ITEM #3

NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD COMMUTER CONNECTIONS PROGRAM

TRANSPORTATION EMISSION REDUCTION MEASURE (TERM) ANALYSIS DRAFT REPORT FY 2009-2011

(July 2008 - June 2011)

Prepared for:

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January 17, 2012

EXECUTIVE SUMMARY

BACKGROUND

This report presents the results of an evaluation of four 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 evaluation documents transportation and air quality impacts for the three-year evaluation period between July 1, 2008 and June 30, 2011, 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.

COG's National Capital Transportation Planning Board (TPB), the designated Metropolitan Planning Organization (MPO) for the Washington, DC metropolitan region, adopted and continues to support 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 might 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/TPB staff, COG/TPB 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 vehicle pollutants (Nitrogen Oxides (NOx), Volatile Organic Compounds (VOC), Particulate Matter (PM2.5), Particulate Matter NOx precursors (PM_NOx), and Carbon Dioxide (CO2)) 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 Table A, the TERMs combined exceeded the collective goals for both vehicle trips reduced and VMT reduced by about 21%. The TERMs did not reach the emission goals; the impact for NOx was about 15% under the goal and VOC impact was 12% under the goal, but this was due entirely to a change in the emission factors. The goals were set in 2006, using 2006 emission factors, but the 2011 factors used in the 2011 evaluation were considerably lower.

When the COC results are added to the TERM impacts, as presented in Table B, the combined impacts again met both the vehicle trip and VMT reduction goals, in this case by 15% and 12% respectively. The combined TERM – COC programs fell about 21% short of the NOx goal and 18% under the VOC goal. Again, the change in the emission factors affected the emission results.

Two TERMs, Telework and Employer Outreach, met their individual participation and travel impact goals. Telework exceeded its vehicle trip reduction goal by about five percent and just met the VMT goal. Employer Outreach, both the overall program and the New/Expanded component, exceeded its vehicle trip and VMT goals by a margin substantial enough to overcome the difference between the 2006 and 2011 emission rates; Employer Outreach met all the emission goals as well as the travel goals. Employer Outreach for Bicycling also met its goals.

The Mass Marketing (MM) TERM came within 10% of its vehicle trip reduction goals, but was substantially under the goal for VMT reduction, primarily because 2011 Mass Marketing program participants traveled much shorter distances to work (9.6 miles one-way) than did 2008 MM participants (31 miles). In 2011, MM influenced a greater share of commuters to shift to bicycle and transit, both of which have short-distance travel profiles. Thus, even with robust participation and vehicle trip reduction, the TERM missed the VMT goal.

Finally, impacts for Guaranteed Ride Home were well below the goals for this program. The Commuter Operations Center and the Software Upgrades TERM also missed their goals. 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 (7/08– 06/11) 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]					
2011 Goal	31,854	11,830	241,208	0.122	0.072
Impacts (7/08 – 6/11)	35,237	12,499	241,834	0.099	0.062
Net Credit or (Deficit)	**3,383**	**669**	**626**	**(0.023)**	**(0.011)**
Guaranteed Ride Home					
2011 Goal	36,992	12,593	355,136	0.177	0.097
Impacts (7/08 – 6/11)	22,984	7,983	208,346	0.076	0.042
Net Credit or (Deficit)	**(14,008)**	**(4,610)**	**(146,790)**	**(0.101)**	**(0.055)**
Employer Outreach – all employers participating [3]					
2011 Goal	581	64,644	1,065,851	0.549	0.343
Impacts (7/08 – 6/11)	1,119	90,350	1,657,809	0.578	0.367
Net Credit or (Deficit)	538	**25,706**	**591,958**	**0.029**	**0.024**
Employer Outreach – new / expanded employer services since July 2008 [3]					
2011 Goal	96	8,618	140,622	0.072	0.046
Impacts (7/08 – 6/11)	551	28,098	461,250	0.177	0.108
Net Credit or (Deficit)	**455**	**19,480**	**320,628**	**0.105**	**0.062**
Employer Outreach for Bicycling [3]					
2011 Goal	61	130	567	0.001	0.001
Impacts (7/08 – 6/11)	274	180	1,083	0.001	0.001
Net Credit or (Deficit)	**213**	**50**	**516**	**0.000**	**0.000**
Mass Marketing					
2011 Goal	11,023	7,758	141,231	0.072	0.044
Impacts (7/08 – 6/11)	10,438	6,922	78,297	0.031	0.021
Net Credit or (Deficit)	**(585)**	**(836)**	**(62,934)**	**(0.041)**	**(0.023)**
TERMS (all TERMs collectively)					
2011 Goal		96,825	1,803,426	0.920	0.556
Impacts (7/08 – 6/11)		117,754	2,186,286	0.784	0.492
Net Credit or (Deficit)		**20,929**	**382,860**	**(0.136)**	**(0.064)**

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 telework attributable to TERM-related activities. Total telework 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 2008 and for Employer Outreach for Bicycling.

Table B
Summary of TERM and COC Results (7/08 – 6/11) 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)					
2011 Goal		96,825	1,803,426	0.920	0.556
Impacts (7/08 – 6/11)		117,754	2,186,286	0.784	0.492
Net Credit or (Deficit)		**20,929**	**382,860**	**(0.136)**	**(0.064)**
Commuter Operations Center – Basic Services [2]					
2011 Goal	152,356	10,399	296,635	0.147	0.081
Impacts (7/08 – 6/11)	81,675	6,190	180,409	0.066	0.036
Net Credit or (Deficit)	(70,681)	**(4,209)**	**(116,226)**	**(0.081)**	**(0.045)**
Commuter Operations Center – Software Upgrades [2]					
2011 Goal		2,370	62,339	0.031	0.017
Impacts (7/08 – 6/11)	3,373	1,717	51,569	0.020	0.010
Net Credit or (Deficit)		**(653)**	**(10,770)**	**(0.012)**	**(0.007)**
All TERMS plus COC					
2011 Goal		109,594	2,162,400	1.098	0.654
Impacts (7/08 – 6/11)		125,661	2,418,264	0.870	0.538
Net Credit or (Deficit)		**16,067**	**255,864**	**(0.228)**	**(0.116)**

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 6.43 annual tons of PM 2.5, 223.1 annual tons of PM 2.5 pre-cursor NOx, and 254,277 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 7.1 annual tons of PM 2.5, 246.4 annual tons of PM 2.5 pre-cursor NOx, and 282,001 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)]	0.8	27.0	30,770
Guaranteed Ride Home	0.7	22.2	26,272
Employer Outreach – all employers [2)]	4.7	165.5	189,976
Employer Outreach – new / expanded Employers [2)]	1.4	48.5	55,584
Employer Outreach for Bicycling	0.0	0.1	138
Mass Marketing	0.2	8.4	9,259
TERMS (all TERMs collectively)	6.4	223.1	254,277
Commuter Operations Center – basic services (not including Software Upgrades)	0.5	18.0	21,393
Commuter Operations Ctr – Software Upgrades	0.2	5.3	6,331
All TERMs plus Commuter Operations Center	7.1	246.4	282,001

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 2008 TERM analysis to results of the 2011 results. Note that, as described in the footnotes to the table, the emission factors declined between 2008 and 2011, resulting in decreased emission reductions, even though the TERMs achieved greater vehicle trip and VMT reductions in 2011.

Table D
Summary of Results for Individual TERMs 7/08– 6/11 Compared to 7/05 – 6/08

TERM	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Maryland and Virginia Telework				
July 2008 – June 2011	12,499	241,834	0.099	0.062
July 2005 – June 2008	21,866	413,703	0.211	0.126
Change [1)]	(9,367)	(171,869)	(0.112)	(0.064)
Guaranteed Ride Home				
July 2008 – June 2011	7,983	208,346	0.076	0.042
July 2005 – June 2008	8,680	227,428	0.106	0.056
Change [1)]	(697)	(19,082)	(0.030)	(0.014)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2008 – June 2011	90,170	1,656,727	0.577	0.366
July 2005 – June 2008	59,163	969,174	0.443	0.266
Change [1)]	31,007	687,553	0.134	0.100
Employer Outreach for Bicycling				
July 2008 – June 2011	180	1.083	0.001	0.001
July 2005 – June 2008	188	1,127	0.001	0.001
Change [1)]	(8)	(44)	0.000	0.000
Mass Marketing				
July 2008 – June 2011	6,922	78,297	0.031	0.021
July 2005 – June 2008	2,577	69,274	0.032	0.017
Change [1)]	4,345	9,023	(0.001)	0.004
InfoExpress Kiosks [2)]				
July 2008 – June 2011	Deleted	Deleted	Deleted	Deleted
July 2005 – June 2008	2,840	52,638	0.027	0.016
Change [1)]	N/A	N/A	N/A	N/A
All TERMs				
July 2008 – June 2011	117,754	2,186,287	0.784	0.492
July 2005 – June 2008	95,314	1,733,344	0.820	0.482
Change [1)]	22,440	452,943	(0.036)	0.010
Commuter Operations Center (Basic Services + Software Upgrades)				
July 2008 – June 2011	7,907	231,978	0.086	0.046
July 2005 – June 2008	22,473	721,678	0.320	0.158
Change [1)]	(14,566)	(489,700)	(0.234)	(0.112)

1) Change in emissions is due in part to reduction in emission factors from 2008 to 2011.
2) InfoExpress Kiosks TERM eliminated prior to July 2008 – no longer in TERM calculation.

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SECTION 1 INTRODUCTION

PURPOSE OF THE REPORT

This report presents the results of an evaluation of four 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, 2008 and June 30, 2011, 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. Various special promotional events also are part of this 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 TDM TERMs noted above. 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, 2007, and 2010, 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 2008 – June 2011." This document (*TERM Evaluation Framework, 2008-2011*) 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 Commuter Operations Center
- Section 9 Summary of 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 2010 for the FY 2009-2011 evaluation period. Sections 4 through 7 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 8 presents similar information for the Commuter Operations Center. The final section, Section 9, 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 is to estimate reductions in vehicle trips (VT), vehicle miles traveled (VMT), and tons of vehicle pollutants resulting from implementation of each TERM between July 2008 and June 2011 and to compare these impacts against the goals established for the TERMs. The Revised Evaluation Framework document finalized in May 2010 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.

Tables 1 and 2 present impact results for reductions in the following impacts and comparisons to the goals set for the impact measures:

- Vehicle trips (VT)
- Vehicle miles traveled (VMT)
- Nitrogen Oxides (NOx)
- Volatile Organic Compounds (VOC)

The impact results for these measures are shown in Table 1 for each TERM individually. Results for all TERMs collectively and for the Commuter Operations Center (COC) are presented in Table 2. As shown in Table 1, the TERMs combined exceeded the collective goals for both vehicle trips reduced and VMT reduced by about 21%. The TERMs did not reach the emission goals; the impact for NOx was about 15% under the goal and VOC impact was 12% under the goal, but this was due entirely to a change in the emission factors. The goals were set in 2006, using 2006 emission factors, but the 2011 factors used in the 2011 evaluation were considerably lower.

When the COC results are added to the TERM impacts, as presented in Table 2, the combined impacts again met both the vehicle trip and VMT reduction goals, in this case by 15% and 12% respectively. The combined TERM – COC programs fell about 21% short of the NOx goal and 18% under the VOC goal. Again, the change in the emission factors affected the emission results.

Two TERMs, Telework and Employer Outreach, met their individual participation and travel impact goals. Telework exceeded its vehicle trip reduction goal by about five percent and just met the VMT goal. Employer Outreach, both the overall program and the New/Expanded component, exceeded its vehicle trip and VMT goals by a margin substantial enough to overcome the difference between the 2006 and 2011 emission rates; Employer Outreach met all the emission goals as well as the travel goals. Employer Outreach for Bicycling also met its goals.

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Finally, impacts for Guaranteed Ride Home were well below the goals for this program. The Commuter Operations Center and the Software Upgrades TERM also missed their goals. The reasons for the shortfalls from the goals vary by TERM and are discussed in individual report sections on each TERM.

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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 telework attributable to TERM-related activities. Total telework 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 2008 and for Employer Outreach for Bicycling.

Table 2
Summary of TERM and COC Results (7/08 – 6/11) 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)					
2011 Goal		96,825	1,803,426	0.920	0.556
Impacts (7/08 – 6/11)		117,754	2,186,286	0.784	0.492
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All TERMS plus COC					
2011 Goal		109,594	2,162,400	1.098	0.654
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Net Credit or (Deficit)		**16,067**	**255,864**	**(0.228)**	**(0.116)**

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 3, below, 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 6.43 annual tons of PM 2.5, 223.1 annual tons of PM 2.5 pre-cursor NOx, and 254,277 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 7.1 annual tons of PM 2.5, 246.4 annual tons of PM 2.5 pre-cursor NOx, and 282,001 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)]	0.8	27.0	30,770
Guaranteed Ride Home	0.7	22.2	26,272
Employer Outreach – all employers [2)]	4.7	165.5	189,976
Employer Outreach – new / expanded Employers [2)]	1.4	48.5	55,584
Employer Outreach for Bicycling	0.0	0.1	138
Mass Marketing	0.2	8.4	9,259
TERMS (all TERMs collectively)	6.4	223.1	254,277
Commuter Operations Center – basic services (not including Software Upgrades)	0.5	18.0	21,393
Commuter Operations Ctr – Software Upgrades	0.2	5.3	6,331
All TERMs plus Commuter Operations Center	7.1	246.4	282,001

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 4 shows comparisons of daily reductions in vehicle trips, VMT, NOx, and VOC from the 2008 TERM analysis to results of the 2011 results. Note that, as described in the footnotes to the table, the emission factors declined between 2008 and 2011, resulting in decreased emission reductions, even though the TERMs achieved greater vehicle trip and VMT reductions in 2011.

Table 4
Summary of Results for Individual TERMs 7/08– 6/11 Compared to 7/05 – 6/08

TERM	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Maryland and Virginia Telework				
July 2008 – June 2011	12,499	241,834	0.099	0.062
July 2005 – June 2008	21,866	413,703	0.211	0.126
Change [1)]	(9,367)	(171,869)	(0.112)	(0.064)
Guaranteed Ride Home				
July 2008 – June 2011	7,983	208,346	0.076	0.042
July 2005 – June 2008	8,680	227,428	0.106	0.056
Change [1)]	(697)	(19,082)	(0.030)	(0.014)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2008 – June 2011	90,170	1,656,727	0.577	0.366
July 2005 – June 2008	59,163	969,174	0.443	0.266
Change [1)]	31,007	687,553	0.134	0.100
Employer Outreach for Bicycling				
July 2008 – June 2011	180	1.083	0.001	0.001
July 2005 – June 2008	188	1,127	0.001	0.001
Change [1)]	(8)	(44)	0.000	0.000
Mass Marketing				
July 2008 – June 2011	6,922	78,297	0.031	0.021
July 2005 – June 2008	2,577	69,274	0.032	0.017
Change [1)]	4,345	9,023	(0.001)	0.004
InfoExpress Kiosks [2)]				
July 2008 – June 2011	Deleted	Deleted	Deleted	Deleted
July 2005 – June 2008	2,840	52,638	0.027	0.016
Change [1)]	N/A	N/A	N/A	N/A
All TERMs				
July 2008 – June 2011	117,754	2,186,287	0.784	0.492
July 2005 – June 2008	95,314	1,733,344	0.820	0.482
Change [1)]	22,440	452,943	(0.036)	0.010
Commuter Operations Center (Basic Services + Software Upgrades)				
July 2008 – June 2011	7,907	231,978	0.086	0.046
July 2005 – June 2008	22,473	721,678	0.320	0.158
Change [1)]	(14,566)	(489,700)	(0.234)	(0.112)

1) Change in emissions is due in part to reduction in emission factors from 2008 to 2011.
2) InfoExpress Kiosks TERM eliminated prior to July 2008 – no longer in TERM calculation.

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. The methodology was updated again, in 2004, 2007, and 2010, following the second, third, and fourth triennial TERM evaluations, respectively, to enhance the analysis results for several TERMs.

This section identifies key enhancements that were made to the methodology since the 2008 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 United States.

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 daily vehicle trips reduced per 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, 2006-2008, and 2009-2011 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 of the *TERM Evaluation Framework, 2008-2011* 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 2008 TERM Analysis Report were used as the basis for the TERM evaluation methods described used in the FY 2009-2011 evaluation. The 2008 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 (2009-2011). 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 – 7 for each individual TERM.

- Maryland and Virginia Telework – Maryland and Virginia Telework (Telework TERM) is a resource service to help employers, commuters, and program partners initiate or expand telework programs. In evaluating telework, several travel changes need to be assessed, including: trip reduction due to telework, 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.

The Virginia component of this TERM ended on June 30, 2009, thus impacts for the TERM reflect availability of the service in Virginia for only the first year of the three-year evaluation period. Impacts during the second and third years include only those generated in Maryland.

- Guaranteed Ride Home (GRH) – No changes to the methodology for FY 2009-2011.
- Employer Outreach – No changes to the methodology for FY 2009-2011.
- Mass Marketing – No changes to the methodology for FY 2009-2011.
- InfoExpress Kiosks – The FY 2006-2008 TERM analysis included a calculation for impacts from the InfoExpress Kiosk TERM, originally part of the Integrated Rideshare TERM, but reported separately in the FY 2006-2008 analysis. The analysis of this TERM identified changes in commute behavior related to the use of information kiosks. The InfoExpress Kiosk program ended on January 31, 2007, thus this program was not included in the 2009-2011 analysis.
- Commuter Operations Center (COC) – No changes to the methodology for FY 2009-2011.

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. Data are collected and analyzed to evaluate regional ridesharing, transit and vanpool subsidy programs, and marketing campaigns. The TERM analysis has been held up as a model for this approach and the data collection and analysis methods used are similar to those used in the MWCOG evaluation.
- 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 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 teleworkers in the region, whether full-time or part-time teleworkers. For FY 2009-2011, 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 eliminated by use of telework 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 as the contribution of the Telework TERM to regional telework. In other words, it was recognized that some telework 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 telework frequency, 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 telework

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 non-telework days and the commute modes on telework days of commuters who teleworked at a location other than home.

- The VTR factor for home-based teleworkers was 0.36 daily trips reduced per teleworker, reflecting the part-time (1.3 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 (0.09) for non-home-based teleworkers, because the majority of these teleworkers drove alone to the telework 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.

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 2011 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 5 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 5
Telework Goals, Estimated Telework TERM Impacts, and Estimated Regional Telework Impacts

	Regional TW Impacts	Telework Goal	Telework TERM Impact*
• Number of teleworkers	603,305	31,854	35,237
• Daily vehicle trips reduced	214,003	11,830	12,499
• Daily VMT reduced	4,140,556	241,208	241,834
• Daily tons NOx reduced	1.895 T	0.122 T	0.099 T
• Daily tons VOC reduced	1.107 T	0.072 T	0.062 T
• Annual tons PM 2.5 reduced	13.1 T	N/A	0.8 T
• Annual tons PM 2.5 pre-cursor NOx reduced	500.0 T	N/A	27.0 T
• Annual tons CO2 reduced	519,974 T	N/A	30,770 T

Impacts vs Goals

Participation Benefit (net over or (under) goal):	Teleworkers: 3,383
Transportation Benefit (net over or (under) goal):	Vehicle Trips: 669 VMT: 626 miles
Emission Benefit (net over or (under) goal):	NOx: (0.023) tons per day VOC: (0.011) tons per day

In 2011, approximately 603,300 regional workers teleworked at least occasionally, representing about 23.5% of the total regional workforce and 25% of all workers who are not self-employed, working only at home. This number of teleworkers represented an increase of 32% over the 2008 number of 456,600 teleworkers and several times the 1996 baseline of 150,900 teleworkers.

Telework growth is likely the result of several factors, including the use of telework by employers to recruit and retain employees. Increasing traffic congestion in the Washington region also might have prompted some commuters to work at home to avoid 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 5 (Telework Goal) and the impacts are shown in the third column (Telework TERM Impacts). The Telework TERM exceeded by 3,383 the goal for the number of teleworkers expected from TERM activities. The TERM also slightly exceeded the reduction goals established for vehicle trips, and VMT. The slight deficit in the emission reduction performance indicators is due to different emission factors used for the goals and the impacts. The goals, which were set in 2005, apply 2005 emission factors, while the 2011 impacts reflect updated, and lower, emission factors.

As shown in Table 5, the Telework TERM was responsible for about six percent of regional teleworkers and telework impacts. In the 2010 State of the Commute Survey, about six 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 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 employer outreach. Seven in ten (71%) teleworkers said they learned of teleworking from their employer. While employers could have learned of telework from many sources, the Commuter Connections Employer Outreach TERM actively promotes telework to employers. So this response likely indicates additional teleworkers who learned about teleworking indirectly from Commuter Connections. Because this cannot be clearly documented, no additional credit is attributed to the Telework TERM. But these impacts are included in the Employer Outreach calculation for employers that offer telework.

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 2009-2011 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 2010. This survey polled 1,000 commuters who had registered for GRH between March 16, 2007 and March 31, 2010. 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)
- Motivation: Importance of GRH to decisions to start or continue use of alternative modes

Data from the GRH survey were used to derive the impact calculation multipliers for the GRH TERM; 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 include only the portion of the VMT reduction that occurred within the MSA. Approximately 38% 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 39.6%
- Outside MSA 40.2%

To determine the number of commuters placed in alternative modes between July 2008 and June 2011, these placement rates were multiplied by the total number of commuters who participated in GRH during that time period, 22,984, divided into the two sub-groups: 14,250 within the MSA and 8,734 outside the MSA. This calculation resulted in 5,643 placements from within the MSA and 3,511 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 0.90 vehicle trips reduced per placement
- Outside MSA 0.99 vehicle trips reduced per placement

As noted earlier, VTR factors represent the average daily 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 0.90 and 0.99 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 8,555 trips reduced; 5,079 from commuters within the MSA and 3,476 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 26.1 miles. The actual one-way distance for the outside MSA respondents was an average of 50.3 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 24.2 one-way miles per trip for each outside-MSA respondent. The VMT calculation reflected the following:

8,555 trips reduced x 26.1 miles per trip

= 223,276 VMT reduced

Estimates of reductions in NOx, VOC, PM 2.5, PM 2.5 pre-cursor NOx, and CO2 for GRH 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 seven percent 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 6 below account for the adjustment and reflect the net GRH impacts.

GUARANTEED RIDE HOME SUMMARY OF GOALS AND IMPACTS

Table 6 presents the transportation and emission impact results for GRH and compares the results against the goals established for the TERM.

Table 6
Guaranteed Ride Home Goals and Estimated Impacts

	TERM Goal	Estimated Impacts
• Number of GRH participants*	36,992	22,984
• New applicants during evaluation period	N/A	12,512
• Daily vehicle trips reduced	12,593	7,983
• Daily VMT reduced	355,136	208,346
• Daily tons NOx reduced	0.177 T	0.076 T
• Daily tons VOC reduced	0.097 T	0.042 T
• Annual tons PM 2.5 reduced	N/A	0.7 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	22.2 T
• Annual tons CO2 reduced	N/A	24,515 T

* Number of participants currently enrolled in GRH

Impacts vs Goals

Participation Benefit (net over or (under) goal): Participants: (14,008)

Transportation Benefit (net over or (under) goal): Vehicle Trips: (4,610)
VMT: (146,790 miles)

Emission Benefit (net over or (under) goal): NOx: (0.101 tons per day)
VOC: (0.055 tons per day)

The number of commuters participating in GRH in June 2011 was about two-thirds of the participant goal, and the vehicle trip reduction, VMT, and emissions impacts were correspondingly short of the goals for these measures. Participation in GRH dropped substantially since 2005, the year the goals were established. Some of the decline could be due to reduced level of Commuter Connections program advertising and outreach focused exclusively on GRH. The 2010 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.

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. A large share 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 and support
- 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 extent of the TDM programs that 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.[1]

- **Level 1 (Bronze1) programs** offer only commute information.
- **Level 2 (Silver) programs** offer two or more commute support services, such as: Employee Transportation Coordinator (ETC), preferential parking, carpool/vanpool formation meetings, bike racks or lockers, transportation fairs, telework program with 1-20% of employees participating, and compressed work schedule with 1-20% of employees participating.
- **Level 3 (Gold) programs** include, in addition to the Level 2 services, at least one of services such as transit subsidy or parking "cash out," telework program with more than 20% of em-

[1] For more details of employer levels, see Appendix 3.

ployees participating, parking fee discount for carpool/vanpools, shuttle to transit stations, comprehensive bicycle/walking program, and company vanpools.

- **Level 4 (Platinum) programs** include two or more of the Level 3 program components, at least two Level 2 strategies, and actively promote the program.

When the Employer Outreach TERM was adopted, the TPB established a goal to be achieved by June 2005 and evaluations conducted for periods through June 2005 measured impacts against this goal. Beginning with the 2005-2008 analysis, new Employer Outreach goals were established for the overall program and for new program activity during the evaluation period. Thus, for the 2008-2011 evaluation, impacts were calculated for "maintained" employer programs and "new/expanded" programs.

Maintained impacts included employers that joined EO before July 1, 2008 and made no changes since that date. Expanded impacts included employers that were involved in EO before July 1, 2008 but expanded their commute assistance services after that date. New impacts included employers that joined the EO program on or after July 1, 2008. A final category was defined to calculate the impacts of employers that were included in the 2008 evaluation but dropped out of EO before June 2011. 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 the following groups of employers:

- Maintained – June 2008 employer programs continued with no change
- Expanded – June 2008 employer programs expanded since June 2008
- New – Employer programs started since June 2008
- Deleted – June 2008 employer programs deleted between July 2008 and June 2011

The overall benefit of the program is the sum of continued programs plus expanded and new programs. As shown below, in June 2011, the ACT! database included 1,119 employers with programs that met the Level 3 or 4 definitions. These employers accounted for 466,522 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 absence of financial incentives or other substantial commute support services.

Of the Level 3 and 4 employers, 568 joined Employer Outreach prior to July 2008 and made no program changes since that time. The expanded category included 267 employers. And 284 were listed as "new" since June 2008. Finally, 182 employers that were counted in the 2008 evaluation were no longer involved in the program. The employee count associated with these employers was smaller (34,404), however, than the number of employees at worksites with new/expanded programs (281,862). Had these employers continued in the program, the total employee count would have been 500,926, so the deleted employees represented a drop of about seven percent.

	Number of Employers			Number of
Employer Status (June 2011)	**Total**	**<100**[1)]	**100+**	**Employees**
- Maintained/unchanged from June 2008	568	303	265	184,660
- Expanded after June 2008	267	85	182	173,346
- New programs	284	130	154	108,516
Total	**1,119**	**518**	**601**	**466,522**
Deleted from 2008	182	110	72	34,404

1) Actual number of employers with fewer than 100 employees.

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 v 2.0, 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 2008 evaluation.

Starting Mode Split – The COMMUTER model v 2.0 requires several "scenario" inputs, including the type of employer (primarily office or non-office occupations) 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.

Program Definition – Employers included in the TERM analysis also were classified by the specific elements offered in their commute program. The COMMUTER model v 2.0 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 2010 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
- Availability of bicycle services
- Availability of a shuttle bus to Metrorail or other transit location

The COMMUTER model v 2.0 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 2010 State of the Commute Survey. Emissions reduced were calculated by multiplying trips and VMT reduced by 2010 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 7.

Table 7
Employer Outreach Goals and Estimated Impacts

	EO Goal	Estimated Impacts
Employer Outreach (all programs)		
• Employers participating - total	581	1,119
– Maintained from 2008	No goal	568
– Expanded after 2008	No goal	267
– New in 2011	No goal	284

- Employers by jurisdiction (continuing and new/expanded)

	Total Employers	Employees	New/Expanded Employers
– Alexandria, VA	50	10,133	22
– Arlington County, VA	160	38,557	33
– District of Columbia	330	146,167	234
– Fairfax County, VA	196	161,860	155
– Frederick County, MD	4	3,468	3
– Loudoun County, VA	11	7,138	4
– Montgomery County, MD	343	73,310	96
– Prince George's County, MD	18	23,099	2
– Prince William County, VA	5	2,590	2
– Tri-County Council, MD	2	200	0

- Employers by size category (Total and New/Expanded)

	Total Employers	Employees	New/Expanded Employers
– Sites with 100+ employees	601	448,178	336
– Fewer than 100 employees	518	18,344	215
– "Equivalent 100+" [1)]	183		89

1) For purposes of program tracking, employers with fewer than 100 employees are grouped into "equivalent 100+" employers. The 518 employers in this category employ 18,344 employees, thus represent 183 "equivalent 100" employers (18,344 / 100).

Travel and Emissions Impacts and Impacts vs Goals

Overall Employer Outreach Program

	EO Goal	Estimated Impacts
Total Program		
• Daily vehicle trips reduced	64,644	90,350
• Daily VMT reduced	1,065,851	1,657,809
• Daily tons NOx reduced	0.549 T	0.578
• Daily tons VOC reduced	0.343 T	0.367
• Annual tons PM 2.5 reduced	N/A	4.7 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	165.5 T
• Annual tons CO2 reduced	N/A	189,976 T

Participating Employers (net over or (under) goal): Employers: 538

Transportation Benefit (net over or (under) goal): Vehicle Trips: 25,706
VMT: 591,958 miles

Emission Benefit (net over or (under) goal): NOx: 0.029 tons per day
VOC: 0.024 tons per day

New / Expanded Employer Programs

	EO Goal	Estimated Impacts
• New/expanded programs	96	551
• Daily vehicle trips reduced	8,618	28,098
• Daily VMT reduced	140,622	461,250
• Daily tons NOx reduced	0.072 T	0.177 T
• Daily tons VOC reduced	0.046 T	0.108 T
• Annual tons PM 2.5 reduced	N/A	1.4 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	48.5 T
• Annual tons CO2 reduced	N/A	55,584 T

Participating Employers (net over or (under) goal): Employers: 455

Transportation Benefit (net over or (under) goal): Vehicle Trips: 19,480
VMT: 320,628 miles

Emission Benefit (net over or (under) goal): NOx: 1.105 tons per day
VOC: 0.062 tons per day

As shown, even with the loss of 182 employers that dropped out since 2008, both the overall number of employers participating in the program and the number of new / expanded employers were well above the goals. The results for vehicle trips and VMT reduced also exceeded the goals.

Emissions reduced for Employer Outreach were calculated by multiplying trips and VMT reduced by 2011 regional emission factors. Details of the calculation are presented in Appendix 3.

Note that Employer Outreach overlaps with the Telework TERM. Eight 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. And seven employers had received telework assistance under the Telework!VA program. Impacts for this program are reported separately in the conformity analysis. To avoid double counting credits of these employers, the impacts from the telework components of these employers' program were removed from the Employer Outreach TERM total. Impacts of non-telework strategies offered by these employers were included in the Employer Outreach impact calculation.

To estimate 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 subtracted from the total Employer Outreach impact. The results presented in Table 7 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.

Two hundred, seventy-four employers offered bicycle strategies in their worksite programs in 2011. 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 2010 State of the Commute (SOC) Survey.

As shown by the results in Table 8 below, the Employer Outreach for Bicycling TERM met all the goals established for the project, by a substantial margin.

Table 8
Employer Outreach – Bike Services Goals and Estimated Impacts

	EO Goal	**Estimated Impacts**
• Employers with bike strategies	61	274
• Daily vehicle trips reduced	130	180
• Daily VMT reduced	567	1,083
• 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	N/A	0.0 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	0.1 T
• Annual tons CO2 reduced	NA	138 T

Participating Employers (net over or (under) goal): Bike Employers: 213

Transportation Benefit (net over or (under) goal): Vehicle Trips: 50
VMT: 516 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

The 2011 Mass Marketing TERM analysis also includes impacts for the annual Bike-to-Work Day and Car Free Day events. Commuter Connections' role in these events is regional and primarily promotional in nature, so their impacts are most appropriately included in the Mass Marketing TERM calculation.

Evaluation Methodology and Data Sources – Umbrella Advertising Campaign

The Mass Marketing TERM has four 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
4) Commuters who participated in the 'Pool Rewards carpool incentive program
5) Commuters who participate in Car Free Day[2]

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.

[2] Impacts for Bike-to-Work Day were calculated using data from a survey of event participants conducted several months following the event. This allowed calculation of impacts for typical days following the event. Comparable data were not available for Car Free Day, thus it was not possible to estimate an ongoing benefit for this event, but it is anticipated that future TERM analyses will include impacts for this program in the Mass Marketing TERM.

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 applications received for 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 prorated 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 2010 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?

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

Percentage of commuters who:

• Recalled recall specific commute message	39%
• Shifted to an alternative mode after hearing the ads	0.9%
• Said the ad influenced their decision to shift	84%
• Did not use any other commute service	100%
• **Resulting influence percentage**	**0.3%**

Thus, 0.3% of regional commuters were directly influenced to make a change. This percentage was multiplied by the number of regional commuters (2,569,890) to estimate alternative mode placements.

Further analysis of survey respondents who made a change showed that 62% continued using the new mode and 18% were temporary users and 20% said they tried the new mode less than one week. These commuters reduced on average 0.97 trips per day with their changes. These factors, and the 9.4 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 2008 and June 2011 when MM ads were aired
- In months between July 2008 and June 2011 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		
	CC Website Uses	RS Apps	GRH Apps
• With ads compared to no ads	33%	2%	11%

These results suggest that ads increase rideshare applications by about 3% and increase GRH applications by about 10%. When taken as a percentage of total new applications, these increases translate to about 2% of total rideshare applications (2/102) and 10% of total GRH applications (11/111). The impact resulting from these increases was assigned to Mass Marketing.

It is also important to note that use of the Commuter Connection website increased by a third during MM advertising periods. Commuters can access numerous commute information services directly from the website, without registering or providing contact information. Because they cannot be included in the applicant follow-up surveys that Commuter Connections conducts to estimate impacts from use of the services, any travel changes that they made after using the website, the MM "referred influence" calculation likely undercounts the impacts of this MM component.

Evaluation Methodology and Data Sources – Bike to Work Day Event

Impacts for the third component of this TERM, Bike-to-Work Day (BTWD) Event, were calculated using data obtained from a survey of BTWD participants conducted following the 2010 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/early 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 drove alone or carpooled on non-bike days (48%) by the number of daily bicycle trips. VMT reductions were estimated by multiplying the vehicle trip reduction by the average one-way commute distance of these participants (9.6 miles). Emissions reduced were calculated as for other TERMs.

Evaluation Methodology and Data Sources – 'Pool Rewards Program

Impacts for the final component of this TERM, 'Pool Rewards carpool incentive, were calculated in a manner similar to that used for the GRH TERM. The number of participants was multiplied by placement rate, VTR factor, and travel distance calculation multipliers to estimate the travel impacts. Data to

derive these multipliers were collected through two tools: mode tracking required of all participating commuters and a post-program survey.

Since the program was open only to commuters who were driving alone prior to the program, all 'Pool Rewards participants were placed in a new mode. A survey conducted by Commuter Connections following the end of their enrollment period identified that 93% had continued to carpool. These results were used to derive the placement factors: 93% continued placement and 7% temporary placement.

The VTR factor was derived from mode use logs submitted by participants at the end of their enrollment period. Participants were required to document how many days they carpooled during their enrollment period. The travel during their enrollment period was compared to their pre-program travel (all drive alone) to determine the average daily drive alone trips they reduced (VTR factor), equal to 0.73 daily trips reduced. The average travel distance of 31.1 miles was estimated from commute travel distance data provided by participants.

Through June 2011, 171 commuters had participated in the program. When this participation number was multiplied by the 93% continued placement rate and 7% temporary rate, the calculation resulted in 159 continued placements and 12 temporary placements. Applying the VTR factors and one way travel distance resulted in 117 daily vehicle trips reduced and 3,653 daily VMT reduced.

MASS MARKETING SUMMARY OF GOALS AND IMPACTS

Table 9 presents the results for the Mass Marketing TERM, compared to the goals. Individual goals were not established for any of the individual elements that comprised the Mass Marketing TERM (direct influence, indirect ridematch influence, BTW Day event, 'Pool Rewards, and indirect GRH influence). Directly influenced commuters accounted for 78% of vehicle trips reduced, Bike to Work Day accounted for about 13% of the total, GRH referrals contributed 7%, and the balance of 2% was divided between indirect rideshare placements and Pool Rewards.

Table 9
Mass Marketing Goals and Estimated Impacts

	MM Goal	Estimated Impacts
Total Mass Marketing		
• Commuter placements	11,023	10,438
• Daily vehicle trips reduced	7,758	6,922
• Daily VMT reduced	141,231	78,297
• Daily tons NOx reduced	0.072 T	0.031 T
• Daily tons VOC reduced	0.044 T	0.021 T
• Annual tons PM 2.5 reduced	N/A	0.2 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	8.4 T
• Annual tons CO2 reduced	N/A	9,259 T

Impacts vs Goals

Participation Benefit (net over or (under) goal):	Commuters: (585)
Transportation Benefit (net over or (under) goal):	Vehicle Trips: (836) VMT: (62,934 miles)
Emission Benefit (net over or (under) goal):	NOx: (0.041 tons per day) VOC: (0.023 tons per day)

MM reached 95% of the goal for commuter placements and 89% of the vehicle trip reduction goal. The TERM fell considerably short of the goals for VMT and emissions reduced, meeting only about 55% of these goals. The shortfall for these measures was largely because the average travel distance for "directly influenced" changes was much shorter (9.4 miles) than had been estimated in the 2008 TERM calculation (31.1 miles). The distance was shorter because a larger share of the 2011 change was made to bicycle and transit than to carpool or vanpool.

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

SECTION 8 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, accessing information from the Commuter Connections website, or contacting a local partner assistance program.

EVALUATION METHODOLOGY AND DATA SOURCES

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 2008. 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 38% 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	22.4%	12.1%
• Outside MSA	30.4%	12.6%

To determine the number of commuters placed in alternative modes between July 2008 and June 2011, these placement rates were multiplied by the number of commuters (81,675) who received assistance from Commuter Connections during that time period. About 39% of the requests were from new applicants or re-applicants. The COC also provided follow-up assistance to about 49,800 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: 50,639 within the MSA and 31,037 outside the MSA. When these applicant counts were multiplied by the placement rates, the calculation resulted in a total of 30,816 placements, with 17,470 placements from within the MSA and 13,346 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	0.37	0.66
• Outside MSA	0.38	0.45

The vehicle trip reductions for temporary placements also were discounted to reflect their short duration of about six weeks (11% of a year). The calculation of vehicle trips reduced produced a total of 8,433 trips reduced.

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 29.4 miles for continued placements and 28.6 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 about 26 one-way miles per trip for each outside-MSA respondent. The VMT calculation resulted in a total of 247,400 VMT reduced.

Emission reduction for the COC was calculated using trip-based and VMT-based regional emission factors. Details of these calculations are presented in Appendix 5. The overall COC results were adjusted to account for overlap with the Software Upgrades (described below), GRH, and Mass Marketing. To avoid double counting of impacts, the COC's contributions to these TERMs were subtracted from the COC "basic impacts."

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. This arrangement was used also for the 2011 evaluation, but Software Upgrade impacts were calculated separately, using the following method.

Impacts of the Software Upgrades was assessed using data from the November 2008 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 2.8% of applicants who lived inside the MSA and 6.3% 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	1.8%	1.0%
• Outside MSA	4.0%	2.3%
VTR factors		
• Within MSA	0.67	0.94
• Outside MSA	0.83	0.57

To estimate vehicle trips reduced, placement rates were multiplied by the 81,675 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 (30.2 miles for continued placements and 26.8 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 regional emission factors. Calculation details for the software upgrade are shown in Appendix 6.

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 10
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	81,675
• Daily vehicle trips reduced	10,399	6,190
• Daily VMT reduced	296,635	180,409
• Daily tons NOx reduced	0.147 T	0.066 T
• Daily tons VOC reduced	0.081 T	0.036 T
• Annual tons PM 2.5 reduced	N/A	0.5 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	18.0 T
• Annual tons CO2 reduced	N/A	21,393 T
Software Upgrades (additional to Basic COC)		
• Daily vehicle trips reduced	2,370	1,717
• Daily VMT reduced	62,339	51,569
• Daily tons NOx reduced	0.031 T	0.020 T
• Daily tons VOC reduced	0.017 T	0.010 T
• Annual tons PM 2.5 reduced	N/A	0.2 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	5.3 T
• Annual tons CO2 reduced	N/A	6,331 T

Impacts vs Goals

Basic COC

Transportation Benefit (net over or (under) goal): Vehicle Trips: (4,209)
VMT: (116,226) miles

Emission Benefit (net over or (under) goal): NOx: (0.081) tons per day
VOC: (0.045) tons per day

Software Upgrades

Transportation Benefit (net over or (under) goal): Vehicle Trips: (653)
VMT: (10,770) miles

Emission Benefit (net over or (under) goal): NOx: (0.010) tons per day
VOC: (0.007) tons per day

As shown, both the Basic COC and Software Upgrades missed their goals, largely because the number of commuter applicants on whom the calculation is based dropped substantially from the 2008 calculation. This drop in applicants could be related to several factors. First, in September 2008, Commuter Connections transitioned to a new online ridematch system and notified existing database applicants that they needed to establish an online account to remain in the database. This effort identified many commuters who were listed in the database but who had moved out of the area or were no longer interested in receiving new ridematch information. This purge deleted a large portion of the applicants who were included in the 2008 TERM analysis.

Second, the COC impacts are calculated only on commuters who can be contacted through a follow-up survey to identify travel changes they made after receiving Commuter Connections services. But the new online system permits commuters to access several services, such as bicycle and transit information, without making a formal application to Commuter Connections. Thus, some COC service recipients, who would have been included in the COC calculation in past TERM evaluations, would have been excluded in the 2011 analysis. The extent of the impact undercounting cannot be estimated at present.

Finally, in late 2008 and early 2009, gasoline prices fell significantly, eliminating one of the prime motivations to seek a rideshare arrangement. Anecdotal evidence from several regional rideshare programs showed similar drops in rideshare applications during this time.

The results shown in Table 11, below were adjusted to eliminate overlap between the COC and individual TERMs. A portion of COC impacts were assigned to Software Upgrades and a small share to GRH, because about one in ten new CC applicants requested both GRH and other information. Finally, the impacts for about two percent 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.

Table 11
Adjustment of Vehicle Trips and VMT for Double Counting Among COC and TERMs

Evaluation Measure	Net COC	Base COC	Mass Marketing	Software Upgrade	GRH
VT reduced	**6,190**	8,433	48	1,717	478
VMT reduced	**180,409**	247,400	1,400	51,569	14,002

Notes:

- Mass Marketing – new applicants influenced by ads to contact CC, see Section 6
- Software upgrades – see description in this section
- GRH – 10% of new/re-applicants ask for GRH and other commute information = 5.7% of COC total after Mass Marketing adjustment

SECTION 9 SUMMARY OF TERM IMPACTS

The preceding sections of this report documented estimated impacts for individual TERMs and for the Commuter Operations Center. As noted earlier in the report, four TERMs administered by Commuter Connections met the collective goal for vehicle trips reduced and VMT reduced. The impacts for emissions reduced were about 15% under the goals, but this was due entirely to a change in the emission factors. The goals were set in 2006, using 2006 emission factors, but the 2011 factors used in the 2011 evaluation were considerably lower.

When the Commuter Operations Center's results are added to the TERM impacts, the combined impacts met both the vehicle trips reduced and VMT reduced goals, but fell short of the combined goals for tons of NOx reduced, and tons of VOC reduced, by 19% and 16%, respectively. Again, the change in the emission factors affected the emission results.

Where shortfalls occurred against the travel goals (vehicle trips and VMT reduced), they appeared to be related to lower than expected participation rates, rather than overly-optimistic travel change factors. COG revised the goals for each TERM following the 2005 analysis, so the 2011 goals reflect more closely the impacts from actual types of behavior changes that commuters make.

Individual sections of this report have discussed factors that affected the achievement of goals. Below are presented highlights of those discussions for the four 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 2008, the number had grown to more than 456,000 and the 2010 State of the Commute survey estimates regional teleworkers at 631,300 or about 25% of regional commuters.

About six percent of regional telework 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 and VMT 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 1.3 days per week and the 28% 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.

In the 2010 State of the Commute Survey, about six 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 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 employer outreach. Seven in ten (71%) teleworkers said they learned of teleworking from their employer. While employers could have learned of telework from many sources, the Commuter Connections Employer Outreach TERM actively promotes telework to employers. So this response likely indicates additional teleworkers who learned about teleworking indirectly from Commuter Connections. Because this cannot be clearly

documented, no additional credit is attributed to the Telework TERM. But these impacts are included in the Employer Outreach calculation for employers that offer telework.

GUARANTEED RIDE HOME

Unlike the Telework TERM, the GRH TERM did not meet the adopted goals, falling about 37% short in the goals for vehicle trips reduced and VMT reduced. The shortfall primarily resulted because the number of new GRH registrants dropped substantially since the GRH goal was established in 2005. 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.

The number of commuters participating in GRH in June 2011 was well below the participant goal, and the vehicle trip reduction, VMT, and emissions impacts were correspondingly short of the goals for these measures. Participation in GRH dropped substantially since 2005, the year the goals were established. Some of the decline could be due to reduced level of Commuter Connections program advertising and outreach focused exclusively on GRH. The 2010 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.

Finally, note that about six percent 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. More than 1,100 employers were participating in Employer Outreach in 2011 and 551 of the employer had either new programs or expanded programs since 2008. Employer Outreach, both the overall program and the New/Expanded component, exceeded its vehicle trip and VMT goals by a margin substantial enough to overcome the difference between the 2006 and 2011 emission rates; Employer Outreach met all the emission goals as well as the travel goals.

We note that Employer Outreach overlaps with the Maryland and Virginia Telework TERM. A small number of 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. Two hundred, nine employers offered bicycle strategies in their worksite programs, three times the goal for this project. Employer Outreach for Bicycling also greatly exceed the other goals established for the project.

MASS MARKETING

This TERM estimates impacts for four primary groups of commuters:[3]

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 participated in the Bike-to-Work Day event
4) Commuters who participated in the 'Pool Rewards carpool incentive program
5) Commuters who participated in the Car Free Day event

Directly influenced commuters accounted for 78% of vehicle trips reduced, Bike to Work Day accounted for about 13% of the total, GRH referrals contributed 7%, and the balance of 2% was divided between indirect rideshare placements and 'Pool Rewards.

MM reached 95% of the goal for commuter placements and 89% of the vehicle trip reduction goal. But it fell considerably short of the goals for VMT and emissions reduced, meeting only about 55% of these goals. The shortfall for these measures was largely because the average travel distance for "directly influenced" changes was much shorter (9.4 miles) than had been estimated in the 2008 TERM calculation (31.1 miles). The distance was shorter because a larger share of the 2011 changes were made to bicycle and transit than to carpool or vanpool.

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 received nearly 82,000 applications between from July 2008 and June 2011. About 39% of the requests were from new applicants or re-applicants and 61% represented additional follow-up assistance to existing applicants who needed a new or additional rider to maintain or expand existing ridesharing arrangements.

The Basic COC missed its goals by substantial percentages, largely because the number of commuter applicants on whom the calculation is based dropped substantially from the 2008 calculation. The drop is likely related to several factors, including a significant purge of database applicants during the September 2008 introduction of a new online ridematch system. Efforts to update the database during the transition identified many applicants who had moved out of the area or were no longer interested in receiving new ridematch information.

A second factor, also related to the online system, is that COC impacts are calculated only on commuters who can be contacted through a follow-up survey to identify travel changes. But the online system permits commuters to access several services without making a formal application to Commuter Connections. Thus, some COC service recipients, who would have been included in the COC calculation in past TERM evaluations, would have been excluded in the 2011 analysis. Finally, in late 2008 and early 2009, gasoline prices fell significantly, eliminating one of the prime motivations to seek a rideshare arrange-

[3] Car Free Day event also is included in the Mass Marketing TERM, but data were not available for the events held during the evaluation period to permit calculation on impacts beyond the event day.

ment. Anecdotal evidence from several regional rideshare programs showed similar drops in rideshare applications during this time.

The 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 2011 evaluation, impacts for this program were reported under the COC, but its individual impacts were shown separately. The Software Upgrades also failed to meet the goals defined for the program, again due to lower than projected participation.

LIST OF APPENDICES

APPENDIX 1 – CALCULATION OF MARYLAND AND VIRGINIA TELEWORK IMPACTS

Populations of Interest

• All regional teleworkers (TW)	603,305	(from SOC survey)
• Employees at worksites assisted by TW	6,384	(from TW assistance survey)

Telework Placement Rates

• Directly assisted TW	5.8%	(% of TW assisted by TW, from SOC survey)
• Assisted worksites	0.9%	(% of new TW at sites, from TW assistance survey)

Placements

Mixed home and Non-home based

• Directly assisted TW	35,176	(regional TW x directly assisted placement rate)
• TW at TW asst. sites	60	(employees at assisted sites x asst site placement rate)
Total assisted TW	**35,237**	

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

• % Home-based TW	97%	(from SOC survey)
• % Non-home (NH)-based TW	3%	(from SOC survey)
• Home-based TW	34,180	(total assisted TW x % Home-based TW)
• NH-based TW	1,057	(total assisted TW x % NH-based TW)

Daily Vehicle Trips Reduced

VTR Factors

• Home-based factor	0.36	(from SOC survey)
• NH-based factor	0.09	(from SOC survey)
• Home-based VT reduced	12,403	(HB TW x HB VTR factor)
• NH-based VT reduced	96	(NH-based TW x NH VTR factor)

Total Daily Vehicle Trips Reduced	**12,499**

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	23.6	(SOC survey)
• Ave. days/wk at TC	1.3	(SOC survey)
• VMT reduction – home TW days	39.8	(SOC survey)
• Ave. days/wk at home	0.7	(SOC survey)
• Total weekly VMT reduction	58.5	
• Daily reduction per teleworker	11.7	

VMT reductions on TW days

• Home-based VMT reduced	229,458	(HB VT reduced x ave trip distance)
• NH-based VMT reduced	12,377	(NH-based TW x daily miles reduced)
Total Daily VMT Reduced	**241,834**	

Daily Emissions Reduced – NOx and VOC

		11 Emission		11 Emission		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	12,499	0.5182			6,477	0.0071
• Running (40 mph)			241,834	0.3444	83,288	0.0918
Total NOx reduced (tons)						**0.099**

		11 Emission		11 Emission		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	12,499	1.4592			18,239	0.0201
• Running (40mph)			241,834	0.1558	37,678	0.0415
Total VOC reduced (tons)						**0.062**

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

		11 Emission		11 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	12,499	0.000			0	0.0000
• Running (40mph)			241,834	0.0115	2,781	0.0031
					Daily	**0.003**
Total PM 2.5 reduced (tons)					**Annual**	**0.77**

Appendix 1, continued

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	12,499	0.6160			7,699	0.0085
• Running (40mph)			241,834	0.374	90,446	0.0997
					Daily	**0.108**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**27.0**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	12,499	0.000			0	0.
• Running (40mph)			241,834	461.7	111,654,939	123.1
					Daily	**123.1**
Total CO2 reduced (tons)					**Annual**	**30,770**

APPENDIX 2 – CALCULATION OF GUARANTEED RIDE HOME IMPACTS

Populations of Interest		
• New GRH registrants	15,369	(GRH database)
• Re-registrants	6,904	
• One-time exceptions	711	(GRH database)
Total GRH base	**22,964**	
Within MSA	62%	14,250
Outside MSA	38%	8,734
GRH Placement Rates (continued rates only)		
• Within MSA placement rate	39.6%	(GRH survey)
• Outside MSA placement rate	40.2%	(GRH survey)
Placements (continued only)		
• Within MSA	**5,643**	(Within MSA base x within MSA placement rate)
• Outside MSA	**3,511**	(Outside MSA base x outside MSA placement rate)
Total Placements	**9,154**	
Daily Vehicle Trips Reduced		
VTR Factors (continued only)		
• Within MSA	0.90	(GRH survey)
• Outside MSA	0.99	(GRH survey)
VT Reduced (continued only)		
• Within MSA	**5,079**	**(**Within MSA placements x within MSA VTR factor)
• Outside MSA	**3,476**	(Outside MSA placements x outside MSA VTR factor**)**
Total Daily Vehicle Trips Reduced	**8,555**	
Daily VMT Reduced		
• Ave one-way trip distance (mi)		
• Within MSA	26.1	from GRH survey)
• Outside MSA	26.1	discounted from actual 50.3 miles from GRH survey)
VMT reduced		
• Within MSA	132,555	(Within MSA VT reduced x trip distance)
• Outside MSA	90,722	(Outside MSA VT reduced x trip distance)
Total Daily VMT Reduced	**223,276**	

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 58% (GRH survey)
- SOV access distance (mi) 5.7 (GRH survey)

Outside MSA – not applicable – all access outside MSA

VT Reduction

- No SOV access 5,609 (VT x non-SOV access %)

Total VT for AQ analysis **5,609**

VMT Reduction

- No SOV access 146,395 (VT x SOV % x trip distance)
- With SOV access 60,092 (VT x SOV % x (trip distance – access distance)

Total VMT for AQ analysis **206,486**

Daily Emissions Reduced – NOx and VOC

		11 Emission		11 Emission		
NOx reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	5,609	0.5182			2,907	0.004
• Running			206,486	0.3444	71,114	0.078
Total NOx reduced (tons)						**0.082**

		11 Emission		11 Emission		
VOC reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	5,609	1.4592			8,185	0.009
• Running			206,486	0.1558	32,171	0.035
Total VOC reduced (tons)						**0.044**

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

		11 Emission		11 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	5,609	0.000			0	0.000
• Running (40mph)			206,486	0.0115	2,375	0.003
					Daily	**0.003**
Total PM 2.5 reduced (tons)					**Annual**	**0.65**

Appendix 2, continued

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,609	0.6160			3,455	0.004
• Running (40mph)			206,486	0.374	77,226	0.085
					Daily	**0.089**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**22.2**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,609	0.000			0	0.0
• Running (40mph)			206,486	461.7	95,334,675	105.1
					Daily	**105.1**
Total CO2 reduced (tons)					**Annual**	**26,272**

Correction for Overlap with MM TERM

Total GRH apps FY 09, 10, 11	22,984	
New GRH apps FY 09, 10, 11	15,369	67%
Estimated MM share of new GRH	10%	
Estimated MM share of GRH impact	6.7%	

	Net GRH	GRH base	MM
Placements	8,542	9,154	612
VMT reduced	7,983	8,555	572
VMT reduced (mi)	203,346	223,276	14,930
Daily Emissions Reduced			
NOx (T)	0.076	0.082	0.005
VOC (T)	0.042	0.044	0.004
Annual Emissions Reduced			
PM 2.5 (T)	0.61	0.65	0.04
PM 2.5 Precursor NOx (T)	20.7	22.2	1.5
CO2 (T)	24,515	26,272	1,757

APPENDIX 3 – CALCULATION OF EMPLOYER OUTREACH

Populations of Interest

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

	Employers	Employees
• 2008 unchanged programs	568	184,660
• Expanded programs in 2011	267	173,346
• New programs in 2011	284	108,516

Average Vehicle Occupancy (AVO)

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

	Starting AVO	Ending AVO
• 2008 unchanged programs	1.29	1.45
• Expanded programs – continued base	1.26	1.45
• Expanded programs – new impacts	1.45	1.49
• New programs	1.22	1.38
• Deleted programs	1.37	1.25

Daily person trips

Total employees x 2 one-way trips per day

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

	Starting	Ending
• 20008 unchanged programs	369,320	369,320
• Expanded programs – continued base	346,692	346,692
• Expanded programs – new impacts	346,692	346,692
• New programs	217,032	217,032
• Deleted programs	68,808	68,808

Daily vehicle trips

Total employees / starting AVO)

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

	Starting	Ending	Difference
• 2008 unchanged programs	287,341	254,108	33,234
• Expanded programs – maintained base	274,195	239,776	34,419
• Expanded programs – new impact	239,776	232,554	7,222
• New programs	178,363	157,486	20,877
• Deleted programs	50,163	55,126	(4,963)

Total Daily Vehicle Trips Reduced

• 2008 maintained impacts	67,653
• New/expanded impacts	28,099
Net 2011 reduction	**95,751**

Appendix 3, continued

Daily VMT reduced

Results produced by COMMUTER model, assuming travel distanced by mode from SOC survey

- 2008 unchanged programs 547,509
- Expanded programs – maintained base 574,822
- Expanded programs – new impact 117,030
- New/expanded programs 344,220
- Deleted programs (81,576)

Total Daily VMT Reduced

- 2008 continued impacts 1,122,331
- New/expanded impacts 461,250

Net 2011 reduction 1,583,581

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

- SOV access percentage 28% (from 2010 SOC survey)
- SOV access distance (mi) 2.6 (from 2010 SOC survey)

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

(VT reduced x non-SOV access %)

- 2008 maintained impacts 48,710
- New/expanded impacts 20,231

VMT Reduction without SOV access

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

- 2008 maintained impacts 1,063,608
- New/expanded impacts 436,861

Emissions Reduced – Maintained from 2008

Daily Emissions Reduced – NOx and VOC

		11 Emission		11 Emission		
NOx reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	48,710	0.5182			25,242	0.028
• Running			1,063,608	0.3444	366.307	0.404
Total NOx reduced (tons)						**0.432**

		11 Emission		11 Emission		
VOC reduced	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	48,710	1.4592			71,078	0.078
• Running			1,063,608	0.1558	165,710	0.183
Total VOC reduced (tons)						**0.261**

Appendix 3, continued

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

PM 2.5	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	48,710	0.000			0	0.0
• Running (40mph)			1,063,608	0.0115	12,231	0.013
					Daily	**0.013**
Total PM 2.5 reduced (tons)					**Annual**	**3.4**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	48,710	0.6160			30,004	0.033
• Running (40mph)			1,063,608	0.374	397,790	0.439
					Daily	**0.472**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**117.9**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	48,710	0.000			0	0
• Running (40mph)			1,063,608	461.7	491,067,975	541
					Daily	**541**
Total CO2 reduced (tons)					**Annual**	**135,327**

Emissions Reduced - New / Expanded

Daily Emissions Reduced – NOx and VOC

NOx reduced	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start + hot soak	20,231	0.5182			10,484	0.012
• Running			436,861	0.3444	150,455	0.165
Total NOx reduced (tons)						**0.177**

VOC reduced	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start + hot soak	20,231	1.4592			29,521	0.033
• Running			436,861	0.1558	68,063	0.075
Total VOC reduced (tons)						**0.108**

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

PM 2.5	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	20,231	0.000			0	0.0
• Running (40mph)			436,861	0.0115	5,024	0.006
					Daily	**0.006**
Total PM 2.5 reduced (tons)					**Annual**	**1.4**

Appendix 3, continued

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	20,231	0.6160			12,461	0.014
• Running (40mph)			436,861	0.374	163,386	0.180
					Daily	**0.194**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**48.5**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	20,231	0.000			0	0
• Running (40mph)			436,861	461.7	201,698,650	222
					Daily	**222**
Total CO2 reduced (tons)					**Annual**	**55,584**

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

	EO base	TW	Net EO	EO-bike
Vehicle Trips Reduced	90,788	437	90,350	180
VMT Reduced (miles)	1,665,157	7,348	1,657,809	1,083
Daily Emissions Reduced				
NOx (tons)	0.581	0.003	0.578	0.001
VOC (tons)	0.369	0.002	0.367	0.001
Annual Emissions Reduced				
PM 2.5 (T)	4.8	0.02	4.7	0.0
PM 2.5 Precursor NOx (T)	166.3	0.8	165.5	0.1
CO2 (T)	190,911	935	189,976	138

Appendix 3, continued

COMMUTER CONNECTIONS
EMPLOYER SERVICES PARTICIPATION LEVELS
(EFFECTIVE JULY 1, 2008)
APRIL 15, 2008

SUPPORT STRATEGIES

Likely range of trip reduction 0%

- Expresses Interest and/or distributes/displays information on Ozone Actions Days

LEVEL 1 (BRONZE)

Likely range of trip reduction 0% to 1%

- Expresses interest in telework, transit benefits, Smart Benefits, or other TDM strategy,
- Conducts Commuter Survey
- Distributes alternative commute info to employees
- Posts alternative commute information, on employee bulletin board(s), intranet sites, newsletter or e-mail

LEVEL 2 (SILVER) – Implements two or more of the following strategies

Likely range of trip reduction 0% to 3% without Telework/Compressed Work Schedules
0% to 9% with Telework/Compressed Work Schedules

- Installs a permanent display case or brochure holders and stock with alternative commute information
- Provides preferential parking for carpools and vanpools
- Implements a telework program with 1-20% of employees participating
- Facilitates car/vanpool formation meetings
- Hosts/sponsors an alternative commute day or transportation fair
- Implements flex-time or staggered work schedule
- Implements compressed work week for 1-20% of employees
- Installs bicycle racks or lockers
- Installs shower facilities for bicyclists and walkers
- Establishes an ETC who regularly provides alternative commute information to employees
- Becomes a Commuter Connections member and provides on-site ridematching
- Supplements GRH program with payment for additional trips or own program

LEVEL 3 (GOLD)

Implements at least one of the following (in addition to the two or more Level 2 strategies):

Likely range of trip reduction **2% to 5% without financial incentive/disincentive, Telework/Compressed Work Schedules**
5% to 20% with financial incentive/disincentive, Telework/Compressed Work Schedules

- Implements a telework program with more than 20% of employees participating
- Implements compressed work week for 21%+ of employees
- Implements a transit/vanpool benefit, Smart Benefits, or parking "cash out" program
- Implements a carpool/bicycle/walk benefit
- Provides free or significantly reduced fee parking for carpools and vanpools (valid only for companies where employees pay for parking)
- Implements a parking fee (valid only for companies that previously did not charge for parking)
- Provides employee shuttle service to transit stations
- Provides company vanpools for employees' commute to work
- Implements a comprehensive Bicycle/Walking program (includes installation of showers bicycle racks/lockers, and financial incentives for bicycling and/or walking)

LEVEL 4 (PLATINUM)

Likely range of trip reduction **2% to 8% without financial incentive, Telework/Compressed Work Schedules**
5% to 30% with financial incentive, Telework/Compressed Work Schedules

Implements two or more of the Level 3 TDM programs (in addition to the 2 or more Level 2 strategies) and actively promotes these programs and alternative commuting

APPENDIX 4 – CALCULATION OF MASS MARKETING IMPACTS

5 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 – Pool Rewards carpool incentive participants
- Part 4 – Bike to Work Day
- Part 5 – GRH credit

PART 1

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

Total commuters in region	2,569,890	(SOC)
• % recall commute message	39%	(SOC)
• % chg to alt mode after ads	0.9%	(SOC)
• % chg influenced by ad	84%	(SOC)
Placements – no contact with CC	**7,177**	(COC – monthly applicant analysis)

Placement Rates

• Continued placement rate	62%	(SOC)
• Temporary placement rate	18%	(SOC)
• One-time/occasional placement rate	20%	(SOC)

Placements

• Continued placements	4,450	(Placements x continued placement rate)
• Temporary placements	1,292	(Placements x temporary placement rate)
• One-time/occasional placements	1,435	(SOC)

Daily Vehicle Trips Reduced

• VTR factor	0.97	(SOC)
• Continued VT reduced	4,316	(Continued placements x continued VTR factor)
• Temporary VT reduced	940	(Temporary placements x temporary VTR factor x 75% credit for temporary use)
• One-time/occasional VT reduced	27	(Temporary placements x temporary VTR factor x 2% credit for one-time/occasional use)
Total Daily Vehicle Trips Reduced	**5,283**	

Daily VMT Reduced

• Ave one-way trip dist (mi)	9.4	(SOC)
Total Daily VMT Reduced	**49,659**	

Appendix 4, continued

PART 1 (cont.)

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

• SOV access percentage	28%	(from SOC – transit riders)
• SOV access distance (mi)	2.7	(from SOC – transit riders)

VT Reduction

• No SOV access	3,804	(VT x non-SOV access %)
Total VT for AQ analysis	**3,804**	

VMT Reduction

• No SOV access	35,754	(VT x SOV % x trip distance)
• With SOV access	9,911	(VT x SOV % x (trip dist – access dist)
Total VMT for AQ analysis	**45,665**	

PART 2

Populations of Interest – commuters influenced by ads to contact CC

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

• FY 2009	7,644	(CC database)
• FY 2010	5,987	(CC database)
• FY 2011	7,374	(CC database)
Total new applicants	**21,005**	
Total CC applicants	81,675	(includes new, re-apply, and follow-up)
New apps 09-11 as % of total	26%	(new apps FYs 09-11 / total CC apps)
% influenced by ads to contact CC	2.2%	(COC – monthly applicant analysis)
% all apps influenced by ads	0.6%	

CC Impacts – FY 09-11	**MM Share**	**Total**
• CC placements	174	30,816
CC Vehicle trips reduced	48	8,433
CC VMT reduced	1,400	247,400

CC Impacts – FY 09-11 – Discounted for AQ Analysis

	MM Share	**Total**
• CC Vehicle trips reduced	32	5,698
• CC VMT reduced	1,315	232,384

Appendix 4, continued

Part 3 – Pool Rewards Participants

Program participants	171	
Placement Rates		
• Continued placement rate	93%	(Pool Rewards follow-up survey)
• Temporary placement rate	7%	(Pool Rewards follow-up survey)
Placements		
• Continued placements	159	(Placements x continued placement rate)
• Temporary placements	12	(Placements x temporary placement rate)
Total placements	**171**	(Total new + increased riders)
Daily Vehicle Trips Reduced		
• VTR factor	0.73	(Pool Rewards logging data)
• Continued VT reduced	115	(Continued placements x continued VTR factor)
• Temporary VT reduced	2	(Temporary placements x temporary VTR factor x 25% credit for temporary use)
Total Daily Vehicle Trips Reduced	**117**	
Daily VMT Reduced		
• Ave one-way trip dist (mi)	31.1	(Pool Rewards logging data)
Total Daily VMT Reduced	**3,653**	

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

• SOV access percentage	50%	
• SOV access distance (mi)	5.5	
VT Reduction		
• No SOV access	59	(VT x non-SOV access %)
Total VT for AQ analysis	**59**	
VMT Reduction		
• No SOV access	1,827	(VT x SOV % x trip distance)
• With SOV access	1,504	(VT x SOV % x (trip dist – access dist)
Total VMT for AQ analysis	**3,330**	

Appendix 4, continued

Part 4 - Bike to Work Day Credit

Participants' riding percentage and frequency

Number of riders	11,794	(BTWD registration data, 2008, 2009, 2010)
% biking to work before event	83.5%	(BTWD survey)
% new riders	9.9%	(BTWD survey)
Number of new riders	1,168	
% who increase riding days	21.8%	
Number of increased riders	2,571	
Total placements	**3,739**	(Total new + increased riders)

Change in Bike Days

Summer Biking

% new riders in summer	9.5%	(BTWD survey)
Weekly new bike days summer	1.4	(BTWD survey)
Weekly new bike days summer	1,569	
% increased riders in summer	20.6	(BTWD survey)
Weekly inc bike days summer	1.6	(BTWD survey)
Weekly inc bike days summer	3,887	

Winter Biking

% new riders biking winter	7%	(BTWD survey)
Weekly new bike days winter	1.4	(BTWD survey)
Weekly new bike days winter	1,222	
% increased riders biking winter	13%	(BTWD survey)
Weekly inc bike days winter	1.7	(BTWD survey)
Weekly inc bike days winter	2,506	

New Bike Days

• Total new bike days summer	152,768	(wkly summer days x 28 wks – Apr-Oct)
• Total new bike days winter	82,019	(wkly winter days x 22 wks – Nov-Mar)
• Total new bike days-year	234,787	(summer bk days + winter bk days)
• New bike trips - year	469,573	(annual bike days x 2)

New Bike Trips and VT Reduction

• Ave new daily bk trips	1,878	(Annual new bike trips / 250)
• % DA/RS on non-bike days	48%	(BTWD survey)
BTWD Daily Vehicle Trips Reduced	**902**	(daily new bike trips x DA %)

Daily VMT Reduced

• Ave trip distance (mi)	9.6	(BTWD survey)
BTWD Daily VMT Reduced	**8,655**	(vehicle trips reduced x average trip distance)

Appendix 4, continued

PART 5 – GRH Credit – From GRH Analysis

Total GRH apps FY 09, 10, 11	22,984	
New GRH apps FY 09, 10, 11	15,369	62% of total applications
Estimated MM share of new GRH	10.0%	
Estimated MM share of GRH impact	6.7%	

	MM Share	GRH base
Placements	612	9,154
VT reduced	572	8,555
VMT reduced	14,930	223,276

Daily Emissions Reduced (NOx, VOC) Parts 1, 2, 3, 4, and 5 combined

NOx reduced	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start + hot soak	5,171				2,680	0.003
• Running			72,772	0.3444	25,063	0.028
Total NOx reduced (tons)						**0.031**

VOC reduced	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start + hot soak	5,171	1.4592			7,546	0.008
• Running			72,772	0.1558	11,338	0.013
Total VOC reduced (tons)						**0.021**

Annual Emissions Reduced (PM 2.5, Precursor NOx, and CO2) Parts 1, 2, 3, 4, and 5 combined

PM 2.5	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,171	0.000			0	0.000
• Running (40mph)			72,772	0.0115	837	0.001
					Daily	**0.001**
Total PM 2.5 reduced (tons)					**Annual**	**0.23**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,171	0.6160			3,185	0.004
• Running (40mph)			72,772	0.374	27,217	0.030
					Daily	**0.034**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**8.4**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,171	0.000			0	0
• Running (40mph)			72,772	461.7	33,598,943	37.0
					Daily	**37.0**
Total CO2 reduced (tons)					**Annual**	**9,259**

Mass Marketing
Total – PART 1, PART 2, PART 3, PART 4, PART 5

	Total MM	No CC Contact	CC Contact	Pool Rewards	GRH	BTWD
Placements	10,438	5,742	174	171	612	3,739
VT reduced	6,922	5,283	48	117	572	902
VMT reduced	78,297	49,659	1,400	3,653	14,930	8,655
Daily Emissions Reduced						
NOx (T)	0.031					
VOC (T)	0.021					
Annual Emissions Reduced						
PM 2.5 (T)	0.231					
PM 2.5 Precursor (T)	8.4					
CO2 (T)	9,259					

APPENDIX 5 – CALCULATION OF COMMUTER OPERATIONS CENTER IMPACTS

Populations of Interest – Commuter Connections Rideshare Applicants

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

• FY 2009	22,578	(CC database)
• FY 2010	24,572	(CC database)
• FY 201	34,525	(CC database)
Total assisted commuters	**81,675**	

Within MSA (62%)	50,639
Outside MSA (38%)	31,037

COC Placement Rates	**In MSA**	**Out MSA**	
• Continued rate	22.4%	30.4%	
• Temporary rate	12.1%	12.6%	
• Total	34.5%	43.0%	
Placements			
• Continued	11,343	9,435	(Apps x cont. rate)
• Temporary	6,127	3,911	(Apps x temporary rate)
• **Total placements 30,816**			

Daily Vehicle Trips Reduced

VTR Factors			
• Continued	0.37	0.38	
• Temporary	0.66	0.45	
• Temporary discount	10.6%	12.6%	
• Continued trips reduced	4,197	3,585	(Placements x cont. VTR factor)
• Temporary trips reduced	429	222	(Placements x temp VTR factor)
Total VT reduced 8,433			

Daily VMT Reduced

Ave one-way trip distance (mi)			
• Continued	29.4	29.4	(Actual Outside dist. 54.4 miles)
• Temporary	28.6	28.6	(Actual Outside dist. 57.9 miles)
• Continued VT reduced	123,389	105,409	(Vehicle trips x ave distance)
• Temporary VT reduced	12,260	6,342	

Total VMT Reduced 247,400

Appendix 5, 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	62%	0%	(CC placement survey)
• SOV access dist (mi) – Continued	5.5	0.0	(CC placement survey)
• Non-SOV access % - Temporary	31%	0%	(CC placement survey)
• SOV access dist (mi) – Temporary	5.3	0.0	(CC placement survey)

VT Reduction

• Cont VT with no SOV access	1,595	3,585	
• Temp VT with no SOV access	518	222	(VT x non-SOV access %)

Total no-SOV VT access 5,598

VMT Reduction

• No SOV access (cont)	46,888	105,409	(VT x SOV % dist)
• No SOV access (temp)	8,459	6,342	
• SOV access (cont)	62,190	0	(VT x SOV % x (dist – access dist))
• SOV access (temp)	3,096	0	

Total SOV VMT access 232,384

Daily Emissions Reduced – NOx and VOC

		11 Emission		**11 Emission**		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	5,698	0.5182			2,953	0.003
• Running			232,384	0.3444	80,033	0.088
Total NOx reduced (tons)						**0.091**

		11 Emission		**11 Emission**		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	5,698	1.4592			8,314	0.009
• Running			232,384	0.1558	36,205	0.040
Total VOC reduced (tons)						**0.049**

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

		11 Emission		**11 Emission**		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	5,698	0.000			0	0.00
• Running (40mph)			232,384	0.0115	2,672	0.003
					Daily	**0.003**
Total PM 2.5 reduced (tons)					**Annual**	**0.74**

Appendix 5, continued

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,698	0.6160			3,510	0.004
• Running (40mph)			232,384	0.374	86,912	0.096
					Daily	**0.100**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**24.9**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	5,698	0.000			0	0
• Running (40mph)			232,384	461.7	107,291,595	118.3
					Daily	**118.3**
Total CO2 reduced (tons)					**Annual**	**29,567**

Correction for Overlap with Integrated Rideshare and GRH TERMs

	Net COC	COC base	MM	Soft Upg	GRH
Placements	25,541	30,816	174	3,354	1,747
Vehicle Trips Reduced	6,190	8,433	48	1,717	478
VMT Reduced (miles)	180,409	247,400	1,400	51,569	14,022
Daily Emissions Reduced					
NOx Reduced (tons)	0.066				
VOC Reduced (tons)	0.036				
Annual Emissions Reduced					
PM 2.5 (T)	0.53				
PM 2.5 Precursor (T)	18.0				
CO2 (T)	21,393				

Notes:
MM influenced commuters – from MM analysis
GRH – 13.3% of new apps/reapps ask for GRH and other info = 5.7% of COC total after MM adjustment

APPENDIX 6 – CALCULATION OF SOFTWARE UPGRADE IMPACTS

Populations of Interest – Commuter Connections Rideshare Applicants

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

• FY 2009	22,578	(CC database)
• FY 2010	24,572	(CC database)
• FY 201	34,525	(CC database)
Total assisted commuters	**81,675**	

Within MSA (62%)	50,639
Outside MSA (38%)	31,037

COC Placement Rates	**In MSA**	**Out MSA**	
• Continued rate	0.8%	2.4%	
• Temporary rate	0.5%	1.4%	
• Total	1.3%	3.8%	
Placements			
• Continued	911	1,241	(Apps x cont. rate)
• Temporary	506	714	(Apps x temporary rate)
• **Total placements 3,373**			

Daily Vehicle Trips Reduced

VTR Factors			
• Continued	0.67	0.83	
• Temporary	0.94	0.57	
• Temporary discount	12.1%	6.9%	
• Continued trips reduced	611	1,030	(Placements x cont. VTR factor)
• Temporary trips reduced	58	28	(Placements x temp VTR factor)
Total VT reduced 1,727			

Daily VMT Reduced

Ave one-way trip distance (mi)			
• Continued	30.2	30.2	(Actual Outside dist. 54.2 miles)
• Temporary	26.8	26.8	(Actual Outside dist. 49.1 miles)
• Continued VT reduced	18,443	31,118	(Vehicle trips x ave distance)
• Temporary VT reduced	1,546	755	
Total VMT Reduced 51,862			

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	87%	0%	(CC placement survey)
• SOV access % - Temporary	38%	0%	(CC placement survey)
• SOV access dist (mi) – Continued	3.3	0.0	(8.1 mi access outside MSA)
• SOV access dist (mi) – Temporary	2.0	0.0	(7.7 mi access outside MSA)

VT Reduction

• Non-SOV access (cont + temp)	115	1,058	(VT x non-SOV access %)

Total VT for AQ analysis **1,174**

VMT Reduction

• SOV access (cont + temp)	18,170	31,873

Total VMT for AQ analysis **50,043**

Daily Emissions Reduced – NOx and VOC

		11 Emission		**11 Emission**		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	1,174	0.5182			608	0.001
• Running			50,043	0.3444	17,235	0.019
Total NOx reduced (tons)						**0.020**

		11 Emission		**11 Emission**		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start + hot soak	1,174	1.4592			1,713	0.002
• Running			50,043	0.1558	7,797	0.008
Total VOC reduced (tons)						**0.010**

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

		11 Emission		**11 Emission**		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	1,174	0.000			0	0.000
• Running (40mph)			50,043	0.0115	575	0.001
					Daily	**0.001**
Total PM 2.5 reduced (tons)					**Annual**	**0.16**

		11 Emission		**11 Emission**		
PM 2.5 Precursor NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• Cold start	1,174	0.6160			723	0.001
• Running (40mph)			50,043	0.374	18,716	0.020
					Daily	**0.021**
Total PM 2.5 Precursor NOx reduced (tons)					**Annual**	**5.4**

Appendix 6, continued

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• Cold start	1,174	0.000			0	0.0
• Running (40mph)			50,043	461.7	23,104,852	25.5
					Daily	**25.5**
Total CO2 reduced (tons)					**Annual**	**6,367**

Correction for Overlap with MM TERM

Total CC applications FY 09, 10, 11	81,675	
New CC applications FY 09, 10, 11	21,005	26%
Estimated MM share of new CC	2%	
Estimated MM share of IR impact	0.6%	

	Net SU	SU Base	MM Share
Placements	3,354	3,373	19
VT reduced	1,717	1,727	10
VMT reduced	51,569	51,862	293
Daily Emissions Reduced			
NOx reduced (T)	0.020		
VOC reduced (T)	0.010		
Annual Emissions Reduced			
PM 2.5 (T)	0.16		
PM 2.5 Precursor (T)	5.3		
CO2 (T)	6,331		