis Report is divided into nine sections following this Introduction section:

- Section 2 Overall Summary of Results
- Section 3 Highlights of Revised Evaluation Methodology
- Section 4 Maryland and Virginia Telework
- Section 5 Guaranteed Ride Home
- Section 6 Employer Outreach
- Section 7 Mass Marketing
- Section 8 InfoExpress Kiosks
- Section 9 Commuter Operations Center
- Section 10 Conclusions About TERM Impacts

Section 2 summarizes the overall results for each TERM individually and for all TERMs plus the Commuter Operations Center collectively. Section 3 presents highlights of the revised evaluation methodology developed in 2007 for the FY 2006-2008 evaluation period. Sections 4 through 8 present for the each individual TERM, a brief description of the TERM and its purpose, an overview of the methodology used to estimate the TERMs' impacts and the data used in the analysis, and a comparison of the measured impacts against the goals set for the TERM. Section 9 presents similar information for the Commuter Operations Center. The final section, Section 10, presents general conclusions from the analysis.

Summaries of the calculations of transportation and air quality impacts of individual TERMs also are included in appendices following the body of the report.

SECTION 2 OVERALL SUMMARY OF RESULTS

The objective of the evaluation was to estimate the reductions in vehicle trips, vehicle miles traveled (VMT), and tons of Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOC) resulting from the implementation of each regional Commuter Connections TERM between July 2005 and June 2008 and to compare these measured impacts against the goals established for the TERMs. The Revised Evaluation Framework document finalized in May 2007 also recommended that other performance measures be tracked for these TERMs to assess levels of program participation, utilization, satisfaction, and cost-effectiveness. These measures are tracked by Commuter Connections on a monthly and annual basis for the TERMs and are reported in other documents.

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As shown in Table 2, the TERMs combined fell about four percent short of the goal for vehicle trips reduced (shortfall of 3,477 trips reduced), and six percent below the goal for VMT reduced (net of -117,963 VMT reduced). The impacts for emissions reduced were about 13% under the goals.

But when the COC results were added to the TERM impacts, the combined impacts exceeded the combined goals. The totals for all Commuter Connections programs, compared to the goals, were: +6,228 daily vehicle trips reduced, +244,741 daily VMT reduced, and +0.018 daily tons of NOx reduced. The combined impacts for VOC reduced were slightly under the goal, by – 0.028 tons reduced.

Two of the five TERMs, Telework and InfoExpress Kiosks, met their individual impact goals. Impacts for Maryland and Virginia Telework were about twice the goal for the TERM. And the InfoExpress Kiosk TERM met its goal. The COC basic service and COC-Software Upgrades also exceeded their goals by substantial margins.

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Net Credit or (Deficit)		**6,228**	**244,741**	**0.018**	**(0.028)**

1) Participation refers to number of commuters participating, except for the Employer Outreach TERM. For this TERM, participation equals the number of employers participating.

2) Impacts for Commuter Operations Center – software Upgrades are in addition to the impacts for the Commuter Operations Center – Basic Services.

Table 3, on the following page, presents annual emission reduction results for PM 2.5, PM 2.5 pre-cursor NOx, and CO2 emissions (Greenhouse Gas Emissions - GHG) for each TERM and for the COC. COG/TPB did not establish specific targets for these impacts for the Commuter Connections TERMs. But COG has begun to measure these impacts for other TERMs, thus these results are provided.

As shown, the TERMs collectively reduce 5.3 annual tons of PM 2.5, 198.9 annual tons of PM 2.5 pre-cursor NOx, and 208,986 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 7.4 annual tons of PM 2.5, 274.5 annual tons of PM 2.5 pre-cursor NOx, and 291,608 annual tons of CO2 (greenhouse gas emissions).

Table 3
Summary of Annual PM 2.5 and CO2 (Greenhouse Gas) Emission Results for Individual TERMs

TERM	Annual Tons PM 2.5 Reduced	Annual Tons PM 2.5 Precursor NOx Reduced	Annual Tons CO2 Reduced
Maryland and Virginia Telework [1)]	1.3	50.0	51,953
Guaranteed Ride Home	0.7	25.2	27,112
Employer Outreach – all employers [2)]	2.9	109.7	115,099
Employer Outreach – new / expanded Employers [2)]	1.1	42.2	44,313
Employer Outreach for Bicycling	0.0	0.2	142
Mass Marketing	0.2	7.6	8,212
InfoExpress Kiosks	0.2	6.4	6,610
TERMS (all TERMs collectively)	5.3	198.9	208,986
Commuter Operations Center – basic services (not including Software Upgrades)	1.7	60.4	65,953
Commuter Operations Center – Software Upgrades	0.4	15.2	16,669
All TERMs plus Commuter Operations Center	7.4	274.5	291,608

2) Impact represents portion of regional telecommuting attributable to TERM-related activities. Total telecommuting credited for conformity is higher than reported for the TERM.

2) Impacts for new / expanded employer programs and Employer Outreach for Bicycling are included in the Employer Outreach – all employers.

Table 4 shows comparisons of results from the 2005 TERM analysis to results of the 2008 results. Note that, as described in the footnotes to the table, the calculation for many of the TERMs changed from 2005 to 2008, as TERMs were restructured. For example, the 2008 Employer Outreach TERM impacts for 2008 were calculated using more conservative coefficients in the COMMUTER model. This resulted in lower impacts per participating employee. As another example, the 2008 Mass Marketing TERM included Bike to Work Day impacts. In 2005, BTW Day was captured under the Employer Outreach for Bicycling TERM. For these reasons, the comparisons between 2005 and 2008 will not be completely equivalent.

Table 4
Summary of Results for Individual TERMs 7/05– 6/08 Compared to 7/02 – 6/05

TERM	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Maryland and Virginia Telework [1]				
July 2005 – June 2008	21,866	413,703	0.211	0.126
July 2002 – June 2005	11,129	226,913	0.187	0.097
Change [2]	10,737	186,790	0.024	0.029
Guaranteed Ride Home				
July 2005 – June 2008	8,680	227,428	0.106	0.056
July 2002 – June 2005	11,647	334,088	0.239	0.105
Change [2]	(2,967)	(106,660)	(0.133)	(0.049)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2005 – June 2008	59,163	969,174	0.443	0.266
July 2002 – June 2005	81,150	1,339,818	1.036	0.526
Change [2]	(21,987)	(370,644)	(0.593)	(0.260)
Employer Outreach for Bicycling [4]				
July 2005 – June 2008	188	1,127	0.001	0.001
July 2002 – June 2005	343	3,431	0.003	0.002
Change [2]	(155)	(2,304)	(0.002)	(0.001)
Mass Marketing [4]				
July 2005 – June 2008	2,577	69,274	0.032	0.017
July 2002 – June 2005	7,299	132,861	0.101	0.050
Change [2]	(4,722)	(63,587)	(0.069)	(0.033)
InfoExpress Kiosks				
July 2005 – June 2008	2,840	52,638	0.027	0.016
July 2002 – June 2005	3,197	62,655	0.052	0.027
Change [2]	(357)	(10,017)	(0.025)	(0.011)
All TERMs				
July 2005 – June 2008	95,126	1,732,217	0.819	0.481
July 2002 – June 2005	119,190	2,220,582	1.705	0.845
Change [2]	(24,064)	(488,365)	(0.886)	(0.364)
Commuter Operations Center (Basic Services + Software Upgrades) [5]				
July 2005 – June 2008	22,473	721,678	0.320	0.158
July 2002 – June 2005	12,160	363,013	0.259	0.115
Change [2]	10,313	358,665	0.061	0.043

1) 2005 impacts included credit for Metropolitan Washington Telework Centers
2) Change in emissions is due in part to reduction in emission factors from 2005 to 2008.
3) 2008 impacts calculated using more conservative model coefficients, resulting in lower per employee impact
4) 2005 impacts included Bike-to-Work Day impacts; in 2008, BTW was included in Mass Marketing TERM
5) 2005 and 2008 impacts included Integrated Rideshare Software Upgrades; this was separate component in 2005

SECTION 3 HIGHLIGHTS OF REVISED EVALUATION METHODOLOGY

BACKGROUND

In 1997, consultants selected by COG developed an evaluation framework to guide the collection and analysis of data to estimate the travel and air quality impacts of TDM TERMs adopted by COG's TPB. This methodology described evaluation objectives, performance measures for each TERM, data needs and data collection tools and sources, and analysis and calculation steps to be used to estimate travel, air quality, energy, and consumer cost impacts of the TERMs. The framework also presented recommendations for the evaluation schedule, responsibilities, and reporting of results to maintain and utilize information produced through the evaluation process.

The methodology developed in 1997 was designed to collect sufficient data, using recognized and accepted survey and tracking techniques, to allow TERM effectiveness to be measured with confidence. But it also was designed to be practical and efficient to undertake. The first TERM analysis, conducted in the summer of 1999, reinforced the well-established view that data collection and evaluation for TDM programs can be challenging, especially when the programs are voluntary. Reliable data can be difficult to assemble, assumptions may need to be made using little data, and many factors outside the TDM program can influence results.

The first evaluation made recommendations for several data collection changes that could enhance the accuracy, rigor, coverage, and reliability of future TERM evaluations. A revised methodology was prepared in 2001, reflecting these recommendations. In 2004 and 2007, following the second and third triennial evaluations, respectively of the TERMs, the methodology was updated again to enhance the analysis results for several TERMs.

This section identifies key enhancements that were made to the methodology since the 2005 TERM Analysis Report was completed and discusses the overall rigor of the evaluation framework as compared to other regions. Overall, the Transportation Demand Management evaluation process employed for this analysis is among the most rigorous and comprehensive in the U.S.

EVALUATION METHODOLOGY OVERVIEW

Evaluation Principles

Before discussing the methodology changes in the Revised Evaluation Methodology, it is useful to review several element of the methodology developed in 1997. The TERM evaluation process was founded on several key evaluation principles that formed the foundation for the Evaluation Framework that has guided the process since 1997. Some of those principles, which have since been adopted by other regions evaluating TDM programs, include:

- Provide sound, definitive, and useful information about the results of the program
- Assure objective evaluation by using a third-party (other than a funding or implementing agent)
- Avoid double counting by separating out the impacts of individual program elements or TERMs
- Report only those impacts associated with the TERMs, and not the combined impacts of the TERMs and the basic commuter services that have been in place since the 1970s

- Follow accepted and recognized evaluation techniques
- Be rigorous, ongoing, resource efficient, unobtrusive for COG partners, and compatible with regional, state, and national practices

Evaluation Methodology Steps

The evaluation of Commuter Connection's TERM program impacts is based on a step-by-step calculation methodology that uses a series of "multiplier factors" to estimate several important program impact measures related to transportation and air quality benefits. The methodology calls for these multiplier factors, which are developed primarily from survey data, to be applied to a known number of commuters in the population that might be influenced or affected by the TERM to make a travel pattern change (population base"). The result of these step-by-step calculations is an estimate of the numbers of vehicle trips, VMT, and emissions reduced through the travel pattern changes made by commuters after contact with the TERM programs or services.

For most TERMs, the population base is commuters who participate in or use TERM services, although in a few cases, the population is broader, such as all regional commuters. Thus, this methodology requires first an accurate documentation of the participation of employers and commuters in each TERM program and an accurate count of other population bases. This is accomplished primarily by program participant tracking performed by Commuter Connections staff and survey results.

As noted earlier, the methodology uses several calculation factors derived from surveys of the populations of interest. The five major factors include:

1) Placement rate (percent of commuters in the population base who shifted to commute alternatives as a result of the TERM)
2) Vehicle trip reduction (VTR) factor (average number of vehicle trips reduced per day by each placement)
3) Average one-way commute trip distance
4) Drive alone access percentage (proportion of ridesharers and transit users that drive alone to the location where they meet their carpool, vanpool, bus, or train)
5) Drive alone access distance (distance commuters travel to rideshare/transit meeting points)

These factors are applied within the basic methodology steps listed below to calculate program impacts for each TERM.

1) Estimate commuter population "base" for the TERM (e.g., all commuters, GRH applicants, rideshare matching applicants, kiosk users, Employer Outreach employees, etc.)
2) Estimate the number of new commute alternative placements – Multiply placement rate by the population base for the evaluation period
3) Estimate vehicle trips reduced – Multiply number of placements by the Vehicle Trip Reduction (VTR) factor
4) Estimate VMT reduced – Multiply number of vehicle trips reduced by average commute distance
5) Adjust vehicle trips and VMT for access mode – Discount vehicle trips reduced and VMT reduced to account for commuters who drive alone to meet rideshare modes and transit

6) Estimate NOx and VOC emissions reduced – Multiply adjusted vehicle trips and VMT reduced by emissions factors consistent with the regional planning process

7) Estimate PM 2.5, PM 2.5 pre-cursor NOX, and CO2 emissions reduced – Multiply adjusted vehicle trips and VMT reduced by emissions factors consistent with the regional planning process

These steps were established largely in the 1997-99 evaluation framework developed in 1997 and remained unchanged for the subsequent evaluations conducted for the 1999-2001, 2002-2005, and FY 2006-2008 evaluations. Two other issues should be noted as background, because they are critical to understanding the high level of rigor build into the evaluation process:

- Prior mode is an important variable in this evaluation; a shift of a commuter to commute alternative mode does not always mean the commuter reduced a vehicle trip. Vehicle trips are reduced only in three cases: 1) if the commuter previously drove alone, 2) if the commuter previously used a commute alternative but increased the frequency of use of this mode, or 3) if the commuter shifted to a higher occupancy commute alternative (e.g., from carpool to vanpool). Section 6 describes the development of vehicle trip reduction (VTR) factors that are used to translate the number of new commute alternatives placements into the number of vehicle trips reduced, taking into account the three change factors listed above.

- For air quality evaluation purposes, it is necessary to know the access mode of ridesharers and transit riders. Access mode refers to the travel mode carpoolers, vanpoolers, and transit riders use to travel from home to Park & Ride lots, to other places where they meet their rideshare partners, or to the bus stop or train station, if they do not walk or are not picked up at home. Access mode is less important for evaluating travel impacts, because access trips generally account for a small portion of the total trip and the alternative mode generally is used in the most congested and longest portion of the trip. However, from an air quality standpoint, a commuter who drives alone to the meeting point still makes a vehicle trip and accumulates some drive alone VMT, which must be subtracted from the total numbers of vehicle trips reduced and VMT reduced in the air quality analysis.

REVISED EVALUATION FRAMEWORK

In general, the TERM analysis approaches documented in the 2005 TERM Analysis Report were used as the basis for the TERM evaluation methods described used in the FY 2006-2008 evaluation. The 2005 TERM Analysis Report concluded with a few minor recommendations for each TERM regarding enhancements to future evaluations. These enhancements were included, for the most part, in the Revised Evaluation Framework for the current evaluation period (2006-2008). A brief summary of key methodology issues and approaches is presented below for each TERM. More details of each approach are presented in Sections 4 – 8 for each individual TERM.

- Maryland and Virginia Telework – Maryland and Virginia Telework (Telework TERM, previously named Telework Resources Center, TRC) is a resource service to help employers, commuters, and program partners initiate or expand telework programs. In evaluating teleworking, several travel changes need to be assessed, including: trip reduction due to teleworking, the mode on non-telework days, and mode and travel distance to telework centers. Telework impacts are primarily estimated from the State of the Commute survey and by surveys conducted of employers directly requesting information from Commuter Connections.

In the 2002-2005 evaluation, the TRC TERM analysis included credit for Commuter Connections assistance to the Metropolitan Washington Telework Centers. This component was eliminated from the analysis, as Commuter Connections has largely eliminated this support. However, credit for telecenter users who obtained telework information from Commuter Connections will continue to be counted.

- Guaranteed Ride Home (GRH) – The primary goal of GRH is to encourage commuters who drive alone to shift to ridesharing, transit, and bike/walk. However, since past evaluation results show that a sizeable portion of GRH applicants were ridesharing before they applied for GRH benefits, the TERM analysis also explores benefits from the continuation and expansion of existing ridesharing arrangements. Thus, the evaluation process estimates the influence of GRH availability on both mode shifts and frequency/duration of ridesharing. Enhancements made over the past several evaluation periods include discounting of VMT reductions made outside the COG non-attainment area and the derivation of one placement rate for both GRH applicants and one-time exemptions. No additional changes were made to the methodology for the FY 2006-2008 evaluation.

- Employer Outreach – Employer outreach applies a two-faceted approach employing empirical data on employer programs and modeled impacts. The empirical data come from the ACT! database of employer contacts, including information on the trip reduction strategies implemented at each worksite. The EPA COMMUTER model (v 2.0) applies these empirical data to project the likely change in employee commuting behavior for given change in the employer's program.

  Three changes were made to the methodology for this TERM for the FY 2006-2008 analysis. First, in the 2002-2005 evaluation, a separate calculation was performed to estimate impacts for employers that were not participating in Employer Outreach but that did offer Metrochek/Smart Benefits through the program administered by the Washington Metropolitan Area Transit Authority (WMATA). This credit was eliminated from the FY 2006-2008 calculation.

  Second, in 2007-2008, the evaluation team reassessed the COMMUTER Model as the predictive tool for the analysis and compared it to other models that could be used. The decision following that analysis was to continue to use the COMMUTER model, but with a modified cost coefficient that better reflects the expected response of employees to financial incentives.

  Third, in the 2002-2005 evaluation, a separate credit was estimated for impacts related to bicycle support implemented by employers participating in Employer Outreach (Employer Outreach for Bicycling TERM). In the FY 2006-2008 evaluation, this credit was captured in the Employer Outreach TERM. This did not result in a loss of benefits, since the Employer Outreach for Bicycling credit was subtracted from the Employer Outreach TERM credit in 2002-2005 to avoid double counting these credits.

- Mass Marketing – The critical issues for this TERM are documenting and attributing changes in attitudes and behavior to the mass marketing campaign. Two types of impacts are measured, "direct" impacts, for commuters who cite the regional marketing campaign as the reason for their commuting change and "referred" impacts generated when advertising encourages commuters to submit rideshare and GRH applications. This is explained further in Section 7. The evaluation was accomplished using a variety of data sources, including the State-of-the-Commute survey and COC tracking data. It also required careful attribution of impacts to Mass Marketing or other TERMs, as appropriate. This TERM also included calculation of Bike to Work Day impacts.

- InfoExpress Kiosks – In the 2002-2005 evaluation framework, the InfoExpress Kiosk TERM was one of two components of the Integrated Rideshare TERM. For the 2005-2008 TERM analysis, the Software Upgrade component of Integrated Rideshare was reported under the Commuter Operations Center, so InfoExpress Kiosks are reported separately in this analysis. The analysis of this TERM used State of Commute survey information to identify changes in commute behavior related to the use of information kiosks. The kiosk evaluation assessed impacts only through January 31, 2007, the end date of the project.

- Commuter Operations Center (COC) – The evaluation of COC activities now includes the impacts of Software Upgrades improved transit information. This program was previously reported under in the Integrated Rideshare TERM.

NATURE OF THE EVALUATION APPROACH AS COMPARED TO OTHER REGIONS

The evaluation approach used in the Washington DC region to assess the impact of the TERMs implemented by Commuter Connection has become recognized as among the most comprehensive and rigorous in the nation. Several regions of a similar size and complexity have looked to this evaluation as a model and adopted similar approaches. For example:

- The evaluation of voluntary trip reduction strategies in Atlanta is using a similar "bottom-up" approach to measure the impact of various program elements individually and carefully sum the results while avoiding double counting from overlapping program influences. The TERM analysis has been held up as a model for this approach.
- A comprehensive evaluation of TDM services in Los Angeles County derived unique placement rates and VTR factors for the programs being evaluated and estimated the cost per person placed and cost per trip reduced of the overall TDM program. This evaluation also explicitly drew from the evaluation experience in Washington DC.
- The New Jersey Department of Transportation also uses an evaluation system that applies placement rates and VTR factors derived from survey data to assess impacts of trip reduction strategies funded by the Department throughout the state. Some elements of this system are based on Commuter Connections' evaluation method.

The only other regions that may have data and an evaluation approach comparable to MWCOG's TERM Analysis are Washington State's Commute Trip Reduction (CTR) program and the regional evaluation performed in the Atlanta, GA region. The CTR program performs its evaluation under a legislative mandate and uses data that regulated employers are required to provide. This shifts some of the effort of data collection to employers and allows full capture of data directly from employers, simplifying some data analysis tasks. In Atlanta, data are collected and analyzed to evaluate regional ridesharing, transit and vanpool subsidy programs, and marketing campaigns. The data collection and analysis methods used are similar to those used in the MWCOG evaluation.

The key characteristics of the evaluation approach used in metropolitan Washington that have elevated or enhanced the state of the practice in TDM evaluation include:

- The careful avoidance of double counting between program elements
- The derivation of unique placement rates for each program element and mode

- The inclusion of placement duration in the calculation of impacts
- The derivation of empirically-based Vehicle Trip Reduction (VTR) factors to avoid the document mistaken assumption that every new placement reduces a full vehicle trip every day
- The consideration of access mode to a shared ride arrangement to account for cold starts

For these reasons, the users of these evaluative results should feel confident that the reported impacts are as accurate and reliable as is reasonably possible and are based on what is widely accepted as one of the most comprehensive and rigorous evaluation approaches being used today in the US.

SECTION 4 MARYLAND AND VIRGINIA TELEWORK

BACKGROUND

The TPB adopted a telework-oriented TERM in the Fiscal Year 1995-2000 TIP and in June 1996, the Metropolitan Washington Telework Resource Center (TRC) was implemented. This TERM has been renamed as Maryland and Virginia Telework (Telework) when its scope was reduced to focus solely on Maryland and Virginia-based employers, but its purpose remains the same: to provide information, training, and assistance to individuals and businesses to further in-home and telecenter-based telework programs. Telework activities during the past few years have included assistance to employers to start or expand telework programs, development of employer telework case studies, distribution of telework information included in a telework information kit, and ongoing marketing and initiatives.

EVALUATION METHODOLOGY AND DATA SOURCES

The goal of Telework is to increase the number of home-based and telework center-based teleworkers in the region, whether full-time or part-time teleworkers. For FY 2006-2008, Telework impacts were evaluated by calculating the number of teleworkers in the region who used or were influenced by Telework services and estimating the number of vehicle trips and VMT they did not make, as a result of telecommuting, and the tons of emissions that were reduced by the trip and VMT reductions. Through this method, only impacts that could be traced directly to the Telework TERM were counted in the impacts for this TERM as the contribution of the Telework TERM to regional telecommuting. In other words, it was recognized that some telecommuting would have occurred even if the Telework TERM was not in place.

Two Telework components were evaluated, including:

- All regional teleworkers who are influenced by Maryland and Virginia Telework services / assistance to begin teleworking
- Telework employees at Maryland and Virginia worksites assisted by Commuter Connections

Data for impacts of these components were obtained from several sources. The sources and the evaluation data collected from each, are described briefly below:

Assisted Employer Telework Survey (new teleworkers at worksites assisted by Telework)

- Percentage of employers with telework programs before and after receiving Telework assistance
- Percentage of teleworkers at assisted sites before and after receiving assistance

State of the Commute Survey (regional commuters)

- Number of regional teleworkers and their frequency of teleworking
- Telework locations – the mix between home-based and non-home-based telework
- Average frequency of teleworking, teleworkers' commute modes on non-telework days, and commute distance they traveled on non-telework days
- Teleworkers travel patterns to telework locations outside the home
- Sources of information teleworkers had used to learn about teleworking

Using results from these surveys and records, the number of teleworkers who had either direct or indirect (through their employers) contact with the Telework TERM during the evaluation period were estimated

and divided into "home-based" and "non-home-based" groups. These numbers of teleworkers were then multiplied by average VTR factors, as identified by the appropriate survey data, to obtain the number of vehicle trips reduced by their teleworking.

For this TERM, VTR factors accounted for both the average telework frequency of the groups as well as their commute modes on telework days (non-home-based teleworkers) and non-telework days (all teleworkers). The VTR factor for home-based teleworkers was 0.45 daily trips reduced per teleworker, reflecting the part-time (1.5 days per week average) telework frequency and the elimination of vehicle trips for teleworkers who drove alone, carpooled, or vanpooled on non-telework days. The VTR factor was lower (0.31) for non-home-based teleworkers, because the majority of these teleworkers drove alone to these outside locations. Thus they did not reduce (and in some cases increased) the number of vehicle trips they made on an average day. However, the benefit of their teleworking was in the reduction of VMT on telework days at a location outside the home.

The VMT reduced by teleworking was calculated for home-based teleworkers by multiplying the number of daily vehicle trips reduced by the average commute distance. In the case of non-home-based teleworkers, the VMT reduced was calculated by multiplying the number of teleworkers on an average day by the reduction of VMT for a telework day (travel distance to main work location minus travel distance to the outside telework location).

Tons of emissions removed were calculated by multiplying vehicle trip and VMT reductions by 2008 emission factors developed for NOx and for VOC for the region. Annual impacts for PM 2.5, PM 2.5 pre-cursor NOx, and CO2 also were calculated. Appendix 1 details the calculations made to estimate impacts for the Telework TERM.

MARYLAND AND VIRGINIA TELEWORK SUMMARY OF GOALS AND IMPACTS

The results of the calculations for Telework are shown in Table 4 below, along with the goals established for the TERM. The net credits or deficits, which were equal to the impacts minus goals, also are shown.

Table 4
Telework Goals, Estimated Telework TERM Impacts, and Estimated Regional Telecommute Impacts

	Regional TW Impacts	Telework Goal	Telework TERM Impact*
• Number of teleworkers	456,636	31,854	49,027
• Daily vehicle trips reduced	203,660	11,830	21,866
• Daily VMT reduced	3,853,246	241,208	413,703
• Daily tons NOx reduced	1,962 T	0.122 T	0.211 T
• Daily tons VOC reduced	1.183 T	0.072 T	0.126 T
• Annual tons PM 2.5 reduced	12.2 T	None	1.3 T
• Annual tons PM 2.5 pre-cursor NOx reduced	466.1T	None	50.0 T
• Annual tons CO2 reduced	483,894 T	None	51,953 T

Impacts vs Goals

Participation Benefit (net over or (under) goal):	Telecommuters: 17,173
Transportation Benefit (net over or (under) goal):	Vehicle Trips: 10,036 VMT: 172,495 miles
Emission Benefit (net over or (under) goal):	NOx: 0.089 tons per day VOC: 0.054 tons per day

As shown, in 2008, approximately 456,000 regional workers were telecommuting at least occasionally, about 17.4% of the total regional workforce and nearly 19% of all workers who are not self-employed, working only at home. This number of teleworkers represented an increase of 43% over the 2005 number of 318,130 teleworkers and several times the 1996 baseline of 150,900 teleworkers. Telecommute growth is likely the result of several factors, including the use of teleworking by employers to recruit and retain employees in a very competitive labor market. Increasing traffic congestion in the Washington region also might have prompted some commuters to work at home or at a telework center or employer satellite center to avoid fighting traffic. Emergency preparedness, with a focus on continuity of operation, also has been a catalyst in the growth of Telework. Finally, the desire of employees for a better balance of work and family, a trend occurring nationally, and greater affordability of sophisticated technology, also might have contributed to the growth in telecommuting.

The Telework TERM's expected contribution to regional teleworking is shown in the second column of Table 4 and the impacts are shown in the third column. The Telework TERM exceeded by more than 17,000 the goal for the number of teleworkers expected from Telework activities. The TERM also substantially exceeded the reduction goals established for vehicle trips, VMT, and emission reductions.

As shown in Table 4, the Telework TERM was responsible for a portion of, but not all of, the regional telecommuting. The TERM is credited with about one tenth of the number of teleworkers and regional telework impacts. One possible area in which the Telework TERM's contribution to the regional telework impacts could have been undercounted is in the area of regional telework advertising. The State of the Commute Survey indicated that about eight percent of teleworkers mentioned Commuter Connections or MWCOG as a source of their telework information. These teleworkers were credited to the Telework TERM contribution.

But an additional five percent said they learned of teleworking through "advertising," newspaper ads, or "other website." Although these sources were not necessarily controlled by Commuter Connections, Commuter Connections has advertised consistently and broadly about telework via radio, television, print media, and the internet. So this response likely indicates additional teleworkers who learned about teleworking from outreach and promotion conducted by Commuter Connections. Because the source of the advertising could not be clearly documented, only a share of these commuters (1.6% of total teleworkers) was credited to the Telework TERM. When added to the eight percent who mentioned telework directly, the total share of teleworkers assisted by the Telework TERM equaled 9.6%.

SECTION 5 GUARANTEED RIDE HOME

BACKGROUND

The regional Guaranteed Ride Home (GRH) program was adopted by the TPB in the Fiscal Year 1995-2000 TIP to eliminate a major barrier to using alternative modes, commuters' fear of being without transportation in the case of an emergency. The program provides up to four free rides home per year in a taxi or rental car in the event of an unexpected personal emergency or unscheduled overtime. When the program was implemented, it was offered to commuters who used alternative modes three or more times per week and who would register with Commuter Connections for GRH. In January 1999, to encourage additional participation, the program guidelines were changed to require use of alternative modes only two days per week. This rule was in place throughout the entire FY 2006-2008 evaluation period.

EVALUATION METHODOLOGY AND DATA SOURCES

The transportation and emissions impacts of the GRH program were measured through data from the GRH survey conducted in the spring of 2007. This survey polled 1,000 commuters who had registered for GRH at some point between March 1, 2004 and March 15, 2007. Both commuters who were currently registered at the time of the survey and those who were "past registrants" were eligible to participate in the survey. Additionally, commuters who had not registered for the program, but had taken a "one-time exception trip" were included in the survey sample.

The survey asked detailed questions needed to define changes commuters made in their travel behavior during their participation in GRH and the influence of GRH on these changes. Information collected from all respondents, included, among other elements:

- Commute patterns: current mode and previous mode (if commuter made a mode shift), frequency of mode use, travel distance, access mode to rideshare/transit pick-up point, and pool occupancy
- Permanence of mode changes: whether change was continued (still in effect) or temporary (commuter had reverted to the original mode)
- Importance of GRH to commuters' decisions to start or continue use of alternative modes

Data from the GRH surveys were used to estimate the calculation multipliers needed to estimate vehicle trips, VMT, and emissions reduced as a result of GRH; placement rate, VTR factor, travel distance, and emission factors. These multipliers were estimated for two sub-groups in the GRH population. The first sub-group included respondents who both live and work within the Washington, DC Metropolitan Statistical Area (MSA); that is within the 11-jurisdiction area covered by the TERM evaluation. The second group included respondents who work within the MSA but live outside it.

This distinction was made because applicants who live outside the MSA traveled a portion of their VMT outside the MSA. During the evaluation, it was decided that the VMT for these "out of MSA" applicants should be discounted to credit VMT reduction only for the portion that occurred within the MSA. Approximately 32% of the total participants lived outside the MSA.

For both sub-groups of survey respondents, the GRH placement rate, that is, the percentage of respondents who registered for GRH and made a mode shift to an alternative mode was calculated. The duration

of alternative mode placement was 45 months, longer than the entire evaluation period. Thus, for purposes of the analysis, all placements were considered "continued placements," that is they made a shift to an alternative mode and did not return to the previous mode. Overall, the continued placement rate for GRH was calculated for the two sub-group populations as follows:

- Within MSA 33.9%
- Outside MSA 44.9%

To determine the number of commuters placed in alternative modes between July 2005 and June 2008, these placement rates were multiplied by the total number of commuters who participated in GRH during that time period, 25,164, divided into the two sub-groups: 17,112 within the MSA and 8,052 outside the MSA. This calculation resulted in 5,801 placements from within the MSA and 3,616 placements from outside the MSA.

These placement figures were then multiplied by GRH VTR factors derived from the survey data to estimate the number of vehicle trips reduced. The VTR factors for the two sub-groups were as follows:

- Within MSA 0.92 vehicle trips reduced per placement
- Outside MSA 1.19 vehicle trips reduced per placement

As noted earlier, VTR factors represent the average number of vehicle trips reduced by a new alternative mode placement. They combine the vehicle trip reduction contributions of various types of mode changes, such as from transit to rideshare, drive alone to transit, and drive alone to carpool, each of which reduces a different number of vehicle trips per day, into one number. VTR factors of 0.92 and 1.19 indicate a significant number of the changes were to higher occupancy modes, such as transit, and/or were shifts from drive alone to alternative modes. The calculation of vehicle trips reduced produced a total of 9,639 trips reduced; 5,337 from commuters within the MSA and 4,303 from commuters outside the MSA.

Next, VMT reduced by GRH was calculated by multiplying the numbers of vehicle trips reduced by the average trip length for GRH commuters who made a shift to an alternative mode. The one-way trip distance for the within MSA respondents was 26.2 miles. The actual one-way distance for the outside MSA respondents was an average of 47.0 miles. To discount the distance credited to the outside MSA respondents, their one-way travel distance was set equal to that of the distance for the within MSA respondents. This resulted in a loss of 20.8 one-way miles per trip for each outside-MSA respondent. The VMT calculation reflected the following:

(5,337 within MSA trips reduced + 4,303 outside MSA trips reduced) x 26.2 miles per trip

= 252,549 VMT reduced

Estimates of reductions in NOx, VOC, PM 2.5, PM 2.5 pre-cursor NOx, and CO2 were calculated using regional emission factors, as described for the Telework TERM. Details of these calculations are shown in Appendix 2.

Note that the GRH results were adjusted to eliminate double counting due to overlap between GRH and the Mass Marketing TERM. About 10% of the GRH impacts were assigned to the Mass Marketing TERM to recognize that some GRH applicants were influenced to contact Commuter Connections and apply for GRH after they heard a Mass Marketing ad. The impacts shown in Table 5 below account for the adjustment and reflect the net GRH impacts.

GUARANTEED RIDE HOME SUMMARY OF GOALS AND IMPACTS

Table 5 presents the transportation and emission impact results for GRH and compares the results against the goals established for the TERM.

Table 5
Guaranteed Ride Home Goals and Estimated Impacts

	TERM Goal	Estimated Impacts
• Number of GRH participants*	36,992	25,164
• New applicants during evaluation period	N/A	15,644
• Daily vehicle trips reduced	12,593	8,680
• Daily VMT reduced	355,135	227,428
• Daily tons NOx reduced	0.177 T	0.106 T
• Daily tons VOC reduced	0.097 T	0.056 T
• Annual tons PM 2.5 reduced	None	0.7 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	25.2 T
• Annual tons CO2 reduced	None	27,112 T

* Number of participants currently enrolled in GRH

Impacts vs Goals

Participation Benefit (net over or (under) goal): Participants: (11,828)

Transportation Benefit (net over or (under) goal): Vehicle Trips: (3,913)
VMT: (127,707 miles)

Emission Benefit (net over or (under) goal): NOx: (0.071 tons per day)
VOC: (0.041 tons per day)

The number of commuters participating in GRH in June 2008 was considerably lower than the participant goal, and the vehicle trip reduction, VMT, and emissions impacts were correspondingly short of the goals for these measures. Participation in GRH has dropped markedly since 2005, perhaps due to reduced level of Commuter Connections program advertising and outreach focused exclusively on GRH. The 2007 State of the Commute survey found that only 26% of respondents said they knew a regional GRH program existed, compared to 59% who said they knew about the program in the 2004 SOC survey.

As noted above, the GRH results were adjusted to account for overlap between GRH and the Mass Marketing TERM. About 10% of GRH credits were assigned to the Mass Marketing TERM. To avoid double counting impacts, this MM share was subtracted from the base GRH impacts. The impacts shown in Table 5 account for the adjustment and reflect the net GRH impacts.

SECTION 6 EMPLOYER OUTREACH

BACKGROUND

The Employer Outreach TERM was adopted by the TPB in the Fiscal Year 1995-2000 TIP. This program provides regional outreach to encourage private sector employers voluntarily to implement TDM strategies that will contribute to reducing vehicle trips to their worksites.

The program was designed to increase outreach efforts in ten jurisdictions located in the region. Seventy percent of the funds received by COG for the Employer Outreach program element is passed-through to the jurisdictions for implementation of the program. Commuter Connections assists the sales force with the following services, designed to enhance regional coordination and consistency:

- Computerized regional employer contact database
- Marketing and information materials
- Employer outreach sales and service force training
- Annual evaluation program
- Support to Employer Outreach Committee

EVALUATION METHODOLOGY AND DATA SOURCES

Two variables are important for assessing the impacts of a TDM employer outreach program. First is the number of employers offering TDM services and the level of effort and commitment by the employer; that is the extent of the TDM programs they implement. Second is the level of employee participation in alternative modes as a result of the program. These two variables are strongly linked, as other TDM effectiveness research has shown. Higher levels of employer effort can be expected to offer greater incentive to employees to use alternative modes, leading to reductions in vehicle trips, VMT, and emissions.

Employer Participation in Commute Programs

The first of these variables was assessed through data collected by Commuter Connections from sales and outreach contacts with employers. Employer Outreach jurisdiction sales representatives documented the levels of programs implemented by their employer clients in the ACT! contact management database maintained by Commuter Connections. The Employer Outreach program specified services employers offered, for example, transit subsidy, information/promotions, Guaranteed Ride Home, etc.

The Employer Outreach program defined four levels of employer effort: Bronze (Level 1), Silver (Level 2), Gold (Level 3), and Platinum (Level 4), distinguished by the expected increasing trip reduction effectiveness of the services offered and the commitment of the employer, as shown below.

- **Bronze (Level 1) programs** offer only commute information.
- **Silver (Level 2) programs** offer the services of an Employee Transportation Coordinator (ETC) and information, and include one or more of: preferential parking, carpool/vanpool formation meetings, bike racks or lockers, transportation fairs, informal telework, and alternative work hours.

- **Gold (Level 3) programs** include, in addition to the Silver services, services such as financial incentives or parking "cash out," formal telework programs, parking fees, on-site ridematching, shuttles to transit stations, showers and lockers for bikers, and company vanpools.
- **Platinum (Level 4) programs** include two or more of the Gold program components and actively promote the program.

The Employer Outreach TERM was considered fully implemented in June 2005, thus the 2008 evaluation goals reflect impacts from employers that either started a new program after June 2008 or added new strategies to an existing program. Employers that joined prior to July 2005 were assumed to have continued in the program and were counted toward a "continued" impact base from 2005. But the analysis showed that 126 employers had dropped out of the program since June 2005. Commuter Connections determined that the impacts that would have been credited for these employers would have to be replaced by new/expanded impacts. Impacts were estimated for three groups of employers:

- Employer programs continued from June 2005
- Employer programs expanded since June 2005
- New employer programs started since June 2005

The overall benefit of the program is the sum of continued programs plus expanded and new programs. As shown below, in June 2008, the ACT! database included 1,006 employers with programs that met the Level 3 or 4 definitions. These employers accounted for 356,719 employees. Level 1 and 2 employers were not included in the regional impact calculation because their level of impact would be very small due to the lack of incentives or enhanced commute alternatives.

Of the Level 3 and 4 employers, 620 joined Employer Outreach prior to July 2005 and made no program changes since that time. Ninety-five employers that participated in 2005 were classified as "expanded" in 2008. And 291 were listed as "new" since June 2005. As noted, 126 employers that were counted in the 2005 evaluation had dropped out of the program. The employee count associated with these employers was smaller (21,728), however, than the number of employees at worksites with new/expanded programs. Had these employers continued in the program, the total employee count would have been 378,447, so the deleted employees represented a drop of about six percent.

	Number of Employers			Number of
Employer Status (June 2008)	**Total**	**100+**	**<100** [1)]	**Employees**
2005 employers				
- Continued from 2005 – no change	620	311	309	180,486
- Expanded program – confirmed	57	20	37	17,939
- Expanded program – not confirmed	38	15	23	7,650
New program – confirmed	137	80	57	83,078
New program – not confirmed [2)]	154	86	65	67,566
Total	**1,006**			**356,719**
Deleted from 2005	126			21,728

1) Actual number of employers with fewer than 100 employees.
2) Employee count information not available for 3 employers

Commuter Connections attempted to contact all employers that were listed as a having new or expanded program to verify the strategies offered at the worksite. Contacts were attempted with 386 employers and programs were verified for 194 of the employers; 57 "expanded" employers and 137 "new" employers. Commuter Connections was not able to reach 38 "expanded" and 154 "new" employers to confirm their status. Because the expanded employers' 2005 programs had been previously verified, the 2005 base impacts for these employers were included in the impact calculation, but the expanded strategies were not counted in the new/expanded impact total.

New employers whose status could not be confirmed were excluded from the calculation for this evaluation period. Unconfirmed employers represented more than 75,000 employees, or about 21% of the employees that could have been counted in the 2008 impact calculations. Thus, their absence had a significant impact on the total impacts reported for the 2006-2008 period.

Employee Participation in Commute Programs

The second variable in the impact evaluation, employees' response to the services offered, was more difficult to obtain. Starting mode split data were available for about 500 employers that had conducted a baseline commuter survey prior to implementing the TDM program. But as is typical for voluntary programs, only a few had conducted a follow-up survey by the time the evaluation data were being collected. Because baseline data were available, but post-program survey data were not, the researchers elected to estimate employee behavior changes using the US EPA's COMMUTER Model, which estimates worksite mode shifts from inputs on starting mode split and TDM program components.

This was the same methodology as was used in the 2005 evaluation, except that a new version of the COMMUTER model replaced the version used in the 2005 evaluation. As noted earlier, the cost coefficient was adjusted in the model, to reflect a more conservative estimate of employees' responses to financial incentive strategies. Readers who are interested in additional details on the model adjustments may contact Commuter Connections staff for additional documentation of the model analysis process and results.

Starting Mode Split – The COMMUTER model requires several "scenario" inputs, including the type of employer (primarily office or non-office) and the starting mode split. For employers that had conducted a baseline, "pre-program" survey, the actual mode split from the survey was used as the input. But for employers that had not conducted a survey, a starting mode split was assigned that reflected the average mode split that would be likely for employers with similar location and employee work conditions.

These average mode splits were calculated by aggregating employers in the ACT! database that had conducted baseline surveys into six groups, based on two employer/site variables that are known to influence mode choice: 1) type of employer / work performed, either office or non-office, and 2) availability of transit service: low, moderate, or high. Low transit was defined as limited bus service within ½ mile of the worksite. Moderate transit included a higher level of frequency and route availability. To be designated as a "high transit" employer, the site had to be within ½ mile of a Metrorail station and have access to a significant level of bus service.

For each of the six combinations of these two variables, for example, non-office employers with high transit and office employer with moderate transit, an average mode split was calculated from the baseline survey data of employers in that employer group that had conducted commuter surveys. Additionally, the Average Vehicle Ridership (AVR) was calculated for each group.

Program Definition – Employers included in the TERM analysis also were classified by the specific elements offered in their commute program. The COMMUTER model permits direct analysis of strategies, such as transit subsidies, that change the travel cost of one or more modes, and strategies that change the travel time (duration of a trip).

The model also has the capability to predict impacts of telework and compressed work schedules (CWS), when certain parameters of the work hours arrangements are known. The ACT! database indicated employers that had a telework program and, in most cases, the number of employees who were teleworking. Employers that offered telework, but for which participation numbers were not available were assumed to have telework rates equal to the regional average calculated from the 2007 State of the Commute survey. The ACT! database also noted employers that offered CWS, but no participation data were included for any of these employers, so default percentages were calculated from the SOC survey.

Other commute strategies, such as GRH, flextime, information support, and preferential parking, all are treated by the model as elements in a "support package." They are not modeled separately. Rather the level or extent of the support service package is modeled and the higher the number of these strategies offered, the higher the level of support that is modeled.

The strategy package assigned to an employer was thus comprised of the following potential actions:

- Amount of financial incentives (transit, carpool, vanpool)
- Participation in telework and number of teleworkers (if known)
- Participation in CWS and assumed percentage of employees participating
- Level of transit/rideshare commuter support offered
- Level of bicycle services offered
- Availability of a shuttle bus to Metrorail or other transit location

The COMMUTER model was run in a batch format that allowed each employer's program components to be modeled separately. The analysis thus calculated for each employer, the final mode split with the program in place. By comparing the starting and ending mode splits, the percentage trip reduction that would be expected following implementation of the program elements was calculated. This trip reduction was then applied to the number of employees at the worksite to estimate the number of vehicle trips reduced for that employer.

Because travel distance was not available for either individual employees or employers in the ACT! database, the number of VMT reduced was estimated by multiplying the vehicle trips reduced for an employer by the average regional one-way trip lengths for each mode, as measured through the 2008 State of the Commute Survey. Emissions reduced were calculated by multiplying trips and VMT reduced by 2008 regional emission factors. Finally, the individual results for each employer were aggregated to estimate the combined impact of all employers in the TERM. Appendix 3 provides details of the calculations of impacts for Employer Outreach.

EMPLOYER OUTREACH SUMMARY OF GOALS AND IMPACTS

The impacts calculated as described above, were compared against the TERM goals. The total goals and impacts are shown in Table 6.

Table 6
Employer Outreach Goals and Estimated Impacts

	EO Goal	Estimated Impacts
Employer Outreach (all programs)		
• Employers participating - total	581	852
– Continued from 2005*	424	658
– New or expanded - confirmed	96	194

* - Net: continued "no change" plus expanded (unconfirmed)

- Employers by jurisdiction (continuing and confirmed new/expanded)

	Total Employers	Employees	New/Expanded Employers
– Alexandria, VA	54	6,915	10
– Arlington County, VA	189	32,423	3
– District of Columbia	185	89,264	22
– Fairfax County, VA	72	50,625	43
– Frederick County, MD	2	3,050	2
– Loudoun County, VA	11	10,860	7
– Montgomery County, MD	314	73,777	99
– Prince George's County, MD	18	20,652	7
– Prince William County, VA	5	1,387	1
– Tri-County Council, MD	2	200	0

- Employers by size category (continuing and confirmed new/expanded)

	Total Employers	Employees	New/Expanded Employers
– Sites with 100+ employees	426	275,934	100
– Fewer than 100 employees	426	13,219	94
– "Equivalent 100+" [1)]	131		27

1) For purposes of program tracking, employers with fewer than 100 employees are grouped into "equivalent 100+" employers. The 426 employers in this category represent 131 "equivalent 100" employers.

Travel and Emissions Impacts and Impacts vs Goals

Overall Employer Outreach Program

	EO Goal	Estimated Impacts
Total Program		
• Daily vehicle trips reduced	64,644	59,163
• Daily VMT reduced	1,065,851	969,174
• Daily tons NOx reduced	0.549 T	0.443
• Daily tons VOC reduced	0.343 T	0.266
• Annual tons PM 2.5 reduced	None	2.9 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	109.7 T
• Annual tons CO2 reduced	None	115,099 T

Participating Employers (net over or (under) goal): Employers: 271

Transportation Benefit (net over or (under) goal): Vehicle Trips: (5,481)
VMT: (96,677) miles

Emission Benefit (net over or (under) goal): NOx: (0.106) tons per day
VOC: (0.077) tons per day

New / Expanded Employer Programs

	EO Goal	Estimated Impacts
• New/expanded programs (confirmed)	96	194
• Daily vehicle trips reduced	8,618	22,510
• Daily VMT reduced	140,622	372,406
• Daily tons NOx reduced	0.072 T	0.178 T
• Daily tons VOC reduced	0.046 T	0.102 T
• Annual tons PM 2.5 reduced	None	1.1 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	42.2 T
• Annual tons CO2 reduced	None	44,313 T

Participating Employers (net over or (under) goal): Employers: 98

Transportation Benefit (net over or (under) goal): Vehicle Trips: 13,892
VMT: 231,784 miles

Emission Benefit (net over or (under) goal): NOx: 0.106 tons per day
VOC: 0.056 tons per day

As shown, even with the loss of 126 employers that dropped out since 2005, the number of employers participating in the program was considerably above the goal overall and the new/expanded employer result (194 employers) was about twice the goal for this measure.

But even with this high participation level, the trip reduction and VMT reduction impacts for Employer Outreach overall were about nine percent below the goals for these measures. This is likely due primarily to the change made in 2008 to the coefficients used in the COMMUTER model. The coefficients were revised in 2008 to reflect more conservative assumptions about the impacts of financial incentives, resulting in lower trip reduction impacts from incentives than would have been calculated in 2005. It also could reflect a shift of some employers from cash / subsidy form of incentive to a pre-tax account. Because a pre-tax program offers smaller cost benefits to commuters than does an equal amount of direct subsidy, the impact on travel behavior would be less.

Finally, it is important to reiterate that a substantial share of employers listed as having new/expanded programs could not be reached to verify their programs and the impacts of their programs were not included in the calculation. But it is likely that at least some of these employers do offer the reported strategies. Thus the actual Employer Outreach benefit could be higher than reported here.

Emissions reduced for Employer Outreach were calculated by multiplying trips and VMT reduced by 2008 regional emission factors. Details of the calculation are presented in Appendix 3.

We note that Employer Outreach overlaps with the Maryland and Virginia Telework TERM. Fifty-five Employer Outreach participants that offered telework also had received assistance from Commuter Connections' Telework program, thus could also be counted in the Telework TERM's "assisted employer" category. To avoid double counting credits, impacts from the telework components of these employers' program were reassigned from Outreach to the Telework TERM. Impacts of non-telework strategies offered by these employers were included in the Employer Outreach impact calculation.

To estimate the extent of the overlap, the COMMUTER model was run for these employers with and without telework. The collective impact (vehicle trips, VMT, and emissions) for these employers' programs when telework was excluded was subtracted from the impact when telework services were included. The difference was considered to be the overlap. This impact was assigned to the Telework TERM and subtracted from the total Employer Outreach impact. The results presented in Table 6 show the adjusted impacts with the overlap removed.

Employer Outreach for Bicycling

A similar exercise was performed to estimate the contribution of bike strategies to Employer Outreach program impacts. The Employer Outreach for Bicycling TERM was adopted by the TPB in the Fiscal Year 1997-2002 TIP. This project provides regional outreach to encourage private sector and non-profit employers with 100 or more employees to implement worksites strategies that encourage employees to use bicycling for commuting.

One hundred, twenty-two employers offered bicycle strategies in their worksite programs. The impacts for these employers were modeled "with bicycling" and "without bicycling." The difference in vehicle trips reduced between these two cases was determined to be the bike strategies' share of the impacts. It was assigned to the Employer Outreach for Bicycling TERM component of Employer Outreach.

The VMT reduced for bicycling was estimated by multiplying the vehicle trips reduced by an average one-way trip length for bicycle commuters, of 6.0 miles, calculated from the 2007 State of the Commute (SOC) Survey. This was a change from the 2005 evaluation, which used a one-way trip distance of 10.0 miles, calculated from Bike-to-Work Day survey data. This change was made because the SOC distance was deemed to be a more realistic distance for bicyclists region-wide who bicycled on a regular basis.

As shown by the results below, the Employer Outreach for Bicycling TERM met all the goals established for the project, by nearly a factor of two.

New / Expanded Employer Programs – Bike Services

	EO Goal	Estimated Impacts
• Employers with bike strategies	61	122
• Daily vehicle trips reduced	130	188
• Daily VMT reduced	567	1,127
• Daily tons NOx reduced	0.001 T	0.001 T
• Daily tons VOC reduced	0.001 T	0.001 T
• Annual tons PM 2.5 reduced	None	0.0 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	0.2 T
• Annual tons CO2 reduced	None	142 T

Participating Employers (net over or (under) goal): Bike Employers: 61

Transportation Benefit (net over or (under) goal): Vehicle Trips: 58
VMT: 560 miles

Emission Benefit (net over or (under) goal): NOx: 0.000 tons per day
VOC: 0.000 tons per day

SECTION 7 MASS MARKETING

BACKGROUND

In July 2003, Commuter Connections embarked on an ambitious effort to educate the region about alternatives to stress-filled solo commuting and to raise awareness of commute assistance services available through Commuter Connections and its partners. This effort, captured in the Mass Marketing TERM, employs radio, television, direct mail, and other mass media to create a new umbrella level of public awareness and to provide a call to action to entice commuters to switch to alternative modes. The objectives of the Mass Marketing TERM are to:

- Raise regional awareness about the Commuter Connections brand
- Address commuters' frustration with congestion
- Induce commuters to try and adopt alternative commute modes

In the 2008 analysis, one additional program component was added to the Mass Marketing TERM analysis. Commuter Connections provides support to the annual Bike-to-Work Day event. In the 2005 evaluation, impacts of BTW Day were captured under the Employer Outreach for Bicycling TERM. But Commuter Connections' role in this event is primarily promotional in nature. Thus, when Employer Outreach for Bicycling was absorbed into the Employer Outreach TERM, this program was moved for the 2008 evaluation to Mass Marketing.

EVALUATION METHODOLOGY – UMBRELLA ADVERTISING CAMPAIGN

The Mass Marketing TERM has three populations of interest:

1) All commuters in the Commuter Connections service area
2) Commuter Connections rideshare and GRH applicants who were influenced by the marketing campaign to request Commuter Connections services
3) Commuters who participate in the Bike-to-Work Day event

This TERM presents two challenges not encountered in most of the other TERMs. First, it is more difficult to assess influence on the general commuting public than it is to identify and track program participants. Second, when commuters who changed travel behavior can be identified, it is still necessary to identify what motivated their change – the media campaign or another influence.

The Mass Marketing evaluation method examines impacts from two types of change, which are measured separately. The first is ***"directly"*** influenced change. These are mode shifts that are made when the ads motivate commuters to change mode with no intermediate contact with Commuter Connections. An example of this type of change would be a carpool formed when a commuter hears the ad and asks a coworker to carpool. Direct influences can only be assessed through a regional survey of commuters that asks about mode change and the reasons for the changes. If a shift occurred and the shift can be attributed to a message that is part of the Mass Marketing campaign, the associated trip, VMT, and emissions reductions can be credited to the campaign.

The second is "referred change." These are mode shifts that occur among commuters who are influenced to contact Commuter Connections by the ads. This change would include, for example, a commuter who hears the ad, requests a ridematch list from Commuter Connections, then forms a new carpool as a result.

Referred influences are best measured by tracking changes in the volume of requests of information and services through two Commuter Connections' traditional programs: the Commuter Operations Center and GRH. A comparison of the volumes of requests received during periods of media activity to periods without media activity can provide an estimate of the change in requests as a result of the ads. A pro-rated share of the impacts of these other TERM impacts then can be assigned to Mass Marketing.

Evaluation of Direct Influence

Directly influenced change is measured for this evaluation through the regional 2007 State of the Commute survey, which included questions related to the following:

- Ad awareness – Were commuters aware of commute advertising and the specific messages conveyed?
- Changes made after hearing the ads – How many commuters who recalled the ads shifted to alternative modes after hearing the ads and how were they traveling before making the change?
- Reasons for change – Did the ads influence the commuters to make the change?
- Other commute services used – Did the commuters use any commute services provided by Commuter Connections?

The results for these questions were used to estimate the number of total regional commuters who were influenced by ads to change mode without any contact with Commuter Connections. The survey results were as follows:

Percentage of commuters who:

• Recalled commute message	35%
• Shifted to an alternative mode after hearing the ads	0.1%
• Said the ad influenced their decision to shift	100%
• Did not use any other commute service	100%
• **Resulting influence percentage**	**0.03%**

Thus, 0.03% of regional commuters were directly influenced to make a change. This percentage was multiplied by the average number of regional commuters (2,426,248) to estimate the number of alternative mode placements.

Further analysis of the survey respondents who had made a change showed that 19% continued using the new mode and 81% were temporary users and these commuters reduced on average 1.00 and 1.70 trips per placement respectively. These factors, and the 31.2 mile per trip distance calculated from the State of the Commute data were applied to the total number of new alternative mode placements to obtain the numbers of vehicle trips and VMT reduced by direct influence.

Evaluation of Referred Influence

Indirect influences were estimated through comparison of the numbers of new Commuter Operations Center and GRH applications received:

- In months between July 2005 and June 2008 when MM ads were aired
- In months between July 2005 and June 2008 when MM ads were NOT aired

As a first step, this analysis calculated the average numbers of applications received during "with MM' and "without MM" periods and compared the numbers. An increase in requests observed during the "with MM" periods could be assumed to result from the ads and other marketing efforts performed during the same time periods. Thus, the analysis also calculated volumes of requests that were received under "with ad" and "without ad" scenarios. The analysis indicated the following:

	Increase in Applications		
	All CC Inquiries	RS Apps	GRH Apps
• With ads compared to no ads	22%	17%	19%

These results suggest that ads increase rideshare applications by about 17% and increase GRH applications by about 15%. When taken as a percentage of total new applications, these increases translate to about 15% of total rideshare applications (17/117) and 16% of total GRH applications (19/119). The impact resulting from these increases was assigned to Mass Marketing.

Evaluation Methodology – Bike to Work Day Event

Impacts for the second component of this TERM, Bike-to-Work Day (BTWD) Event, were calculated using data obtained from a survey of BTWD participants conducted following the 2007 BTW Day event. The survey included questions regarding participants' use of bicycling for commuting before and after the event, and their ongoing level of bicycle commuting.

The impact methodology estimated the trip reduction impacts of new ridership by calculating the number of commuters who started riding to work after the event or who increased the number of days per week they rode to work and the average number of "new" bike days per week. Two periods of time were examined: 1) spring/summer/fall following the event and 2) winter following the event. From these data the number of new "seasonal" use and "continued winter" use days were calculated for a year. This number was then translated to a daily figure.

The number of vehicle trips reduced by new bicycling was estimated by multiplying the percentage of participants who said they drove alone or carpooled on non-cycling days (49%) by the number of daily bicycle trips. VMT reductions were estimated by multiplying the vehicle trip reduction by the average commute distance of these participants (10.4 miles). Emissions reduced were calculated as for other TERMs.

MASS MARKETING SUMMARY OF GOALS AND IMPACTS

Shown in Table 7 are the shows the results for the TERM, compared to the goals established for Mass Marketing. Individual goals were not established for any of the four elements that comprised the Mass

Marketing TERM (direct influence, indirect ridematch influence, indirect GRH influence, and BTW Day event). Directly influenced commuters accounted for about 20% of vehicle trips reduced, indirect placements accounted for about 30% of the total, GRH referrals contributed 37%, and the balance of 13% was generated by Bike to Work Day.

Table 7
Mass Marketing Goals and Estimated Impacts

	MM Goal	Estimated Impacts
Total Mass Marketing		
• Commuter placements	11,023	5,464
• Daily vehicle trips reduced	7,758	2,577
• Daily VMT reduced	141,231	69,274
• Daily tons NOx reduced	0.072 T	0.032 T
• Daily tons VOC reduced	0.044 T	0.017 T
• Annual tons PM 2.5 reduced	None	0.2 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	7.6 T
• Annual tons CO2 reduced	None	8,212 T

Impacts vs Goals

Transportation Benefit (net over or (under) goal): Vehicle Trips: (5,181)
VMT: (71,957 miles)

Emission Benefit (net over or (under) goal): NOx: (0.040 tons per day)
VOC: (0.027 tons per day)

MM reached about half of the goal for commuter placements, but fell farther short of the goals for vehicle trips and VMT reduced, meeting 33% and 49% respectively of these two goals. Emissions also fell short, by similar percentages. The shortfall for this TERM was largely in the areas of ad-prompted mode changes without additional contact to Commuter Connections. Such "directly-influenced" changes were considerably under those counted in the 2005 evaluation. In 2005, about one percent of commuters region-wide said they had made a directly-influenced mode change, as measured in the 2004 State of the Commute survey and in the 2005 Mini-Household survey. In the 2007 SOC survey, only one tenth of one percentage reported directly-influenced changes.

Details of the calculation for Mass Marketing are presented in Appendix 4. Appendix 4 also shows the calculations for Bike-to-Work Day.

SECTION 8 INFOEXPRESS KIOSKS

BACKGROUND

InfoExpress Kiosks was adopted as a project under the Integrated Rideshare TERM by the TPB in the FY1995-2000 TIP. This TERM project involved installation of InfoExpress traveler information kiosks in the District of Columbia and in Northern Virginia and was designed to improve the quality and delivery of alternative mode information products to commuters.

The InfoExpress traveler kiosks were launched in January 1998. Kiosks were placed permanently at two locations in the District of Columbia and at nine locations in Northern Virginia. Two mobile kiosks, one in the District of Columbia and one in Northern Virginia were been temporarily installed at various sites. In addition, Fairfax County placed Commuter Connections' ridematch applications on its Community Residence Information System kiosks.

The kiosks offered self-service transit schedules and maps and other commute information. Commuters also could apply for ridematching and for the regional GRH program through the kiosk. Requests for ridematches and other information offered by Commuter Connections but not immediately available through the kiosks were then e-mailed directly to the Commuter Operations Center for service delivery.

The kiosks also offered information on weather, real-time traffic, and maps & guides and kiosks located at retail locations in Fairfax County additionally provided local county information. Kiosks located at retail centers also offer retail information such as maps and lists of special events occurring at the sites. Since they were installed, several design improvements have been made to enhance the ease of use and attractiveness of the displays.

The InfoExpress Kiosk program ended on January 31, 2007, thus the daily impacts of this TERM are calculated only for the period July 1, 2005 through January 31, 2007.

EVALUATION METHODOLOGY AND DATA SOURCES

It is technologically easy to track the number of kiosk users for various information screens, but very difficult to follow-up with users to determine their use of the information they received because kiosk use is largely anonymous. Commuter Connections had contact names and phone numbers for only tiny fraction of kiosk users recorded between July 2005 and June 2008, those who had submitted an on-screen Commuter Connections application for a ridematch and/or GRH or who completed an on-line survey, including their names and phone numbers.

For analysis of other TERMS, Commuter Connections conducted surveys of commuters who had used TERM services. But because the kiosks allow users to obtain some information, notably transit schedules and maps, without any further contact with Commuter Connections, kiosk use and mode change information for these commuters was captured through questions included in the 2007 State of the Commute survey.

This survey asked commuters about the following information:

- Use of the InfoExpress kiosks to obtain travel or commute information
- Changes in travel pattern or trial use of alternative mode after receiving information
- Mode used prior to making the change and duration of the change
- Commute distance

About 10% of the commuters surveyed in the State of the Commute survey said they had seen a kiosk and 11% of these commuters had used a kiosk to obtain transportation information. This represented approximately 243,200 commuters region-wide. About 30% of these commuters said they tried or started using an alternative mode with information they received from the kiosk (placement rate). About a quarter of these commuters continued using the new mode; the rest were temporary placements. Analysis of the changes made by these commuters produced VTR factors of 0.54 for continued placements and 1.55 for those who made temporary changes. The relatively high VTR factors, relative to factors for many other TERMs, were due to the substantial use of the kiosks to obtain and use transit information.

Because the InfoExpress Kiosks program ended in January 2007, about half-way through the three-year evaluation period, these VTR factors were discounted to credit only 53% of the total impact (19 months / 36 months) for the time the Kiosks were in place. This resulted in effective VTR factors of 0.29 for continued placements and 0.82 for temporary placements.

Vehicle trips reduced through the use of the kiosk was calculated by multiplying these kiosk VTR factors by the number of kiosk placements. Finally, as with Telework and GRH, daily VMT reduced was calculated by multiplying the number of vehicle trips reduced by average trip distances calculated from the kiosk survey (24.0 miles per one-way trip for continued placements and 17.3 miles for temporary placements). Emission reduction was calculated by multiplying vehicle trips and VMT reduced by the 2005 regional emission factors. Calculation details for kiosk impacts are presented in Appendix 5.

INFOEXPRESS KIOSKS SUMMARY OF GOALS AND IMPACTS

Shown in Table 8 below are the evaluation results for InfoExpress Kiosks. As shown, the TERM met its individual goals for all impact measures.

Table 8
InfoExpress Kiosks Goals and Estimated Impacts

	TERM Goal	Estimated Impacts
• Daily vehicle trips reduced	1,178	2,840
• Daily VMT reduced	46,755	52,638
• Daily tons NOx reduced	0.023 T	0.027 T
• Daily tons VOC reduced	0.013 T	0.016 T
• Annual tons PM 2.5 reduced	None	0.2 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	6.4 T
• Annual tons CO2 reduced	None	6,610 T

Impacts vs Goals

Transportation Benefit (net over or (under) goal):	Vehicle Trips: 1,062 VMT: 5,883 miles
Emission Benefit (net over or (under) goal):	NOx: 0.004 tons per day VOC: 0.003 tons per day

SECTION 9 COMMUTER OPERATIONS CENTER

BACKGROUND

Since the 1970's, COG has offered basic commute information and assistance, such as regional ride-matching database, to commuters living and/or working in the Washington metropolitan region. Prior to 1995, when Commuter Connections was established, these services were provided by COG's RideFinders program. Because these services, now provided through the Commuter Operations Center (COC), were available when the emissions baseline was developed for regional conformity, the Center was not established as a TERM, but was included in the region's TIP as an ongoing program and also is part of the region's congestion management process.

The function of the Commuter Operations Center is to increase commuters' awareness of alternative modes, through regional and local marketing and outreach programs and to encourage and assist commuters to form ridesharing arrangements. Encouraging commuters who drive alone to shift to alternative modes is a priority for the COC, but the COC also assists commuters who now use alternative modes to continue to do so, by offering ridematching and transit assistance when carpools break up or commuters' travel patterns change and disrupt existing alternative mode arrangements.

Commuter Connections program services include: carpool and vanpool matchlists, transit route and schedule information, information on Park & Ride lot locations and HOV lanes, telework information, commute program assistance for employers, GRH, and bicycling and walking information. Commuters obtain services by calling a toll-free telephone number or by submitting a ridematch application obtained from COG, an employer, a local partner assistance program, a transportation management association (TMA), or through the internet or one of the InfoExpress Kiosks described in Section 8.

EVALUATION METHODOLOGY

In past years, the Commuter Operations Center has enhanced the services it offers to commuters and expanded its marketing of alternative modes to raise public awareness of and interest in alternatives. These efforts were designed to increase the number of commuters placed in alternative modes and generate trip, VMT, and emission reduction benefits for the region. Further, the activities of the COC support the implementation of the TERMs administered by Commuter Connections. Thus, although it is not an adopted TERM, the COC is included in this evaluation.

The impacts of the COC were measured using data from a Commuter Connections placement survey conducted in November 2005. This survey interviewed a sample of commuters assisted by Commuter Connections in the three-months prior to the survey and collected data to estimate placement rates, VTR factors, drive alone access percentages, and travel and access distances. As was done for GRH, these multipliers were estimated for two sub-groups of applicants. The first sub-group included respondents who both live and work within the Washington, DC Metropolitan Statistical Area (MSA); that is within the 11-jurisdiction area covered by the TERM evaluation. The second group included respondents who work within the MSA but live outside it.

This distinction was made because applicants who live outside the MSA traveled a portion of their VMT outside the MSA. During the evaluation, it was decided that the VMT for these "out of MSA" applicants should be discounted to credit VMT reduction only for the portion that occurred within the MSA. Approximately 31% of the total participants lived outside the MSA.

For each sub-group of survey respondents, the placement rate, that is, the percentage of respondents who switched to an alternative mode, was calculated. Two rates were calculated, a "continued" rate, including respondents who switched and remained in the new alternative mode until the placement survey was conducted, and a "temporary" rate, including respondents who made a switch, but returned to their original mode before the survey. The two sub-group populations had the following placement rates:

	Continued	Temporary
• Within MSA	25.0%	15.7%
• Outside MSA	31.1%	13.2%

To determine the number of commuters placed in alternative modes between July 2005 and June 2008, these placement rates were multiplied by the number of commuters (185,639) who received assistance from Commuter Connections during that time period. About a quarter of the requests (43,654) were from new applicants or re-applicants. The COC also provided follow-up assistance to 141,994 commuters. This assistance provided additional match names for existing carpools and vanpools that needed a new or additional rider to maintain or expand existing ridesharing arrangements.

For calculation of impacts, these applicants were divided into the two sub-groups: 128,091 within the MSA and 57,548 outside the MSA. When these applicant counts were multiplied by the placement rates, the calculation resulted in a total of 77,627 placements, with 52,133 placements from within the MSA and 25,493 placements from outside the MSA.

These placement figures were then multiplied by VTR factors derived from the survey data to estimate the number of vehicle trips reduced. The VTR factors, expressed in terms of average vehicle trips reduced per placement, for the two sub-groups were as follows:

	Continued	Temporary
• Within MSA	0.44	0.61
• Outside MSA	0.48	0.45

The vehicle trip reductions for temporary placements also were discounted to reflect their short duration of 6.6 weeks of the year (12%). The calculation of vehicle trips reduced produced a total of 24,639 trips reduced; 15,648 from commuters within the MSA and 8,991 from commuters outside the MSA.

Next, VMT reduced was calculated by multiplying the numbers of vehicle trips reduced by the average trip length for commuters who made a shift to an alternative mode. The one-way trip distance for the within MSA respondents was 32.2 miles for continued placements and 31.1 miles for temporary placements. The actual average one-way distances for the outside MSA respondents were 54.4 miles for continued placements and 57.9 miles for temporary placements. To discount the distance credited to the outside MSA respondents, their one-way travel distance was set equal to that of the distance for the within MSA respondents, resulting in a loss of more than 22 one-way miles per trip for each outside-MSA respondent. The VMT calculation resulted in a total of 791,211 VMT reduced.

Emission reduction for the COC was calculated using trip-based and VMT-based regional emission factors for 2008. Details of these calculations are presented in Appendix 6.

Appendix 6 shows that these overall COC results were adjusted to account for overlap between the COC and several individual TERMs, including the Software Upgrade project (described below), and the Info-Express Kiosk project, GRH, and Mass Marketing, described in other sections of this analysis report. To avoid double counting of impacts, the COC's contributions to these TERMs were assigned to the other TERMs and were subtracted from the COC "basic impacts." The "Net COC" impacts are thus attributable only to the basic COC and not to any TERM.

Software Upgrade

The 2005 TERM evaluation included a "Software Upgrade" project as part of the Integrated Rideshare TERM, adopted by the TPB in the FY 1995-2000 TIP. This service involves upgrading and maintaining the regional ridematching system to include integrated transit information, information on HOV lanes, Park & Ride lots, and telecommuting, to provide full-service commuter information through traveler information kiosks. By providing transit and telework information to all commuters who received a matchlist, the service is expected to encourage commuters to try transit and park & ride lots, even if they did not have these options in mind when they requested assistance from Commuter Connections. The Software Upgrade portion of the TERM was implemented in October 1998. In the 2008 evaluation, this component was merged into the COC impacts. But they were calculated separately, using the following method.

Impacts of the Software Upgrades was assessed using data from the November 2005 rideshare placement survey. This survey assessed changes commuters made after receiving a ridematch or other commute service from Commuter Connections. Respondents were asked if they remembered receiving transit and/or park & ride (P&R) information on a matchlist and if they used the information to make any travel changes. Changes to transit influenced by use of transit information and changes to rideshare or transit influenced by P&R information were captured in this COC component.

The surveys showed that 4.3% of applicants who lived inside the MSA and 5.9% of applicants who lived outside the MSA used the transit and/or P&R information to shift to an alternative mode. Most said they continued using the alternative mode. The placement rates and VTR factors for this calculation were:

	Continued	Temporary
Placement Rates		
• Within MSA	2.7%	1.6%
• Outside MSA	5.0%	0.9%
VTR factors		
• Within MSA	0.65	0.64
• Outside MSA	0.75	0.60

To estimate vehicle trips reduced, placement rates were multiplied by the 185,639 commuters who applied to Commuter Connections or received follow-up assistance from Commuter Connections during the evaluation period and by the VTR factors derived from the placement surveys for commuters who used the information provided.

VMT reductions were estimated by multiplying the number of trips by the average trip lengths calculated from the placement surveys (32.3 miles for continued placements and 33.8 miles per trip for temporary placements). As was explained in the descriptions for both the GRH TERM and the COC, these distances were used for both within MSA and outside MSA respondents. Emission reduction was calculated using

trip-based and VMT-based 2008 regional emission factors. Calculation details for the software upgrade are shown in Appendix 7.

COMMUTER OPERATIONS CENTER SUMMARY OF GOALS AND IMPACTS

Shown below are the evaluation results for the COC and the goals established for the Center.

Table 9
Commuter Operations Center Regional Goals and Estimated Impacts

	Regional Goal	Estimated Impacts
Commuter Operations Center (basic services)		
• Total commuters (new and re-apply)	152,356	185,639
• Daily vehicle trips reduced	10,399	17,951
• Daily VMT reduced	296,635	575,237
• Daily tons NOx reduced	0.147 T	0.256 T
• Daily tons VOC reduced	0.081 T	0.126 T
• Annual tons PM 2.5 reduced	None	1.7 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	60.4 T
• Annual tons CO2 reduced	None	65,953 T
Software Upgrades (additional to Basic COC)		
• Daily vehicle trips reduced	2,370	4,523
• Daily VMT reduced	62,339	146,441
• Daily tons NOx reduced	0.031 T	0.064 T
• Daily tons VOC reduced	0.017 T	0.032 T
• Annual tons PM 2.5 reduced	None	0.4 T
• Annual tons PM 2.5 pre-cursor NOx reduced	None	15.2 T
• Annual tons CO2 reduced	None	16,669 T

Impacts vs Goals

Applicant Number (net over or (under) goal):	Applicants: 33,283
Basic COC	
Transportation Benefit (net over or (under) goal):	Vehicle Trips: 7,552 VMT: 278,602 miles
Emission Benefit (net over or (under) goal):	NOx: 0.109 tons per day VOC: 0.045 tons per day
Software Upgrades	
Transportation Benefit (net over or (under) goal):	Vehicle Trips: 2,153 VMT: 84,102 miles
Emission Benefit (net over or (under) goal):	NOx: 0.033 tons per day VOC: 0.015 tons per day

As shown, the COC more than fulfilled the applicant goal for the three-year period, exceeding the goal by 33,283 total applicants. And both the COC basic services and software upgrades substantially exceeded the goals for vehicle trips, VMT, and emissions reduced.

The results shown in Table 9 were adjusted results that eliminated double counting due to overlap between the COC and individual TERMs. As was explained previously, a portion of the Commuter Operations Center's impacts were assigned to the Software Upgrades component. Additionally, a small portion of the COC's impacts resulted from applications received through the kiosks (0.1% of total applications). And about one in ten new CC applicants requested both GRH and other information (5.7% of total COC assisted commuters). Finally, the impacts for about 15% of new COC applicants were assigned to the Mass Marketing TERM, to reflect the impact of this TERM in influencing commuters to contact CC for travel-assistance services.

To avoid double counting of impacts, the impacts of these other TERMs were subtracted from the COC base impacts to determine the net impacts attributable solely to the COC and to account for those impacts covered by TERMs and those attributable to the base operations. These adjustments are shown in Table 10 below. The "Net COC" impacts shown in Table 10 were used in Table 9 as the impacts attributable only to the COC and not to any TERM.

Table 10
Adjustment for Double Counting Among COC and TERMs

Evaluation Measure	COC Base	Mass Marketing	Kiosks	Software Upgrade	GRH	Net COC
Placements	77,627	2,400	134	8,628	4,288	62,177
VT reduced	24,639	762	43	4,522	1,361	17,951
VMT reduced	791,211	24,261	1,368	146,441	43,705	575,237
Daily Emissions Reduced (Tons)						
NOx	0.351	0.011	0.0006	0.065	0.019	0.256
VOC	0.173	0.005	0.0003	0.032	0.010	0.126
Annual Emissions Reduced (Tons)						
PM 2.5	2.3	0.1	0.0	0.4	0.1	1.7
PM 2.5 pre-cursor NOx	82.9	2.6	0.1	15.2	4.6	60.4
CO2	90,582	2,800	157	16,669	5,004	65,952

Notes:

- Mass Marketing – new applicants influenced by ads to contact CC, see Section 7
- Kiosks - 0.1% of new COC applications received through kiosks
- Software upgrades – see description in this section
- GRH – 10% of new/re-applicants ask for GRH and other commute information = 5.5% of COC total after Mass Marketing adjustment

SECTION 10 CONCLUSIONS ABOUT TERM IMPACTS

The preceding sections of this report documented estimated impacts for individual TERMs and for the Commuter Operations Center. As noted in an earlier section, the combined set of programs administered by Commuter Connections did not meet the goals set for the five TERMs collectively, although several of the TERMs did meet or exceed their individual goals.

Three of the TERMs met goals established for participation, vehicle trip, VMT, and emissions reductions. Commuters and employers, as appropriate, apparently are aware of and utilizing the services. Where shortfalls did occur against the goals, they appeared to be related to the less aggressive marketing campaigns implemented for GRH and Mass Marketing during 2006 and the early part of 2007. But COG revised the goals for each TERM following the 2005 analysis, so the 2008 goals reflect more closely the impacts from actual types of behavior changes that commuters make than did the 2005 goals.

It also should be noted that many of the impact calculations in this report used data from surveys that are subject to statistical error rates. So the impact numbers should be considered estimates of impacts that could be somewhat higher or lower than are shown.

Individual sections of this report have discussed factors that affected the achievement of goals. Below are presented highlights of those discussions for the five TERMs and the COC.

MARYLAND AND VIRGINIA TELEWORK

The incidence of telework continues to grow in the Washington region. In 1996, about 150,000 regional workers were telecommuting. By 2005, the number had grown to more than 318,000, an increase of 165,000 and the 2007 State of the Commute survey estimates regional teleworkers at 456,600 or about 19% of regional commuters.

About 10% of the teleworkers can be attributed to the efforts of the Telework TERM, either directly through information distributed to commuters, through regional advertising to the public-at-large, or through assistance to employers that want to start a telework program. This number of new teleworkers exceeded the goal set for the Telework TERM.

The Telework TERM exceeded the goals for trip, VMT, and emission reductions assigned to the TERM. The goals were revised following the 2005 analysis and now more closely represent the actual telework patterns existing in the region; primarily the average frequency of 1.5 days per week and the 29% non-drive alone mode share of teleworkers on non-telework days. These two factors have a substantial impact on the total trip reduction generated by teleworking.

It is possible the Telework TERM's contribution could be slightly underreported. About five percent of regional teleworkers said they learned of telecommuting through "advertising," newspaper ads, or "other website." Although these sources were not necessarily controlled by Commuter Connections, Commuter Connections has advertised consistently and broadly about telework via radio, television, print media, and the internet. So this response likely indicates additional teleworkers who learned about telework from outreach and promotion conducted by Commuter Connections. Because the source of the advertising could not be clearly documented, only a small share of these commuters (1.9% of total teleworkers) was credited to the Telework TERM.

GUARANTEED RIDE HOME

Unlike the Telework TERM, the GRH TERM did not meet the adopted goals, falling 31% short in the number of vehicle trips reduced and about 36% short of the VMT goal. The shortfall primarily resulted because the number of new GRH registrants dropped substantially in 2006 and 2007 from annual registration counts of previous years.

COG adjusted the goals for this TERM after the 2005 evaluation to reflect the actual travel patterns of typical GRH applicants and the fact that a sizeable share of GRH registrants were ridesharing or using transit prior to registering. These changes resulted in the vehicle trip and VMT calculations more accurately measuring the trip reduction per new GRH registrant, but the lower participation levels results in correspondingly lower results for vehicle trip and VMT reduction goals.

Finally, note that about 10% of GRH impacts were assigned to the Mass Marketing TERM to recognize that some GRH applicants were influenced to contact Commuter Connections and apply for GRH after they heard a Mass Marketing advertisement.

EMPLOYER OUTREACH

Employer Outreach greatly exceeded the participation goals set for the program, for both overall participation and participation of employers with new or expanded programs. And the trip reduction and VMT reduction impacts for the new/expanded component of the program were well above the goals set for this activity.

Overall, however, Employer Outreach fell about nine percent short in travel and emissions impacts for the combination of employers continued from 2005 and new and expanded employers. This is likely due primarily to the change made in the 2008 calculation method for the COMMUTER model. The model coefficients were revised in 2008 to reflect more conservative assumptions about the impacts of financial incentives, resulting in lower trip reduction impacts from incentives than would have been calculated in 2005. The shortfall also could reflect a shift of some employers from cash / subsidy form of incentive to a pre-tax account. Because a pre-tax program offers smaller cost benefits to commuters than does an equal amount of direct subsidy, the impact on travel behavior would be less.

Finally, it is important to reiterate that a substantial share of employers listed as having new/expanded programs could not be reached to verify their programs and the impacts of their programs were not included in the calculation. But it is likely that at least some of these employers do offer the reported strategies. Thus the actual Employer Outreach benefit could be higher than reported here.

We note that Employer Outreach overlaps with the Maryland and Virginia Telework TERM. Some employers counted in Employer Outreach could also be counted in the Telework TERM's "assisted employer" category. To avoid double counting credits, employers that offered telework strategies that also had received assistance from the Telework TERM were included in the comprehensive Employer Outreach impact calculation, but impacts from the telework components of their programs were removed from Employer Outreach impacts and assigned to the Telework TERM.
Separate impacts also were calculated for the Employer Outreach for Bicycling component of this TERM. This project provides regional outreach to encourage employers to implement worksites strategies that encourage employees to use bicycling for commuting.

One hundred, twenty-two employers offered bicycle strategies in their worksite programs, twice the goal for this project. Employer Outreach for Bicycling also greatly exceed the other goals established for the project.

MASS MARKETING

MM reached about half the goal for commuter placements and for VMT, but fell farther short of the goals for vehicle trips reduced, meeting 33% of this goal. Emissions also fell short, by similar percentages. This TERM estimates impacts for three primary groups of commuters,

1) "Directly influenced" commuters who had no contact with Commuter Connections other than through hearing or seeing the ads
2) Indirectly influenced commuters, who were influenced by the ads to contact Commuter Connections for rideshare or GRH assistance
3) Commuters who participated in Bike to Work Day events

Directly influenced commuters accounted for about 20% of vehicle trips reduced, indirect placements accounted for about 30% of the total, GRH referrals contributed 37%, and the balance of 13% was generated by Bike to Work Day.

The shortfall for this TERM was largely in the areas of ad-prompted mode changes without additional contact to Commuter Connections. Such directly-influenced changes were considerably under those counted in the 2005 evaluation. In 2005, about one percent of commuters region-wide said they had made a directly-influenced mode change, as measured in the 2004 State of the Commute survey and in the 2005 Mini-Household survey. In the 2007 SOC survey, only one tenth of one percentage reported directly-influenced changes.

INFOEXPRESS KIOSKS

The InfoExpress Kiosk TERM met its goals for all impact measures. Because the InfoExpress Kiosks program ended in January 2007, about half-way through the three-year evaluation period, the impacts for this TERM were discounted to credit only 53% of the total impact (19 months / 36 months) for the time the Kiosks were in place.

COMMUTER OPERATIONS CENTER

The Commuter Operations Center is not an adopted TERM, but was included in this evaluation because it supports the success of several of the TERMs, including GRH, Integrated Rideshare, and Employer Outreach. The COC fulfilled more than 185,600 requests during the 30-month period from July 2005 through June 2008, about 21% over the goal set for the program. About 43,645 of the requests were from new applicants or re-applicants. This high response is likely related to the steep rise in gas prices during the last 18 months of the period.

But the COC also provided follow-up assistance to nearly 142,000 commuters. This assistance included providing additional match names for existing carpools and vanpools that needed or wanted a new or additional rider. Some of this assistance likely helped maintain existing ridesharing arrangements. The

COC substantially exceeded the goals for vehicle trips, VMT, and NOx, and VOC emissions reduced, by 72%, 94%, and73% and 58%, respectively.

These base COC results reflect adjustments to eliminate double counting due to overlap between the COC, GRH, and the Mass Marketing TERM. The overlap with GRH results because some commuters request both GRH and ridematch assistance. The overlap with Mass Marketing reflects the impact of this TERM in influencing commuters to contact the COC for travel-assistance services.

The COC impacts also were adjusted to separate the impact of the software upgrades implemented previously under the Integrated Rideshare TERM. In this 2008 evaluation, impacts for this program were reported under the COC, but its individual impacts were shown separately. The software upgrades met all the goals defined for the program.

LIST OF APPENDICES

APPENDIX 1 – CALCULATION OF MARYLAND AND VIRGINIA TELEWORK IMPACTS

Populations of Interest

• All regional teleworkers (TW)	456,636	(from SOC survey)
• Employees at worksites assisted by TW	127,161	(from TW assistance survey)

Telecommute Placement Rates

• Directly assisted TW	9.6%	(% of TW assisted by TW, from SOC survey)
• Assisted worksites	4.1%	(% of new TW at sites, from TW assistance survey)

Placements

Mixed home and Non-home based

• Directly assisted TW	43,762	(regional TW x directly assisted placement rate)
• TW at TW asst. sites	5,264	(employees at assisted sites x asst site placement rate)
Total assisted TW	**49,027**	

Breakdown of placements by Location (home-based and telecenter-based)

• % Home-based TW	95%	(from SOC survey)
• % Non-home (NH)-based TW	5%	(from SOC survey)
• Home-based TW	46,575	(total assisted TW x % Home-based TW)
• NH-based TW	2,451	(total assisted TW x % NH-based TW)

Daily Vehicle Trips Reduced

VTR Factors

• Home-based factor	0.45	(from SOC survey)
• NH-based factor	0.31	(from SOC survey)
• Home-based VT reduced	21,097	(HB TW x HB VTR factor)
• NH-based VT reduced	769	(NH-based TW x NH VTR factor)

Total Daily Vehicle Trips Reduced 21,866

Appendix 1, continued

Daily VMT Reduced

Ave one-way trip distance (mi)

• Home-based TW	18.5	(SOC survey)

Telecenter reductions (TC days) – other than MWTC

• VMT reduction – Non-home days	19.4	(SOC survey)
• Ave. days/wk at TC	1.0	(SOC survey)
• VMT reduction – home TW days	31.8	(SOC survey)
• Ave. days/wk at home	0.9	(SOC survey)
• Total weekly VMT reduction	47.8	
• Daily reduction per teleworker	9.6	

VMT reductions on TW days

• Home-based VMT reduced	390,290	(HB VT reduced x ave trip distance)
• NH-based VMT reduced	23,412	(NH-based TW x daily miles reduced)
Total Daily VMT Reduced	**413,702**	

Daily Emissions Reduced – NOx and VOC

		08 Emission		08 Emission		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	21,866	0.6291			13,758	0.0152
• Running (40 mph)			413,703	0.4287	177,396	0.1955
Total NOx reduced (tons)						**0.211**

		08 Emission		08 Emission		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	21,866	1.7343			37,922	0.0418
• Running (40mph)			413,703	0.1836	75,956	0.0837
Total VOC reduced (tons)						**0.126**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

		10 Emission		10 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	21,866	0.000			0	0.000
• Running (40mph)			413,703	0.0115	4,758	0.005
					Daily	**0.005**
Total PM 2.5 reduced (tons)					**Annual**	**1.3**

Appendix 1, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	21,866	0.6652			14,545	0.016
• Running (40mph)			413,703	0.4038	167,053	0.184
					Daily	**0.200**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**50.0**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	21,866	0.000			0	0.
• Running (40mph)			413,703	455.7	188,524,584	208
					Daily	**208**
Total CO2 reduced (tons)					**Annual**	**51,953**

APPENDIX 2 – CALCULATION OF GUARANTEED RIDE HOME IMPACTS

Populations of Interest		
• GRH registrants	15,644	(GRH database)
• Re-registrants	9,114	
• One-time exceptions	406	(GRH database)
Total GRH base	**25,164**	
Within MSA	68%	17,112
Outside MSA	32%	8,052
GRH Placement Rates (continued rates only)		
• Within MSA placement rate	33.9%	(GRH survey)
• Outside MSA placement rate	44.9%	(GRH survey)
Placements (continued only)		
• Within MSA	**5,801**	(Within MSA base x within MSA placement rate)
• Outside MSA	**3,615**	(Outside MSA base x outside MSA placement rate)
Total Placements	**9,416**	
Daily Vehicle Trips Reduced		
VTR Factors (continued only)		
• Within MSA	0.92	(GRH survey)
• Outside MSA	1.19	(GRH survey)
VT Reduced (continued only)		
• Within MSA	**5,336**	**(**Within MSA placements x within MSA VTR factor)
• Outside MSA	**4,303**	(Outside MSA placements x outside MSA VTR factor**)**
Total Daily VT Reduced	**9,639**	
Daily VMT Reduced		
• Ave one-way trip distance (mi)		
• Within MSA	26.2	(from GRH survey)
• Outside MSA	26.2	(discounted from actual 47.0 miles from GRH survey)
VMT reduced		
• Within MSA	139,823	(Within MSA VT reduced x trip distance)
• Outside MSA	112,726	(Outside MSA VT reduced x trip distance)
Total Daily VMT Reduced	**252,549**	

Appendix 2, continued

Trip and VMT Adjustment for SOV Access to HOV Modes (reduce VT and VMT for AQ analysis)

Inside MSA

- SOV access percentage 50% (GRH survey)
- SOV access distance (mi) 4.8 (GRH survey)

Outside MSA – not applicable – all access outside MSA

VT Reduction

- No SOV access 6,971 (VT x non-SOV access %)

Total VT for AQ analysis 6,971

VMT Reduction

- No SOV access 182,637 (VT x SOV % x trip distance)
- With SOV access 57,103 (VT x SOV % x (trip distance – access distance)

Total VMT for AQ analysis 239,740

Daily Emissions Reduced – NOx and VOC

		08 Emission		08 Emission		
NOx reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	6,971	0.6292			4,386	0.005
• Running			239,740	0.4288	102,801	0.113
Total NOx reduced (tons)						**0.118**

		08 Emission		08 Emission		
VOC reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	6,971	1.7343			12,090	0.013
• Running			239,740	0.1836	44,016	0.049
Total VOC reduced (tons)						**0.062**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

		10 Emission		10 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	6,971	0.000			0	0.000
• Running (40mph)			239,740	0.0115	2,757	0.003
					Daily	**0.003**
Total PM 2.5 reduced (tons)					**Annual**	**0.80**

Appendix 2, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	6,971	0.6652			4,637	0.005
• Running (40mph)			239,740	0.4038	96,807	0.107
					Daily	**0.112**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**28.0**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	6,971	0.000			0	0.0
• Running (40mph)			239,740	455.7	109,249,733	120
					Daily	**120**
Total CO2 reduced (tons)					**Annual**	**30,107**

Correction for Overlap with MM TERM

Total GRH apps FY 06, 07, 08	25,164	
New GRH apps FY 06, 07, 08	15,644	62%
Estimated MM share of new GRH	16%	
Estimated MM share of GRH impact	10%	

	GRH base	MM	Net GRH
Placements	9,416	937	8,480
VMT reduced	9,639	959	8,680
VMT reduced (mi)	252,549	25,121	227,428
Daily Emissions Reduced			
NOx (T)	0.118	0.012	0.106
VOC (T)	0.0632	0.006	0.056
Annual Emissions Reduced			
PM 2.5 (T)	0.80	0.10	0.70
PM 2.5 Precursor NOx (T)	28.0	2.8	25.2
CO2 (T)	30,107	2,995	27,112

APPENDIX 3 – CALCULATION OF EMPLOYER OUTREACH

Populations of Interest

Level 3 or 4 sites (data from ACT! database)

	Employers	Employees
• 2005 continued programs	709	205,160
• Expanded programs	57	22,790
• New programs	137	84,723

Average Vehicle Occupancy (AVO)

Starting AVO from employee survey data, Final AVO from COMMUTER model

	Starting AVO	Ending AVO
• 2005 continued programs	1.34	1.53
• Expanded programs	1.38	1.52
• New programs	1.21	1.40

Daily person trips

Total employees x 2 one-way trips per day

Starting (pre-program) and ending (with-program)

	Starting	Ending
• 2005 continued programs	410,320	410,320
• Expanded programs	45,580	45,580
• New programs	169,446	169,446

Daily vehicle trips

Total employees / starting AVO)

Starting (pre-program) and ending (with-program)

	Starting	Ending	Difference
• 2005 continued programs	306,688	268,552	38,136
• Expanded programs	33,098	30,020	3,078
• New programs	140,310	120,878	19,432

Total Daily Vehicle Trips Reduced

• 2005 continued programs	38,136
• New/expanded programs	22,510

Daily VMT

Total employees / starting AVO)

Starting (pre-program) and ending (with-program)

• 2005 continued programs	620,638
• Expanded programs	50,037
• New/expanded programs	322,369

Appendix 3, continued

Trip and VMT Adjustment for SOV Access to HOV Modes (reduce VT and VMT for AQ analysis)

- SOV access percentage 28% (from SOC survey)
- SOV access distance (mi) 3.1 (from SOC survey)

VT Reduction without SOV access – used as base for AQ analysis

(VT reduced x non-SOV access %)

- 2005 continued programs 27,458
- New/expanded programs 16,207

VMT Reduction without SOV access

(Total VT reduced – (VT reduced x SOV % x trip distance)

- 2005 continued programs 587,536
- New/expanded programs 352,867

Emissions Reduced

Continued from 2005

Daily Emissions Reduced – NOx and VOC

		08 Emission		08 Emission		
NOx reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	27,076	0.6292			17,276	0.019
• Running			586,356	0.4288	251,936	0.277
Total NOx reduced (tons)						**0.297**

		08 Emission		08 Emission		
VOC reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	27,076	1.7343			47,620	0.052
• Running			587,356	0.1836	107,872	0.119
Total VOC reduced (tons)						**0.171**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

		10 Emission		10 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	27,076	0.000			0	0.0
• Running (40mph)			586,356	0.0115	6,757	0.007
					Daily	**0.007**
Total PM 2.5 reduced (tons)					**Annual**	**1.9**

Appendix 3, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	27,076	0.6652			18,265	0.020
• Running (40mph)			586,356	0.4038	237,247	0.262
					Daily	**0.282**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**70.4**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	27,076	0.000			0	0
• Running (40mph)			586,356	455.7	267,740,286	295
					Daily	**295**
Total CO2 reduced (tons)					**Annual**	**73,783**

New / Expanded in 2008

Daily Emissions Reduced – NOx and VOC

NOx reduced	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start + hot soak	16,207	0.6292			10198	0.012
• Running			352,867	0.4288	151,310	0.167
Total NOx reduced (tons)						**0.179**

VOC reduced	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start + hot soak	16,207	1.7343			28,108	0.031
• Running			352,867	0.1836	64,786	0.071
Total VOC reduced (tons)						**0.102**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

PM 2.5	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	16,207	0.000			0	0.0
• Running (40mph)			352,867	0.0115	4,058	0.004
					Daily	**0.004**
Total PM 2.5 reduced (tons)					**Annual**	**1.1**

Appendix 3, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	16,207	0.6652			10,781	0.012
• Running (40mph)			352,867	0.4038	142,488	0.157
					Daily	**0.169**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**42.2**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	16,207	0.000			0	0
• Running (40mph)			352,867	455.7	160,801,698	177
					Daily	**177**
Total CO2 reduced (tons)					**Annual**	**44,313**

Correction for Overlap with TW TERM and Impacts for EO for Bicycling

	EO base	TW	Net EO	EO-bike
Vehicle Trips Reduced	60,645	1,483	59,163	188
VMT Reduced (miles)	993,044	23,870	969,174	1,127
Daily Emissions Reduced				
NOx (tons)	0.456	0.0123	0.443	0.001
VOC (tons)	0.274	0.0077	0.266	0.001
Annual Emissions Reduced				
PM 2.5 (T)	3.0	0.1	2.9	0.0
PM 2.5 Precursor NOx (T)	112.6	2.9	109.7	0.2
CO2 (T)	118,097	2,996	115,099	142

APPENDIX 4 - CALCULATION OF MASS MARKETING IMPACTS

4 impact components
- Part 1 - Commuters influenced by ads to change mode – no contact CC
- Part 2 – Commuters influenced by ads to contact CC
- Part 3 – GRH credit
- Part 4 – Bike to Work Day

PART 1

Populations of Interest – commuters influenced by ads to change mode – no contact CC

Total commuters in region	2,426,248	(SOC)
• % recall commute message	35%	(SOC)
• % chg to alt mode after ads	0.1%	(SOC)
• % chg influenced by ad	100%	(SOC)
Placements – no contact with CC	**628**	(COC – monthly applicant analysis)
Placement Rates		
• Continued placement rate	19%	(SOC)
• Temporary placement rate	81%	(SOC)
Placements		
• Continued placements	119	(Placements x continued placement rate)
• Temporary placements	509	(Placements x temporary placement rate)
Daily Vehicle Trips Reduced		
VTR Factors		
• Continued VTR factor	1.00	(SOC)
• Temporary VTR factor	1.70	(SOC)
• Continued VT reduced	119	(Continued placements x continued VTR factor)
• Temporary VT reduced	399	(Temporary placements x temporary VTR factor x 0.46 discount for temporary use)
Total Daily Vehicle Trips Reduced	**518**	
Daily VMT Reduced		
• Ave one-way trip dist (mi)	31.2	(SOC)
Total Daily VMT Reduced	**16,175**	

Trip and VMT Adjustment for SOV Access to HOV Modes (reduce VT and VMT for AQ analysis)

• SOV access percentage	28%	(from CC placement survey)
• SOV access distance (mi)	3.1	(from CC placement survey)

Appendix 4, continued

PART 1 (cont.)

VT Reduction		
• No SOV access	373	(VT x non-SOV access %)
Total VT for AQ analysis	**373**	

VMT Reduction		
• No SOV access	11,646	(VT x SOV % x trip distance)
• With SOV access	4,079	(VT x SOV % x (trip dist – access dist)
Total VMT for AQ analysis	**15,725**	

Daily Emissions Reduced – Part 1

		08 Emission		08 Emission		
NOx reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	373	0.6292			235	0.0003
• Running			15,725	0.4288	6,743	0.0074
Total NOx reduced (tons)						**0.0077**

		08 Emission		08 Emission		
VOC reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	373	1.7343			647	0.0007
• Running			15,725	0.1836	2,887	0.0032
Total VOC reduced (tons)						**0.0039**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

		10 Emission		10 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	6,971	0.000			0	0.0000
• Running (40mph)			239,740	0.0115	181	0.0002
					Daily	**0.0002**
Total PM 2.5 reduced (tons)					**Annual**	**0.05**

		10 Emission		10 Emission		
PM 2.5 Precursor NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	6,971	0.6652			248	0.0003
• Running (40mph)			239,740	0.4038	6,350	0.007
					Daily	**0.007**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**1.8**

		08 Emission		08 Emission		
CO2	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	6,971	0.000			0	0
• Running (40mph)			239,740	455.7	7,166,004	8
					Daily	**8**
Total CO2 reduced (tons)					**Annual**	**1,975**

Appendix 4, continued

PART 2

Populations of Interest – commuters influenced by ads to contact CC

New CC apps (does not include re-apply or follow-up)

• FY 2006	13,479	(CC database)
• FY 2007	11,364	(CC database)
• FY 2008	13,418	(CC database)
Total applicants	**38,261**	

Commuters influenced by ads to contact CC	15%	(COC – monthly applicant analysis)
New apps 06-08 as % of total	21%	(new apps FY04, 05 / total CC apps)
% all apps influenced by ads	3.1%	

CC Impacts – FY 06-08	**Total**	**MM Share**
• CC placements	77,627	2,400
• CC Vehicle trips reduced	24,639	762
• CC VMT reduced	791,211	24,461

CC Impacts – FY 05-08 – Discounted for AQ Analysis

	Total	**MM Share**
• CC Vehicle trips reduced	14,248	440
• CC VMT reduced	721.303	22,300

Daily Emissions Reduced – NOx and VOC (Part 2)

NOx reduced	**Trips**	**08 Emission Factor**	**VMT**	**08 Emission Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	440	0.6292			277	0.0003
• Running			22,300	0.4288	9,562	0.0105
Total NOx reduced (tons)						**0.011**

VOC reduced	**Trips**	**08 Emission Factor**	**VMT**	**08 Emission Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	440	1.7343			764	0.0008
• Running			22,300	0.1836	4,094	0.0045
Total VOC reduced (tons)						**0.005**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2 (Part 2)

PM 2.5	**Trips**	**10 Emission Factor**	**VMT**	**10 Emission Factor**	**Tot gm**	**Tot ton**
• Cold start	6,971	0.000			0	0.0
• Running (40mph)			239,740	0.0115	256	0.01
					Daily	**0.01**
Total PM 2.5 reduced (tons)					**Annual**	**2.6**

Appendix 4, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	6,971	0.6652			293	0.0003
• Running (40mph)			239,740	0.4038	9,005	0.001
					Daily	**0.010**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**2.6**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	6,971	0.000			0	0
• Running (40mph)			239,740	455.7	10,161,901	11
					Daily	**11**
Total CO2 reduced (tons)					**Annual**	**2,800**

PART 3 – GRH Credit

From GRH Analysis

Total GRH apps FY 06, 07, 08	25,164	
New GRH apps FY 06, 07, 08	15,644	62%
Estimated MM share of new GRH	16.0%	
Estimated MM share of GRH impact	9.9%	

	GRH base	MM
Placements	9,416	937
VT reduced	9,639	959
VMT reduced	225,549	25,121
Daily Emissions Reduced		
NOx (T)	0.118	0.012
VOC (T)	0.062	0.006
Annual Emissions Reduced		
PM 2.5 (T)	0.8	0.1
PM 2.5 Precursor NOx (T)	28.0	2.8
CO2 (T)	30,107	2,995

Appendix 4, continued

Part 4 - Bike to Work Day Credit

Participants' riding percentage and frequency

Number of riders	6,846	(BTWD registration data, 2005, 2006, 2007)
% biking to work before event	78.9%	(BTWD survey)
% new riders	9.6%	(BTWD survey)
Number of new riders	657	
% who increase riding days	12.3%	
Number of increased riders	842	
Total new + increased riders	1,499	Placement

Change in Bike Days

Pre-Event		
% biking before event	78.9%	
Ave days riding before event	2.5	(BTWD survey)
Weekly bike days before	13,342	
Summer Biking		
% biking after event	88%	(BTWD survey)
Ave days riding after event	2.6	(BTWD survey)
Weekly bike days after	15,596	
Fall Biking		
% new riders biking late fall	76%	(BTWD survey)
Weekly bike days late fall	1.04	(BTWD survey)
Weekly new bike days fall	518	
% increased riders biking late fall	72%	(BTWD survey)
Weekly new bike days late fall	0.92	(BTWD survey)
Weekly increased bike days	555	

New Bike Days

• New wkly bike days summer	2,254	(riders x % new after event x ave days summer)
• New wkly bike days fall	1,073	(riders x % new riders x still ride winter x ave days)
• Total new bike days summer	63,124	(wkly summer days x 28 wks – Apr-Oct)
• Total new bike days winter	23,601	(wkly winter days x 22 wks – Nov-Mar)
• Total new bike days-year	86,725	(summer bk days + winter bk days)
• New bike trips - year	173,450	(annual bike days x 2)

New Bike Trips and VT Reduction

• Ave new daily bk trips	694	(Annual new bike trips / 250)
• % DA/RS on non-bike days	49%	(BTWD survey)
• Daily vehicle trips reduced	338	(daily new bike trips x DA %

BTWD Daily Vehicle Trips Reduced 338

Appendix 4, continued

Daily VMT Reduced

- Ave trip distance (mi) 10.4 (BTWD survey)

BTWD Daily VMT Reduced **3,518** (vehicle trips reduced x average trip distance)

Total Daily Vehicle Trips Reduced **338** (Bike program VT reduced + BTWD VT reduced)
Total Daily VMT Reduced **3,518** (Bike program VMT reduced + BTWD VMT reduced)

Daily Emissions Reduced – NOx and VOC

		08 Emission		08 Emission		
NOx reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	338	0.6292			213	0.0002
• Running			3,518	0.4288	1,508	0.0017
Total NOx reduced (tons)						**0.0019**

		08 Emission		08 Emission		
VOC reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	338	1.7343			587	0.0006
• Running			3,518	0.1836	646	0.0007
Total VOC reduced (tons)						**0.001**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2 (Part 2)

		10 Emission		10 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	338	0.000			0	0.000
• Running (40mph)			3,518	0.0115	40	0.000
					Daily	**0.0**
Total PM 2.5 reduced (tons)					**Annual**	**0.0**

Appendix 4, continued

		10 Emission		10 Emission		
PM 2.5 Precursor NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	338	0.6652			225	0.002
• Running (40mph)			3,518	0.4038	1,420	0.0016
					Daily	**0.002**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**0.5**

		08 Emission		08 Emission		
CO2	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	338	0.000			0	0
• Running (40mph)			3,518	455.7	1,602,954	1.8
					Daily	**1.8**
Total CO2 reduced (tons)					**Annual**	**442**

Appendix 4, continued

Mass Marketing
Total – PART 1, PART 2, PART 3, AND PART 4

	No Contact	CC Contact	GRH	BTWD	Total MM
Placements	628	2,400	937	1,499	**5,464**
VT reduced	518	762	959	338	**2,577**
VMT reduced	16,175	24,461	35,121	3,518	**69,274**
Daily Emissions Reduced					
NOx (T)	0.008	0.01	0.012	0.002	**0.032**
VOC (T)	0.004	0.005	0.006	0.001	**0.017**
Annual Emissions Reduced					
PM 2.5 (T)	0.05	0.07	0.08	0.01	0.21
PM 2.5 Precursor (T)	1.8	2.6	2.8	0.45	7.6
CO2 (T)	1,975	2,800	2,995	442	8,212

APPENDIX 5 - CALCULATION OF INFOEXPRESS KIOSK IMPACTS

Populations of Interest – Regional Commuters who used Kiosks to obtain commute information

• Regional kiosk users	27,627	(SOC survey)

Kiosk Placement Rates

• Continued placement rate	6.6%	(SOC survey)
• Temporary placement rate	24.6%	(SOC survey)

Placements

• Continued placements	1,829	(Kiosk users x continued placement rate)
• Temporary placements	6,798	(Kiosk users x temporary placement rate)
Total placements	**8,627**	

Daily Vehicle Trips Reduced

VTR Factors

• Continued VTR factor	0.54	(SOC survey) x 53% (reduced kiosk period)
• Temporary VTR factor	1.55	(SOC survey) x 53%
• Continued VT reduced	523	
• Temporary VT reduced	2,316	(Temporary placements x temporary VTR factor x 42% discount for temporary use)
Total Daily Vehicle Trips Reduced	**2,840**	

Daily VMT Reduced

• Continued one-way trip dist (mi)	24.0	
• Temp trip dist (mi)	17.3	(from SOC survey)
• Continued VMT reduced	12,563	
• Temp VMT reduced	40,075	(Temp VT reduced x Temp trip distance)
Total Daily VMT Reduced	**52,638**	

Daily Emissions Reduced

NOx reduced	**Trips**	**08 Emission Factor**	**VMT**	**08 Emission Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	2,840	0.6292			1,787	0.0020
• Running			52,638	0.4288	22,571	0.0249
Total NOx reduced (tons)						**0.027**

VOC reduced	**Trips**	**08 Emission Factor**	**VMT**	**08 Emission Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	2,840	1.7343			4,925	0.0054
• Running			52,638	0.1836	9,664	0.0107
Total VOC reduced (tons)						**0.016**

Appendix 5, continued

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2 (Part 2)

PM 2.5	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	2,840	0.000			0	0.000
• Running (40mph)			52,638	0.0115	605	0.001
					Daily	**0.001**
Total PM 2.5 reduced (tons)					**Annual**	**0.2**

Appendix 4, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	2,840	0.6652			1,889	0.0021
• Running (40mph)			52,638	0.4038	21,255	0.023
					Daily	**0.026**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**6.4**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	2,840	0.000			0	0
• Running (40mph)			52,638	455.7	23,987,303	26.4
					Daily	**26**
Total CO2 reduced (tons)					**Annual**	**6,610**

APPENDIX 6 - CALCULATION OF COMMUTER OPERATIONS CENTER IMPACTS

Populations of Interest – Commuter Connections Rideshare Applicants

New, Reapply, Transit/other, follow-up requests

• FY 2006	63,358	(CC database)
• FY 2007	58,221	(CC database)
• FY 2008	64,060	(CC database)
Total assisted commuters	**185,639**	

Within MSA (69%)	128,091
Outside MSA (31%)	57,548

COC Placement Rates	**In MSA**	**Out MSA**	
• Continued rate	25.0%	31.3%	
• Temporary rate	15.7%	13.2%	
• Total	40.7%	44.3%	
Placements			
• Continued	32,023	17,897	(Apps x cont. rate)
• Temporary	20,110	7,596	(Apps x temporary rate)
• **Total placements 77,627**			
Daily Vehicle Trips Reduced			
VTR Factors			
• Continued	0.44	0.48	
• Temporary	0.61	0.45	
• Temporary discount	12.7%	11.7%	
• Continued trips reduced	14,090	8,591	(Placements x cont. VTR factor)
• Temporary trips reduced	1,558	400	(Placements x temp VTR factor)
Total VT reduced 24,639			
Daily VMT Reduced			
Ave one-way trip distance (mi)			
• Continued	32.2	32.2	(Actual Outside dist. 54.4 miles)
• Temporary	31.1	31.1	(Actual Outside dist. 57.9 miles)
• Continued VT reduced	453,698	276,623	(Vehicle trips x ave distance)
• Temporary VT reduced	48,452	12,438	
Total VMT Reduced 791,211			

Appendix 6, continued

Trip and VMT Adjustment for SOV Access to HOV Modes (reduce VT and VMT for AQ analysis)

	In MSA	Out MSA	
• SOV access % -Continued	67%	0%	(CC placement survey)
• SOV access dist (mi) – Continued	6.6	0.0	(CC placement survey)
• Non-SOV access % - Temporary	61%	0%	(CC placement survey)
• SOV access dist (mi) – Temporary	8.0	0.0	(CC placement survey)

VT Reduction

• Cont VT with SOV access	9,440	0	
• Temp VT with SOV access	950	0	(VT x non-SOV access %)
Total SOV VT access	**10,391**		

VMT Reduction

• SOV access (cont)	62,306	0	(VT x SOV % x (dist – access dist))
• SOV access (temp)	7,603	0	
Total SOV VMT access	**69,909**		

Total VT for AQ analysis **14,248**
Total VMT for AQ analysis **721,303**

Daily Emissions Reduced – NOx and VOC

		08 Emission		**08 Emission**		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	14,248	0.6292			8,965	0.010
• Running			721,303	0.4288	309,295	0.341
Total NOx reduced (tons)						**0.351**

		08 Emission		**08 Emission**		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	14,248	1.7343			24,710	0.027
• Running			721,303	0.1836	132,431	0.146
Total VOC reduced (tons)						**0.173**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

		10 Emission		**10 Emission**		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	14,248	0.000			0	0.00
• Running (40mph)			721,303	0.0115	8,295	0.009
					Daily	**0.009**
Total PM 2.5 reduced (tons)					**Annual**	**2.3**

Appendix 6, continued

PM 2.5 Precursor NOx	Trips	10 Emission Factor	VMT	10 Emission Factor	Tot gm	Tot ton
• Cold start	14,248	0.6652			9,478	0.020
• Running (40mph)			721,303	0.4038	291,262	0.321
					Daily	**0.332**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**82.9**

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	14,248	0.000			0	0
• Running (40mph)			721,303	455.7	328,697,658	362
					Daily	**362**
Total CO2 reduced (tons)					**Annual**	**90,582**

Correction for Overlap with Integrated Rideshare and GRH TERMs

	COC base	MM	Kiosk	Soft Upg	GRH	Net COC
Placements	77,627	2,400	134	8,628	4,288	62,177
Vehicle Trips Reduced	24,639	762	43	4,523	1,361	17,951
VMT Reduced (miles)	791,211	24,461	1,363	146,441	43,705	575,237
Daily Emissions Reduced						
NOx Reduced (tons)	0.351	0.011	0.001	0.065	0.019	0.256
VOC Reduced (tons)	0.173	0.005	0.000	0.032	0.010	0.13
Annual Emissions Reduced						
PM 2.5 (T)	2.3	0.1	0.0	0.4	0.1	1.7
PM 2.5 Precursor (T)	82.9	2.6	0.1	15.2	4.6	60.4
CO2 (T)	90,582	2,800	157	16,669	5,003	65,953

Notes:
MM influenced commuters – from MM analysis
Kiosk – 0.2% of COC base applications obtained through kiosks
GRH – 13.3% of new apps/reapps ask for GRH and other info = 5.7% of COC total after MM adjustment

APPENDIX 7 - CALCULATION OF SOFTWARE UPGRADE IMPACTS

Populations of Interest – Commuter Connections Rideshare Applicants

New, Reapply, Transit/other, follow-up requests

• FY 2006	63,358	(CC database)
• FY 2007	58,221	(CC database)
• FY 2008	64,060	(CC database)
Total assisted commuters	**185,639**	

Within MSA (69%)	128,091
Outside MSA (31%)	57,548

COC Placement Rates	**In MSA**	**Out MSA**	
• Continued rate	2.7%	5.0%	
• Temporary rate	1.6%	0.9%	
• Total	4.3%	5.9%	
Placements			
• Continued	3,458	2,877	(Apps x cont. rate)
• Temporary	2,049	518	(Apps x temporary rate)
• **Total placements 8,903**			

Daily Vehicle Trips Reduced

VTR Factors			
• Continued	0.65	0.75	
• Temporary	0.64	0.60	
• Temporary discount	17.0%	12.0%	
• Continued trips reduced	2,248	2,158	(Placements x cont. VTR factor)
• Temporary trips reduced	223	37	(Placements x temp VTR factor)
Total VT reduced 4,666			

Daily VMT Reduced

Ave one-way trip distance (mi)			
• Continued	32.3	32.3	(Actual Outside dist. 56.9 miles)
• Temporary	33.8	33.8	(Actual Outside dist. 57.2 miles)
• Continued VT reduced	72,610	69,705	(Vehicle trips x ave distance)
• Temporary VT reduced	7,537	1,260	

Total VMT Reduced 151,113

Appendix 7, continued

Trip and VMT Adjustment for SOV Access to HOV Modes (reduce VT and VMT for AQ analysis)

	In MSA	Out MSA	
• SOV access % -Continued	85%	0%	(CC placement survey)
• SOV access % - Temporary	86%	0%	(CC placement survey)
• SOV access dist (mi) – Continued	6.6	0.0	(CC placement survey)
• SOV access dist (mi) – Temporary	8.0	0.0	(CC placement survey)

VT Reduction

• SOV access (cont + temp)	2,103	0	(VT x non-SOV access %)

Total VT for AQ analysis 2,564

VMT Reduction

• SOV access (cont + temp)	14,145	0

Total VMT for AQ analysis 136,967

Daily Emissions Reduced – NOx and VOC

		08 Emission		08 Emission		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	2,564	0.6292			1,613	0.002
• Running			136,967	0.4288	58,732	0.065
Total NOx reduced (tons)						**0.067**

		08 Emission		08 Emission		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	2,564	1.7343			4,446	0.005
• Running			136,967	0.1836	25,147	0.028
Total VOC reduced (tons)						**0.033**

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2

		10 Emission		10 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	2,564	0.000			0	0.00
• Running (40mph)			136,967	0.0115	1,575	0.002
					Daily	**0.002**
Total PM 2.5 reduced (tons)					**Annual**	**0.4**

		10 Emission		10 Emission		
PM 2.5 Precursor NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	2,564	0.6652			1,705	0.002
• Running (40mph)			136,967	0.4038	55,307	0.061
					Daily	**0.063**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**15.7**

Appendix 7, continued

CO2	Trips	08 Emission Factor	VMT	08 Emission Factor	Tot gm	Tot ton
• Cold start	2,564	0.000			0	0
• Running (40mph)			136,967	455.7	62,415,955	69
					Daily	**69**
Total CO2 reduced (tons)					**Annual**	**17,200**

Correction for Overlap with MM TERM

Total CC applications FY 06, 07, 08	186,373	
New CC applications FY 06, 07, 08	38,261	21%
Estimated MM share of new CC	15%	
Estimated MM share of IR impact	3.1%	

	SU Base	MM	Net SU
Placements	8,903	275	8,628
VT reduced	4,666	144	4,522
VMT reduced	151,113	4,672	146,441
Daily Emissions Reduced			
NOx reduced (T)	0.067	0.002	0.064
VOC reduced (T)	0.033	0.001	0.032
Annual Emissions Reduced			
PM 2.5 (T)	0.4	0.01	0.4
PM 2.5 Precursor (T)	15.7	0.5	15.2
CO2 (T)	17,200	531	16,669