Item #5

NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD COMMUTER CONNECTIONS PROGRAM

TRANSPORTATION EMISSION REDUCTION MEASURE (TERM) DRAFT ANALYSIS REPORT FY 2012-2014

July 2011 - June 2014

Prepared for:

Metropolitan Washington Council of Governments
777 North Capitol Street, NE, Suite 300
Washington, DC 20002-4239

Prepared by:

LDA Consulting
Washington, DC
202-548-0205

In association with:

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

September 16, 2014

NATIONAL CAPITAL REGION TRASPORTATION PLANNING BOARD
COMMUTER CONNECTIONS PROGRAM

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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, 2011 and June 30, 2014, for the following TERMs:

- Maryland Telework – Provides information and assistance to commuters and employers to further in-home and telework center-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). The purpose of the TERMs is 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 Commuter Connections program is considered integral in regional travel demand management and is included in the region's TERMs technical documentation which was updated in July 2013. Travel parameters prior to the year 2010 were captured by the regional travel demand model. Only the effects of the incremental growth of the Commuter Connections program post 2010 will be accounted for in future analysis years.

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 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 comprehensive evaluation for these programs. It should be noted, however, that the evaluation is conservative in the sense that it includes credit only for impacts that can be reasonably documented with accepted measurement methods and tools. Note that many of the calculations used data from surveys that are subject to some statistical error, at rates common to such surveys.

A primary purpose of this evaluation was to develop 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, to 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 vehicle trips reduced by 10% and exceeded the VMT goal by about 6%. The TERMs did not reach the emission goals; the impact for NOx was about 13% under the goal and VOC impact was 26% 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 factors used in the 2014 evaluation were considerably lower, reflecting a cleaner fleet.

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 20% and 14%, respectively. The combined TERM – COC programs fell about 3% short of the NOx goal and 19% under the VOC goal. Again, the change in the emission factors affected the emission results.

Two TERMs, Employer Outreach, and Mass Marketing, easily met their individual participation, travel impact, and emission goals. Employer Outreach, both the overall program and the New/Expanded component, exceeded its vehicle trip and VMT goals by substantial margins. Employer Outreach for Bicycling also met its goals.

The Mass Marketing (MM) TERM generated vehicle trip reduction 33% above its goal and VMT reduction 23% above the goal. These results are due in part to the expansion of the MM TERM to include additional components (e.g., Car Free Day), but also due to the shift in additional credit from GRH and the Commuter Operations Center (15%) compared to the 2011 TERM share of 3% for the COC and 10% for GRH.

The impacts for the other two TERMs were below their goals. The Telework TERM's vehicle trip and VMT reductions fell 18% and 15% short of their goals. This result was due to a change in the TERM during FY 2012 to include only telework impacts generated by Commuter Connections among commuters and employers located in Maryland. Telework impacts generated by Commuter Connections outside of Maryland are still included in the 2014 TERM, but they are counted under the Commuter Operations Center component of the analysis, so are not included in the TERM total.

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 shortfalls from the GRH goals are primarily due to declining registrations, compared with 2011 and previous years.

Additional details on the calculations for each TERM are described in individual sections of this report.

Table A
Summary of Daily Impact Results for Individual TERMs (July 2011 – June 2014) and Comparison to Goals

TERM	Participation [1]	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Telework Assistance [2]					
2014 Goal	31,854	11,830	241,208	0.122	0.072
Impacts (7/11 – 6/14)	26,334	9,651	205,511	0.101	0.051
Net Credit or (Deficit)	**(5,520)**	**(2,179)**	**(35,698)**	**(0.021)**	**(0.021)**
Guaranteed Ride Home					
2014 Goal	36,992	12,593	355,136	0.177	0.097
Impacts (7/11 – 6/14)	21,156	7,711	212,834	0.087	0.033
Net Credit or (Deficit)	**(15,836)**	**(4,882)**	**(142,302)**	**(0.090)**	**(0.064)**
Employer Outreach – all employers participating [3]					
2014 Goal	581	64,644	1,065,851	0.549	0.343
Impacts (7/11 – 6/14)	1,756	78,533	1,327,044	0.534	0.305
Net Credit or (Deficit)	1,175	**13,889**	**261,193**	**(0.015)**	**(0.038)**
Employer Outreach – new / expanded employer services since July 2011 [3]					
2014 Goal	96	8,618	140,622	0.072	0.046
Impacts (7/11 – 6/14)	1,130	38,375	568,078	0.267	0.140
Net Credit or (Deficit)	**1,034**	**29,757**	**447,456**	**0.195**	**0.094**
Employer Outreach for Bicycling [3]					
2014 Goal	61	130	567	0.001	0.001
Impacts (7/11 – 6/14)	472	323	1,937	0.002	0.002
Net Credit or (Deficit)	**411**	**193**	**1,370**	**0.001**	**0.001**
Mass Marketing					
2014 Goal	11,023	7,758	141,231	0.072	0.044
Impacts (7/11 – 6/14)	22,065	10,294	173,269	0.081	0.024
Net Credit or (Deficit)	**11,042**	**2,536**	**32,038**	**0.009**	**(0.020)**
TERMS (all TERMs collectively)					
2014 Goal		96,825	1,803,426	0.920	0.556
Impacts (7/11 – 6/14)		106,189	1,918,658	0.803	0.412
Net Credit or (Deficit)		**9,364**	**115,232**	**(0.117)**	**(0.144)**

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 2011 and for Employer Outreach for Bicycling.

Table B
Summary of TERM and COC Results (July 2011 – June 2014) 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)					
2014 Goal		96,825	1,803,426	0.920	0.556
Impacts (7/11 – 6/14)		106,189	1,918,658	0.803	0.412
Net Credit or (Deficit)		**9,364**	**115,232**	**(0.117)**	**(0.144)**
Commuter Operations Center – Basic Services [2]					
2014 Goal	152,356	10,399	296,635	0.147	0.081
Impacts (7/11 – 6/14)	122,593	23,262	488,226	0.230	0.110
Net Credit or (Deficit)	(29,763)	**12,863**	**191,591**	**0.083**	**0.029**
Commuter Operations Center – Software Upgrades [2]					
2014 Goal		2,370	62,339	0.031	0.017
Impacts (7/11 – 6/14)	4,681	2,379	66,442	0.028	0.011
Net Credit or (Deficit)		**9**	**4,103**	**(0.003)**	**(0.006)**
All TERMS plus COC					
2014 Goal		109,594	2,162,400	1.098	0.654
Impacts (7/11 – 6/14)		131,830	2,473,326	1.061	0.533
Net Credit or (Deficit)		**22,236**	**310,926**	**(0.037)**	**(0.121)**

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 previously 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 9 annual tons of PM 2.5, 215 annual tons of PM 2.5 pre-cursor NOx, and 200,012 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 11.8 annual tons of PM 2.5, 280 annual tons of PM 2.5 pre-cursor NOx, and 261,496 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
Telework Assistance [1)]	1.08	25.40	23,528
Guaranteed Ride Home	0.95	21.60	21,891
Employer Outreach – all employers [2)]	6.14	147.91	135,753
Employer Outreach – new / expanded Employers [2)]	2.79	67.23	61,475
Employer Outreach for Bicycling	0.01	0.35	237
Mass Marketing	0.85	20.28	18,840
TERMS (all TERMs collectively)	9.02	215.19	200,012
Commuter Operations Center – basic services (not including Software Upgrades)	2.43	57.59	54,441
Commuter Operations Center – Software Upgrades	0.31	7.04	7,043
All TERMs plus Commuter Operations Center	11.76	279.82	261,496

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 2011 TERM analysis to results of the 2014 results. Note that, as described in the footnotes to the table, the emission factors declined between 2011 and 2014, resulting in decreased emission reductions, even though the TERMs achieved greater vehicle trip and VMT reductions in 2014.

The Employer Outreach TERM impacts declined in 2014 compared with 2011, but the coefficients used in the model applied to estimate these impacts were modified in 2014 to be consistent with the updated regional travel model approved by the TPB. The coefficients fell substantially, resulting in lower vehicle trip and VMT reductions in 2014, even though the number of participating employers rose substantially.

Table D
Summary of Results for Individual TERMs 7/11– 6/14 Compared with 7/08 – 6/11

TERM	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Telework Assistance				
July 2011 – June 2014	9,651	205,511	0.101	0.051
July 2008 – June 2011	12,499	241,834	0.099	0.062
Change [1)]	(2,848)	(36,324)	0.002	(0.011)
Guaranteed Ride Home				
July 2011 – June 2014	7,711	212,834	0.087	0.033
July 2008 – June 2011	7,983	208,346	0.076	0.042
Change [1)]	(272)	4,488	0.011	(0.009)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2011 – June 2014	78,210	1,325,107	0.533	0.304
July 2008 – June 2011	90,170	1,656,727	0.577	0.366
Change [1)]	(11,960)	(331,620)	(0.044)	(0.062)
Employer Outreach for Bicycling				
July 2011 – June 2014	323	1,937	0.001	0.001
July 2008 – June 2011	180	1,083	0.001	0.001
Change [1)]	143	854	0.000	0.000
Mass Marketing				
July 2011 – June 2014	10,294	173,269	0.081	0.024
July 2008 – June 2011	6,922	78,297	0.031	0.021
Change [1)]	3,372	94,973	0.050	0.003
All TERMs				
July 2011 – June 2014	106,189	1,918,658	0.803	0.412
July 2008 – June 2011	117,754	2,186,286	0.784	0.492
Change [1)]	(11,565)	(267,628)	0.019	(0.080)
Commuter Operations Center (Basic Services + Software Upgrades)				
July 2011 – June 2014	25,641	554,668	0.258	0.121
July 2008 – June 2011	7,907	231,978	0.086	0.046
Change [1)]	17,734	322,690	0.172	0.075

1) Change in emissions is due in part to reduction in emission factors from 2011 to 2014.

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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 congestion management process. This evaluation documents transportation and air quality impacts for the three-year evaluation period between July 1, 2011 and June 30, 2014, for the following TERMs:

- Telework Assistance – Provides information and assistance to commuters and employers to further in-home and telework center-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 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 these TERMs, but works with partner organizations, such as local jurisdiction commute programs and transportation management associations (TMAs) to implement them.

Commuter Connections also operates the Commuter Operations Center (COC), providing direct commute assistance services, such as carpool and vanpool matching, transit, telework, and Park & Ride information, and other travel information services that are most cost-effectively provided by a central agency, through telephone and internet assistance to commuters. 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 and meaningful information for 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, 2010, and 2013, 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, FY 2012 – FY 2014." This document (*TERM Evaluation Framework, 2012-2014*) 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. 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 Telework Assistance
- 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 2013 for the FY 2012-FY 2014 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 TERM's 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 2011 and June 2014 and to compare these impacts against the goals established for the TERMs. The Revised Evaluation Framework document finalized in May 2013 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 vehicle trips reduced by 10% and exceeded the VMT goal by about 6%. The TERMs did not reach the emission goals; the impact for NOx was about 13% under the goal and VOC impact was 26% 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 factors used in the 2014 evaluation were considerably lower, reflecting a cleaner fleet.

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 20% and 14%, respectively. The combined TERM – COC programs fell about 3% short of the NOx goal and 19% under the VOC goal. Again, the change in the emission factors affected the emission results.

Two TERMs, Employer Outreach, and Mass Marketing, easily met their individual participation, travel impact, and emission goals. Employer Outreach, both the overall program and the New/Expanded component, exceeded its vehicle trip and VMT goals by substantial margins. Employer Outreach for Bicycling also met its goals.

The Mass Marketing (MM) TERM generated vehicle trip reduction 33% above its goal and VMT reduction 23% above the goal. These results are due in part to the expansion of the MM TERM to include additional components (e.g., Car Free Day), but also due to the shift in additional credit from GRH and the Commuter Operations Center (15%) compared to the 2011 TERM share of 3% for the COC and 10% for GRH.

The impacts for the other two TERMs were below their goals. The Telework TERM's vehicle trip and VMT reductions fell 18% and 15% short of their goals. This result was due to a change in the TERM during FY 2012 to include only telework impacts generated by Commuter Connections among commuters and employers located in Maryland. Telework impacts generated by Commuter Connections outside of Maryland are still included in the 2014 TERM, but they are counted under the Commuter Operations Center component of the analysis, so are not included in the TERM total.

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 reason for shortfalls from the GRH goals is primarily due to declining registrations, compared with 2011 and previous years.

Additional details on the calculations for each TERM are described in individual sections of this report.

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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 2011 and for Employer Outreach for Bicycling.

Table 2
Summary of TERM and COC Results (July 2011 – June 2014) and Comparison to Goals

TERM	Participation [1]	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
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Commuter Operations Center – Software Upgrades [2]					
2014 Goal		2,370	62,339	0.031	0.017
Impacts (7/11 – 6/14)	4,681	2,379	66,442	0.028	0.011
Net Credit or (Deficit)		**9**	**4,103**	**(0.003)**	**(0.006)**
All TERMS plus COC					
2014 Goal		109,594	2,162,400	1.098	0.654
Impacts (7/11 – 6/14)		131,830	2,473,326	1.061	0.533
Net Credit or (Deficit)		**22,236**	**310,926**	**(0.037)**	**(0.121)**

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 previously part of the Integrated Rideshare TERM.

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

As shown, the TERMs collectively reduce 9 annual tons of PM 2.5, 215 annual tons of PM 2.5 pre-cursor NOx, and 200,012 annual tons of CO2 (greenhouse gas emissions). When the Commuter Operations Center is included, these emissions impacts rise to 11.8 annual tons of PM 2.5, 280 annual tons of PM 2.5 pre-cursor NOx, and 261,496 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
Telework Assistance [1)]	1.08	25.40	23,528
Guaranteed Ride Home	0.95	21.60	21,891
Employer Outreach – all employers [2)]	6.14	147.91	135,753
Employer Outreach – new / expanded Employers [2)]	2.79	67.23	61,475
Employer Outreach for Bicycling	0.01	0.35	237
Mass Marketing	0.85	20.28	18,840
TERMS (all TERMs collectively)	9.02	215.19	200,012
Commuter Operations Center – basic services (not including Software Upgrades)	2.43	57.59	54,441
Commuter Operations Center – Software Upgrades	0.31	7.04	7,043
All TERMs plus Commuter Operations Center	11.76	279.82	261,496

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 2011 TERM analysis to results of the 2014 results. Note that, as described in the footnotes to the table, the emission factors declined between 2011 and 2014, resulting in decreased emission reductions, even though the TERMs achieved greater vehicle trip and VMT reductions in 2014.

The Employer Outreach TERM impacts declined in 2014 compared with 2011, but the coefficients used in the model applied to estimate these impacts were modified in 2014 to be consistent with the updated regional travel model approved by the TPB. The coefficients fell substantially, resulting in lower vehicle trip and VMT reductions in 2014, even though the number of participating employers rose substantially.

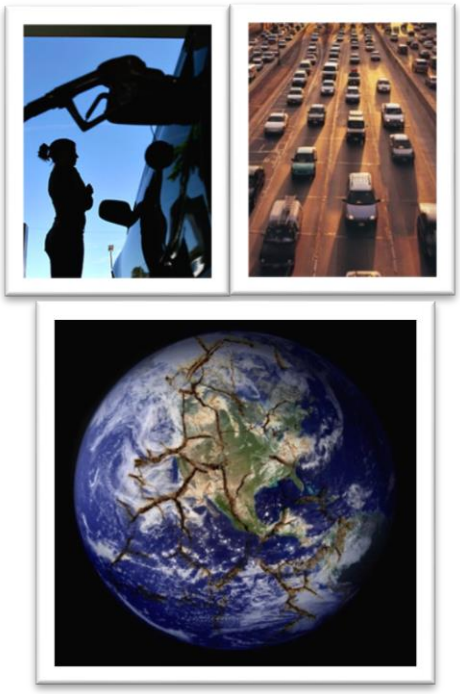
Table 4
Summary of Results for Individual TERMs 7/11– 6/14 Compared with 7/08 – 6/11

TERM	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily Tons NOx Reduced	Daily Tons VOC Reduced
Telework Assistance				
July 2011 – June 2014	9,651	205,511	0.101	0.051
July 2008 – June 2011	12,499	241,834	0.099	0.062
Change [1)]	(2,848)	(36,324)	0.002	(0.011)
Guaranteed Ride Home				
July 2011 – June 2014	7,711	212,834	0.087	0.033
July 2008 – June 2011	7,983	208,346	0.076	0.042
Change [1)]	(272)	4,488	0.011	(0.009)
Employer Outreach – All services except Employer Outreach for Bicycling				
July 2011 – June 2014	78,210	1,325,107	0.533	0.304
July 2008 – June 2011	90,170	1,656,727	0.577	0.366
Change [1)]	(11,960)	(331,620)	(0.044)	(0.062)
Employer Outreach for Bicycling				
July 2011 – June 2014	323	1,937	0.001	0.001
July 2008 – June 2011	180	1,083	0.001	0.001
Change [1)]	143	854	0.000	0.000
Mass Marketing				
July 2011 – June 2014	10,294	173,269	0.081	0.024
July 2008 – June 2011	6,922	78,297	0.031	0.021
Change [1)]	3,372	94,973	0.050	0.003
All TERMs				
July 2011 – June 2014	106,189	1,918,658	0.803	0.412
July 2008 – June 2011	117,754	2,186,286	0.784	0.492
Change [1)]	(11,565)	(267,628)	0.019	(0.080)
Commuter Operations Center (Basic Services + Software Upgrades)				
July 2011 – June 2014	25,641	554,668	0.258	0.121
July 2008 – June 2011	7,907	231,978	0.086	0.046
Change [1)]	17,734	322,690	0.172	0.075

1) Change in emissions is due in part to reduction in emission factors from 2011 to 2014.

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 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 efficient to undertake. The first TERM analysis, conducted in 1999, reinforced the 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 factors outside the 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, 2010, and 2013, following subsequent triennial TERM evaluations, to enhance the analysis results for several TERMs.

This section identifies key enhancements that were made to the methodology since the 2011 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 calculation of Commuter Connection's TERM program impacts is based on a step-by-step methodology that applies a series of "multiplier factors" to estimate program impact measures related to transportation and air quality benefits generated by the TERMs. The methodology calls for these multiplier factors, which are developed primarily from survey data, to be applied to a known number of regional commuters who might be influenced or assisted 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 commute 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 the TERM service, 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 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.

The methodology applies five primary calculation factors derived from surveys of the populations of interest:

1) Placement rate (percentage 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 carpoolers/vanpoolers and transit users who that drive alone to the location where they meet their carpool, vanpool, bus, or train)
5) Drive alone access distance (distance commuters travel to carpool/vanpool/transit meeting points)

These factors are applied within the 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, 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 daily NOx and VOC emissions reduced – Multiply adjusted vehicle trips and VMT reduced by daily emissions factors consistent with the regional planning process
7) Estimate annual PM 2.5, PM 2.5 pre-cursor NOX, and CO2 emissions reduced – Multiply adjusted vehicle trips and VMT reduced by annual emissions factors consistent with the regional planning process

These steps were established largely in the evaluation framework developed in 1997 and remained unchanged for the subsequent evaluations conducted for FY 2000–FY 2002, FY 2003–FY 2005, FY 2006–FY 2008, and FY 2009-FY 2011. They also will be applied to the FY 2012 – FY 2014 evaluation described in this report.

Key Evaluation Issues

Several other issues should be noted as background, because they are critical to understanding the high level of rigor build into the evaluation process:

- Avoid Double Counting – The evaluation separates the impacts of individual Commuter Connections programs to avoid double counting benefits. For example, carpools might be formed as a joint result of online ridematching and GRH program benefits. These impacts must either be credited to one of the two TERMs or divided between the TERMs. Program benefits are not necessarily additive.
- Separate Impacts of Program Elements – Similarly, the evaluation separates the baseline impacts of Commuter Operations Center "basic" services from the impacts of the new TERM programs. This is especially important for the Mass Marketing TERM, because its impacts can be "direct," meaning the marketing effort alone motivated use of alternative modes, or "referred," meaning the marketing effort influenced commuters to utilize another Commuter Connections program, such as ridematching. In such cases, the travel and air quality impacts will be assigned to the TERM or to the Commuter Operations Center, based on their respective influences.
- Account for Commute Mode Prior to Change – Prior mode is an important variable in this evaluation, because a shift to an alternative mode does not always mean a vehicle trip was eliminated. Vehicle trips are reduced only in three cases: 1) the commuter shifts from driving alone to an alternative mode, 2) the commuter increases the frequency of use of an alternative mode, or 3) the commuter shifts to a higher-occupancy mode (e.g., from carpool to vanpool).
- Account for Access Mode to Transit and Carpool/Vanpool – For air quality evaluation purposes, it is necessary to know the access mode of carpoolers, vanpoolers, and transit riders. Access mode refers to how carpoolers, vanpoolers, and transit riders travel from home to bus stops, train stations, Park & Ride lots, or other places where they meet rideshare partners or board a bus or train. Access mode is a minor issue in the evaluation of travel impacts, because access trips generally account for a very small portion of the total miles traveled and the alternative mode generally is used for the most congested and longest portion of the trip. However, commuters who drive alone to the meeting point still make a vehicle trip and accumulate some drive-alone VMT, which must be subtracted from the vehicle trips reduced and VMT reduced in the air quality analysis.

REVISED EVALUATION FRAMEWORK

In general, the TERM analysis approaches documented in the 2011 TERM Analysis Report were used as the basis for the TERM evaluation methods applied in the FY 2012-2014 evaluation. The 2011 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 (2012-2014). 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.

- Telework Assistance – Telework Assistance (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 only in Maryland. However, Commuter Connections continues to provide telework information to commuters who live and/or work outside Maryland. Impacts of this assistance are included in the Commuter Operations Center impacts.

- Guaranteed Ride Home (GRH) – No changes to the methodology for FY 2012-2014.

- Employer Outreach – No changes to the basic calculation methodology for FY 2012-2014, however the cost and time coefficients used in the EPA COMMUTER model were modified to be consistent with the current MWCOG regional travel model.

- Mass Marketing – Added a component to estimate impacts from Car Free Day events.

- Commuter Operations Center (COC) – Expanded the Software Upgrades impacts to include shifts to telecommuting and bicycle that were influenced by information received on these travel options. Added new component for telework assistance to commuters who live and work outside Maryland.

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 served as the basic 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.
- Triangle J Council of Governments, in the Raleigh-Durham region of North Carolina, 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 region. 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 TELEWORK ASSISTANCE (MARYLAND)

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 Telework Assistance (Telework) when its scope was reduced to focus solely on Maryland employers, but its purpose remains the same: to provide information, training, and assistance to individuals and businesses to further in-home and non-home-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 Assistance is to increase the number of telecommuters in the region, whether full-time or part-time telecommuters. For FY 2012-2014, Telework impacts were evaluated by calculating the number of telecommuters in the region who used or were influenced by Telework Assistance 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 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:

- Regional telecommuters who live and/or work in Maryland who were influenced by Telework services / assistance to begin telecommuting
- Telecommuting employees at Maryland worksites assisted by Commuter Connections

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

<u>Assisted Employer Telework Survey</u> (new telecommuters at worksites that received Telework Assistance services)

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

<u>State of the Commute Survey</u> (regional commuters)

- Number of regional telecommuters and their telecommute frequency
- Telecommuters' home and work location (43% in Maryland and 57% not in Maryland)
- Telecommute locations – the mix between home-based and non-home-based
- Average telecommute frequency, telecommuters' travel modes on non-telework days, and commute distance they traveled on non-telecommute days
- Telecommuters' travel patterns to telecommute locations outside the home
- Sources of information telecommuters had used to learn about telework

Using results from these surveys and records, the number of telecommuters 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 telecommuters were then multiplied by average VTR factors, as identified by the appropriate survey data, to obtain the number of vehicle trips reduced by their telecommuting.

For this TERM, VTR factors accounted for both the average telecommute frequency of the groups as well as their travel modes on non-telecommute days and the travel modes on telecommute days of commuters who traveled to a telecommute location other than home.

- The VTR factor for Maryland-based home-based telecommuters was 0.37 daily trips reduced per telecommuter, reflecting the part-time (1.43 days per week average) telework frequency and the elimination of vehicle trips for telecommuters who drove alone, carpooled, or vanpooled on non-telecommute days.

- The VTR factor was much lower (0.02) for non-home-based telecommuters, because the majority of these telecommuters drove alone to the telecommute 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 telecommuting was in the reduction of VMT on telecommute days.

The VMT reduced by telecommuting was calculated for Maryland-based home-based telecommuters by multiplying the number of daily vehicle trips reduced by the average commute distance (21.3 miles one-way). In the case of non-home-based telecommuters, the VMT reduced was calculated by multiplying the number of telecommuters on an average day by the 10.1 mile 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 2015 emission factors developed by MWCOG staff for the Washington metropolitan region, using the MOVES emission model. Daily emissions were calculated for the TERMs for NOx and for VOC. 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 Telework TERM impacts.

TELEWORK ASSISTANCE 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 - MD
• Number of telecommuters	676,053	31,854	26,620
• Daily vehicle trips reduced	227,695	11,830	9,651
• Daily VMT reduced	4,120,189	241,208	205,511
• Daily tons NOx reduced	2.0839 T	0.1222 T	0.1011 T
• Daily tons VOC reduced	1.1328 T	0.0723 T	0.0511 T
• Annual tons PM 2.5 reduced	21.60 T	N/A	1.08 T
• Annual tons PM 2.5 pre-cursor NOx reduced	525.78 T	N/A	25.40 T
• Annual tons CO2 reduced	473,925 T	N/A	23,528 T

Impacts vs Goals

Participation Benefit (net over or (under) goal):	Telecommuters: (5,520)
Transportation Benefit (net over or (under) goal):	Vehicle Trips: (2,179) VMT: (35,698) miles
Emission Benefit (net over or (under) goal):	NOx: (0.0211) tons per day VOC: (0.0212) tons per day

In 2011, approximately 676,050 regional workers teleworked at least occasionally, representing about 25% of the total regional workforce and 27% of all workers who are not self-employed, working only at home. This number of regional telecommuters represented a 12% increase over the 2011 count of 603,300, 49% over the 2008 number of 456,600 telecommuters and more than four times the 1996 baseline of 150,900 telecommuters.

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 fell short of the goals for the number of telecommuters expected from TERM activities. The TERM also missed the reduction goals established for vehicle trips, VMT, and emissions. But note that these goals were established at a time that the District of Columbia and Virginia also participated in the TERM. In 2013, Maryland telecommuters accounted for approximately 43% of regional telecommuters.

As shown in Table 5, the Telework TERM was responsible for about four percent of regional telecommuters and telework impacts. In the 2013 State of the Commute Survey, about nine percent of Maryland telecommuters mentioned Commuter Connections or MWCOG as a source of their telework information. These telecommuters 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. More than seven in ten (73%) telecommuters said they learned of teleworking from their employer. While employers could have learned of telework from many sources, the Commuter Connections Employer Outreach TERM also promotes telework to employers. So this response likely indicates additional telecommuters 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 2012-2014 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 2013. This survey polled 2,374 commuters who had registered for the Washington Regional GRH Program between March 16, 2010 and March 15, 2013. Both commuters who were currently registered at the time of the survey and those who had been registered at some point during the three year period but whose registrations had expired 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 lived and worked in 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 worked in the MSA but lived outside it.

This distinction was made because applicants who lived 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 37% of the total participants lived outside the MSA.

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 for both groups of respondents. The duration of alternative mode placement was 68 months, considerably 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 61.3%
- Outside MSA 61.1%

To determine the number of commuters placed in alternative modes between July 2011 and June 2014, these placement rates were multiplied by the total number of commuters who participated in GRH during that time period, 21,156, divided into the two sub-groups: 13,328 within the MSA and 7,828 outside the MSA. This calculation resulted in 8,170 placements from within the MSA and 4,783 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 0.68 vehicle trips reduced per placement
- Outside MSA 0.61 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 0.68 and 0.61 indicate that a moderate number of the changes were from one alternative mode to another and/or reflected part-time changes to alternative modes. The calculation of vehicle trips reduced produced a total of 8,474 vehicle trips reduced; 5,556 from commuters within the MSA and 2,918 from commuters outside the MSA.

Next, VMT reduction from 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 27.6 miles. The actual one-way distance for the outside MSA respondents was an average of 50.1 miles, but 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 22.5 one-way miles per trip for each outside-MSA respondent. The final VMT calculation reflected the following:

8,474 trips reduced x 27.6 miles per trip

= 233,883 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 nine 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	21,156
• New applicants during evaluation period	N/A	13,255
• Daily vehicle trips reduced	12,593	7,711
• Daily VMT reduced	355,136	212,834
• Daily tons NOx reduced	0.1766 T	0.0871 T
• Daily tons VOC reduced	0.0970 T	0.0327 T
• Annual tons PM 2.5 reduced	N/A	0.95 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	21.60 T
• Annual tons CO2 reduced	N/A	21,891 T

* Number of participants currently enrolled in GRH

Impacts vs Goals

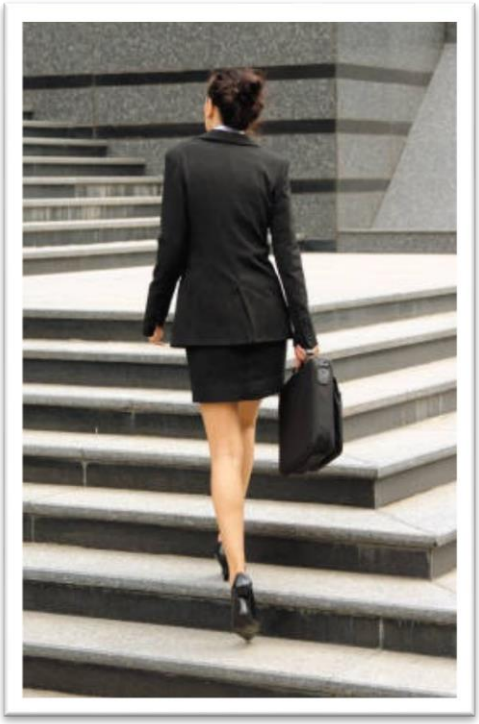
Participation Benefit (net over or (under) goal): Participants: (15,836)

Transportation Benefit (net over or (under) goal): Vehicle Trips: (4,882)
VMT: (142,302 miles)

Emission Benefit (net over or (under) goal): NOx: (0.0895 tons per day)
VOC: (0.0643 tons per day)

The number of commuters participating in GRH in June 2014 was about 57% of the participant goal. 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 2013 State of the Commute survey found that only 23% 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

Employer Outreach is aimed at increasing the number of private employers implementing worksite commuter assistance programs, but Employer Outreach is ultimately designed to encourage employees of client employers to shift from driving alone to alternative modes.

Two primary evaluation questions are thus important. First, how many employers start or expand commuter assistance programs? And second, how many employees use alternative modes in response to new employer-sponsored services at the worksite? 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.

The populations of interest for this TERM are:

- Employers that participate in Employer Outreach
- Employers that offer bicycle services (Employer Outreach for Bicycling)
- Employees at Employer Outreach worksites
- Employees at worksites that offer bicycle services

Employer Participation in Commute Programs

The employer participation component of the analysis 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 employees 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 2011-2014 evaluation, impacts were calculated for "maintained" employer programs and "new/expanded" programs.

Maintained impacts included employers that joined EO before July 1, 2011 and made no changes since that date. Expanded impacts included employers that were involved in EO before July 1, 2011 but expanded their commute assistance services after that date. New impacts included employers that joined the EO program on or after July 1, 2011. A final category was defined to calculate the impacts of employers that were included in the 2011 evaluation but dropped out of EO before June 2014. 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 2011 employer programs continued with no change
- Expanded – June 2011 employer programs expanded since June 2011
- New – Employer programs started since June 2011
- Deleted – June 2011 employer programs deleted between July 2011 and June 2014

The overall benefit of the program is the sum of continued programs plus expanded and new programs. As shown below, in June 2014, the ACT! database included 1,756 employers with programs that met the Level 3 or 4 definitions. These employers accounted for 649,448 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, 626 joined Employer Outreach prior to July 2011 and made no program changes since that time. The expanded category included 329 employers. And 801 were listed as "new" since June 2011. Finally, 150 employers that were counted in the 2011 evaluation were no longer involved in the program. The employee count associated with these employers was much smaller (42,426), however, than the number of employees at worksites with new programs (241,354). Had these employers continued in the program, the total employee count would have been 691,874, so the deleted employees represented a drop of about six percent.

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

Employer Status (June 2014)	Number of Employers Total	<100[1)]	100+	Number of Employees
- Maintained/unchanged from June 2011	626	289	337	228,720
- Expanded after June 2011	329	149	180	179,374
- New programs	801	491	310	241,354
Total	**1,756**	**929**	**827**	**649,448**
Deleted from 2011	150	83	67	42,426

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 2011 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 2013 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 telecommuters (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 2013 State of the Commute Survey. Emissions reduced were calculated by multiplying trips and VMT reduced by 2015 regional emission factors provided by MWCOG staff. 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	1,756
– Maintained from 2011	No goal	626
– Expanded after 2011	No goal	329
– New in 2014	No goal	801

- Employers by jurisdiction (continuing and new/expanded)

	Total Employers	Employees	New/Expanded Employers
– Alexandria, VA	142	24,275	125
– Arlington County, VA	271	60,629	213
– District of Columbia	550	220,633	324
– Fairfax County, VA	247	180,251	120
– Frederick County, MD	16	17,330	15
– Loudoun County, VA	14	11,557	6
– Montgomery County, MD	462	103,574	281
– Prince George's County, MD	22	22,445	17
– Prince William County, VA	25	6,556	23
– Tri-County Council, MD	7	2,198	6

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

	Total Employers	Employees	New/Expanded Employers
– Sites with 100+ employees	827	616,297	490
– Fewer than 100 employees	929	33,151	640
– "Equivalent 100+" [1)]	331		229

1) For purposes of program tracking, employers with fewer than 100 employees are grouped into "equivalent 100+" employers. The 928 employers in this category employ 33,057 employees, thus represent 330 "equivalent 100" employers (33,057 / 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	78,533
• Daily VMT reduced	1,065,851	1,327,044
• Daily tons NOx reduced	0.5490 T	0.5340
• Daily tons VOC reduced	0.3430 T	0.3047
• Annual tons PM 2.5 reduced	N/A	6.14 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	147.91 T
• Annual tons CO2 reduced	N/A	135,753 T

Participating Employers (net over or (under) goal): Employers: 1,175

Transportation Benefit (net over or (under) goal): Vehicle Trips: 13,889
VMT: 261,193 miles

Emission Benefit (net over or (under) goal): NOx: (0.0150) tons per day
VOC: (0.0383) tons per day

New / Expanded Employer Programs

	EO Goal	Estimated Impacts
• New/expanded programs	96	1,130
• Daily vehicle trips reduced	8,618	38,375
• Daily VMT reduced	140,622	568,078
• Daily tons NOx reduced	0.0724 T	0.2670 T
• Daily tons VOC reduced	0.0455 T	0.1398 T
• Annual tons PM 2.5 reduced	N/A	2.79 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	67.23 T
• Annual tons CO2 reduced	N/A	61,475 T

Participating Employers (net over or (under) goal): Employers: 1,034

Transportation Benefit (net over or (under) goal): Vehicle Trips: 29,757
VMT: 427,456 miles

Emission Benefit (net over or (under) goal): NOx: 0.1946 tons per day
VOC: 0.0943 tons per day

As shown, even with the loss of 150 employers that dropped out since 2011, 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.

Note that Employer Outreach could overlap with the Telework TERM, if Employer Outreach clients also had received Telework Assistance services; the telework portion of these employers' programs would appropriately be counted in the Telework TERM's "assisted employer" category. To assess the level of overlap, the list of the employers that received Telework Assistance was compared against the ACT! client database. Only two employers that offered telework also had received telework assistance from Commuter Connections. To avoid double counting credits, 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 impacts (vehicle trips, VMT, and emissions) for these employers' programs excluding telework were subtracted from the impact when telework services were included. The difference was considered to be the overlap and 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.

A total of 47 employers offered bicycle strategies in their worksite programs in 2014. 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 4.6 miles, calculated from the 2013 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.

Table 8
Employer Outreach – Bike Services Goals and Estimated Impacts

	EO Goal	Estimated Impacts
• Employers with bike strategies	61	472
• Daily vehicle trips reduced	130	323
• Daily VMT reduced	567	1,937
• Daily tons NOx reduced	0.0006 T	0.0013 T
• Daily tons VOC reduced	0.0005 T	0.0012 T
• Annual tons PM 2.5 reduced	N/A	0.0124 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	0.3513 T
• Annual tons CO2 reduced	NA	237 T

Participating Employers (net over or (under) goal): Bike Employers: 411

Transportation Benefit (net over or (under) goal): Vehicle Trips: 193
VMT: 1,370 miles

Emission Benefit (net over or (under) goal): NOx: 0.007 tons per day
VOC: 0.007 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, social media, 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 2014 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 six populations of interest:

1) All commuters in the Commuter Connections service area
2) Commuter Connections rideshare applicants who were influenced by the marketing campaign to request Commuter Connections services
3) GRH applicants who were influenced by the marketing campaign to request Commuter Connections services
4) Commuters who participated in the 'Pool Rewards carpool incentive program
5) Commuters who participate in the Bike-to-Work Day event
6) Commuters who participate in Car Free Day

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 co-worker to carpool. Direct influences can only be assessed through a regional survey of commuters that asks about mode change and the reasons for the changes. If a shift occurred and the shift can be attributed to a message that is part of the Mass Marketing campaign, the associated trip, VMT, and emissions reductions can be credited to the campaign.

The second is "***referred change***." These are mode shifts that occur among commuters who are influenced to contact Commuter Connections by the ads. This type of 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 inquiries and 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 pro-rated share of the impacts of these other TERM impacts then can be assigned to Mass Marketing.

Evaluation of Direct Influence

Directly influenced change is measured for this evaluation through the 2013 regional 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 and could the source of the ad be reasonably assigned to Commuter Connections?
- Changes made after hearing the ads – How many commuters who recalled Commuter Connections' ad messages shifted to alternative modes after hearing the ads and how were they traveling before 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 any commute message 41%
- Recalled Commuter Connections ad message 21%

Commuters who recalled specific commute messages were asked about actions and influences related to the ads. Among respondents who recalled Commuter Connections messages, the surveyed indicated:

- Shifted to an alternative mode after hearing CC ads 2.8%
- Said the ad influenced their decision to shift 84%
- Did not use any other commute service 100%
- **Resulting influence percentage from CC ads 0.5%**

Thus, 0.5% of regional commuters were directly influenced to make a change. This percentage was multiplied by the number of regional commuters (2,481,673) to estimate alternative mode placements.

Further analysis of survey respondents who made a change showed that 40% continued using the new mode and 60% were temporary or occasional users. Continued users reduced on average 0.70 vehicle trips per day with their changes and temporary users reduced an average of 0.62 vehicle trips per day. These factors, and the 15.8 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 volume of requests made to the Commuter Connections' website and the numbers of ridematch and GRH applications received:

- In months between July 2011 and June 2014 when MM ads were aired
- In months between July 2011 and June 2014 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 suggested that the ads prompted an additional 10% of ridematch applications, but that GRH applications declined during the ad months:

	Increase in Applications		
	CC Website Uses	RS Apps	GRH Apps
• With ads compared to no ads	23%	10%	-10%

But the use of the Commuter Connection website increased by 23% during MM advertising periods and this pattern was stable across 2011, 2012, and 2013. It is helpful to note that commuters can access numerous commute information services directly from the website, without registering or providing contact information. Because these respondents 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 are not included in the Commuter Operations Center calculation, so a MM "referred influence" calculation based solely on the number of rideshare applications or GRH applications likely undercounts the impacts of this MM component.

For these reasons, it was decided to base the MM referred influence percentage on the increase in the volume of website uses, rather than on application counts. When taken as a percentage of total website users, these increases translate to about 19% of total uses (23/123). To be conservative, a slightly lower percentage, 15%, was used o assigned impacts to Mass Marketing.

Evaluation Methodology and Data Sources – 'Pool Rewards Program

Impacts for the fourth 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 three tools: mode tracking required of all participating commuters and two post-program surveys.

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 in 2011, following the end of the first participants' enrollment period found that 93% had continued to carpool immediately after the program ended. A second follow-up survey, conducted in spring 2014 with all past 'Pool Rewards participants, explored longer-term retention in alternative modes. The 2014 survey found that 65% of participants were still using an alternative mode and 35% had returned to driving alone to work. These results were used to derive the long-term retention placement factors: 65% continued placement and 35% temporary placement.

The temporary 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 0.64 daily trips reduced. The average travel distance of 31.1 miles was estimated from commute travel distance data provided by participants. The 2014 survey was used to estimate the VTR factor and travel distance for long-term, continued placements. That survey estimated a VTR factor of 0.72 and a one-way travel distance of 31.2 miles.

Through June 2014, approximately 288 commuters had completed the program. An additional 142 commuters started the program but did not complete it. Because their decision to leave the program did not necessarily mean they had stopped carpooling or using another alternative mode, half of these commuters also were counted in the

impact calculation, leading to a total of 359 participants for the impact calculation. When this participation number was multiplied by the placement rates, the calculation resulted in 233 continued placements and 126 temporary placements. Applying the VTR factors and one way travel distance resulted in 209 daily vehicle trips reduced and 6,521 daily VMT reduced.

Evaluation Methodology and Data Sources – Bike to Work Day Event

Impacts for the fifth component of this TERM, Bike-to-Work Day (BTWD) Event, were calculated using data obtained from a survey of BTWD participants conducted following the 2013 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 increased the 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 through 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 (47%) 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 (10.4 miles). Emissions reduced were calculated as for other TERMs.

Evaluation Methodology and Data Sources – Car Free Day Event

The final Mass Marketing component was Car Free Day, an annual event to encourage commuters to leave their cars at home for one day. CFD events were held in the Washington region in November of 2011, 2012, and 2013. Commuters who participated in the events made online pledges, indicating the types of transportation they intended to use for that day and the type of transportation they typically would have used for those trips.

Data were available from participant pledges to estimate the impacts on the day of the event. The distribution of pledged modes included 39% transit, 51% bike or walk, 7% carpool/vanpool, and 3% telework. Additionally, 46% of participants said they regularly drove alone and the pledge data indicated that the average trip reduced 19.4 miles. These data were used to determine the vehicle trip and VMT reductions for the event days.

Comprehensive survey data regarding long-term continuation of CFD pledges were not available at the time of this evaluation, but the event had many similarities in participants' non-event commute travel to that of BTW Day participants, thus, data from that event were used as proxies for the CFD analysis. As noted, 46% of CF Day participants regularly drove alone, essentially the same percentage as was observed in the BTW Day event (47%). And 90% of pledges were made for transit, bike, or walk activity.

The BTW Day survey found that about 11% of participants started biking to work after the event and another 22% increased their use of bicycle for commuting. For the CF Day analysis, a conservative estimate of 5% was assumed as the share of participants who continued to use the new alternative modes following the event.

The number of vehicle trips and VMT reduced by use of new alternative modes was estimated by multiplying the number of participants by the 5% continuation rate, by a VTR factors that assumed the participant used the new alternative mode two days per week, and by the 19.4 mile average VMT reduction. Emissions reduced were calculated as for other TERMs.

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 and GRH influences, 'Pool Rewards, BTW Day, Car Free Day, and indirect GRH influence). But the analysis determined that direct ad influences accounted for 68% of vehicle trips reduced, 'Pool Rewards and the two events accounted for about 20% of the total, and the ridematch and GRH referrals contributed the remaining 12%.

Table 9
Mass Marketing Goals and Estimated Impacts

	MM Goal	Estimated Impacts
Total Mass Marketing		
• Commuter placements	11,023	22,065
• Daily vehicle trips reduced	7,758	10,294
• Daily VMT reduced	141,231	173,269
• Daily tons NOx reduced	0.0721 T	0.0808 T
• Daily tons VOC reduced	0.0439 T	0.0239 T
• Annual tons PM 2.5 reduced	N/A	0.85 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	20.28 T
• Annual tons CO2 reduced	N/A	18,840 T

Impacts vs Goals

Participation Benefit (net over or (under) goal):	Commuters: 11,042
Transportation Benefit (net over or (under) goal):	Vehicle Trips: 2,536 VMT: 32,038
Emission Benefit (net over or (under) goal):	NOx: 0.0087 tons per day VOC: (0.0200) tons per day

MM greatly exceeded its goal for commuter placements and was about 33% over the goal for vehicle trips reduced and 23% over the goal for VMT reduced. This results is due in part to the expansion of the MM TERM to include additional components (e.g., Car Free Day), but also due to the shift in additional credit from GRH and the Commuter Operations Center (15%) compared to the 2011 TERM share of 3% for the COC and 10% for GRH.

Details of the calculation for Mass Marketing are presented in Appendix 4.

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 1997, when Commuter Connections was established, these services were provided by COG's RideFinders program. Because these services 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. But only benefits above the 1997 baseline are included as a TERM.

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 and information primarily through the Commuter Connections website, but also can call a toll-free telephone number or contact a local partner assistance program for personal assistance from a commuter services representative.

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.

Base COC Impacts

The impacts of the COC were primarily measured using data from a Commuter Connections placement survey conducted in November 2011. 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 lived and worked 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 worked within the MSA but lived 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 44% 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	32.8%	6.0%
• Outside MSA	38.6%	4.0%

To determine the number of commuters placed in alternative modes between July 2011 and June 2014, these placement rates were multiplied by the number of commuters (87,247) who received assistance from Commuter Connections during that time period. About 40% of the requests were from new applicants or re-applicants. The COC also provided follow-up assistance to about 52,200 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: 48,858 within the MSA and 38,389 outside the MSA. When these applicant counts were multiplied by the placement rates, the calculation resulted in a total of 35,310 placements, with 18,956 placements from within the MSA and 16,354 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	0.51	0.53
• Outside MSA	0.58	0.53

The vehicle trip reductions for temporary placements also were discounted to reflect their short duration of about nine weeks (17% of a year). The calculation of vehicle trips reduced produced a total of 17,172 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 27.5 miles for continued placements and 23.7 miles for temporary placements. The actual average one-way distances for the outside MSA respondents were 50.6 miles for continued placements and 43.2 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 23 one-way miles per trip for each outside-MSA respondent. The VMT calculation resulted in a total of 470,691 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."

Telework Assistance Outside of Maryland

As noted in Section 4 (Telework Assistance – Maryland), commuters who receive telework assistance from Commuter Connections but who live and work outside Maryland are not counted in the Telework TERM. Instead, their impacts are counted in the COC. The calculation for these impacts follows the method described in Section 4.

Using results from the State of Commute survey, the number of non-Maryland telecommuters who had direct contact with the Telework TERM during the evaluation period were estimated and divided into "home-based" and "non-home-based" groups. These numbers of telecommuters were then multiplied by average VTR factors and one-way travel distances, as identified by the appropriate survey data, to obtain the number of vehicle trips and VMT reduced by their telecommuting.

- VTR factor for non-Maryland-based home-based telecommuters was 0.35 daily trips reduced per telecommuter and the average one-way travel distance was 15.3 miles.
- The VTR factor for non-home-based telecommuters was 0.02 and the net VMT reduced per telework day was 10.1 miles.

These calculations estimated 35,346 telecommuters, 12,255 daily vehicle trips reduced, and 187,465 daily VMT reduced by Commuter Connections-assisted telecommuting. These impacts were added to the COC base impacts.

Software Upgrade

Included within the Commuter Operations Center program is the Integrated Rideshare TERM-Software Upgrades Project. When it began, the Integrated Rideshare TERM provided improvements to the quality and delivery of alternative mode information. In particular, the TERM added transit, park and ride, telecenter, and bicycling information to carpool/vanpool ridematch lists to inform commuters of the range of travel options that were available. Since 2008, when Commuter Connections introduced its updated web-based TDM system, these additional services have been available on a self-service basis through the online information system. But these services represent upgrades to the original ridematching services, so their impacts are captured under the Commuter Operations Center, but are reported separately in the regional TERM tracking sheet.[2]

By providing transit and telework information to all commuters who received ridematches, 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. 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 and 2014 evaluations, but Software Upgrade impacts are calculated separately.

Impacts of the Software Upgrades was assessed using data from the November 2011 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 information about transit options, park & ride (P&R) locations, bicycle routes, and / or telework when they received assistance from Commuter Connections. Respondents who recalled any or all of these services were asked follow-up questions to determine if they used the information to make any travel changes. Mode changes that were influenced by use of any of these information services were captured in this COC component.

The surveys showed that 5.4% of applicants who lived within the MSA and 5.7% of applicants who lived outside the MSA used the transit, P&R, bicycle, and/or telework 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:

[2] The Integrated Rideshare TERM originally had two components; Ridematching Software Upgrades, and Inf-Express Kiosks. The InfoExpress Kiosk project was discontinued during the 2005-2008 evaluation period.

	Continued	Temporary
Placement Rates		
• Within MSA	4.7%	0.7%
• Outside MSA	5.2%	0.5%
VTR factors		
• Within MSA	0.50	0.54
• Outside MSA	0.63	0.50

To estimate vehicle trips reduced, placement rates were multiplied by the 87,247 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 (28.0 miles for continued placements and 24.1 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	87,247
• Daily vehicle trips reduced	10,399	23,262
• Daily VMT reduced	296,635	488,226
• Daily tons NOx reduced	0.1474 T	0.2296 T
• Daily tons VOC reduced	0.0808 T	0.0822 T
• Annual tons PM 2.5 reduced	N/A	2.43 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	57.88 T
• Annual tons CO2 reduced	N/A	54,441 T
Software Upgrades (additional to Basic COC)		
• Daily vehicle trips reduced	2,370	2,379
• Daily VMT reduced	62,339	66,442
• Daily tons NOx reduced	0.0311 T	0.0238 T
• Daily tons VOC reduced	0.0173 T	0.0112 T
• Annual tons PM 2.5 reduced	N/A	0.31 T
• Annual tons PM 2.5 pre-cursor NOx reduced	N/A	7.04 T
• Annual tons CO2 reduced	N/A	7,043 T

Impacts vs Goals

Basic COC

Transportation Benefit (net over or (under) goal):	Vehicle Trips: 12,863 VMT: 191,591 miles
Emission Benefit (net over or (under) goal):	NOx: 00822 tons per day VOC: 0287 tons per day

Software Upgrades

Transportation Benefit (net over or (under) goal):	Vehicle Trips: 9 VMT: 4,103 miles
Emission Benefit (net over or (under) goal):	NOx: (0.0028) tons per day VOC: (0.0061) tons per day

As shown, the COC greatly exceeded its goals, largely due to the shift of non-Maryland telework credit from the Telework Assistance TERM to the COC. The telework impacts accounted for 53% of the total COC vehicle trips reduced and 38% of the COC's VMT reduction. The Software Upgrade met the goals for vehicle trips and VMT reduced, although it is likely that this calculation underrepresents the true impact of both the Software Upgrades and COC base program.

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 online information 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 2014 analysis. The extent of the impact undercounting cannot be estimated at present.

It is also worth noting that in recent years, several external factors have occurred that could have influenced commuters' interest in alternative mode use. One such factor is gasoline prices, which fell significantly in 2010 and which have remained relatively stable, eliminating one of the prime motivations to seek a rideshare arrangement. A second factor could be the large reduction by Federal agencies in the amount of transit and vanpool financial incentives that are available to employees. These subsidies had been set at $230 per month during 2011 and 2012, but were cut in half in 2012; this likely reduced the attractiveness of transit and vanpooling for many Federal employees. It also is possible that some private employers that offered subsidies reduced these benefits to be consistent with the change in the benefit provisions.

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 Overlap between the COC and TERMs
(excluding telework credit for non-Maryland telecommuters)

`	Net Base COC	Base COC	Mass Marketing	Software Upgrade	GRH
Evaluation Measure					
VT reduced	**11,007**	17,172	498	2,379	3,288
VMT reduced	**300,761**	470,691	13,650	66,442	3,288

Notes:

- Mass Marketing – new applicants influenced by ads to contact CC, see Section 6
- Software upgrades – see description in this section
- GRH – 59% of new/reapply applicants who shifted to alternative modes registered for GRH = 23% of placement credit was assigned to GRH (59% x 39% new/reapply share of total applicants)

Table 12 shows the addition of the net Base COC and telework credit for non-Maryland telecommuters who were assisted by Commuter Connections.

Table 12
Total Commuter Operations Center Credit
(Adjusted Base COC + Non-Maryland Telework)

`	Total COC	Net Base COC	Non-MD Telework
Evaluation Measure			
VT reduced	23,262	11,007	12,255
VMT reduced	488,226	300,761	187,465

SECTION 9 SUMMARY OF TERM IMPACTS

The preceding sections of this report documented estimated impacts for four individual TERMs and for the Commuter Operations Center. As noted earlier in the report, the four TERMs combined exceeded the collective goals for vehicle trips reduced by 10% and exceeded the VMT goal by about 6%. The TERMs did not reach the emission goals; the impact for NOx was about 13% under the goal and VOC impact was 26% under the goal, but this was due largely to a change in the emission factors. The goals were set in 2006, using 2006 emission factors, but the factors used in the 2014 evaluation are considerably lower, reflecting a much cleaner vehicle fleet.

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 20% and 14%, respectively. The combined TERM – COC programs fell about 3% short of the NOx goal and 19% under the VOC goal. 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.

TELEWORK ASSISTANCE

The incidence of telework continues to grow in the Washington region. In 1996, about 150,000 regional workers were telecommuting. The 2013 State of Commute Survey estimated the number of telecommuters had grown to more than 675,000, or about 27% of regional commuters. 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. 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.

Overall, about four 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. In the 2013 State of the Commute Survey, about nine percent of Maryland telecommuters mentioned Commuter Connections or MWCOG as a source of their telework information. These telecommuters were credited to the Telework TERM contribution.

The Telework TERM did not meet the goals set for the TERM, even though 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 1.4 days per week and the 40% non-drive alone mode share of telecommuters on non-telework days. These two factors have a substantial impact on the total trip reduction generated by teleworking. Note, however that since 2009, the Telework TERM includes only outreach and assistance efforts to employers in Maryland and commuters who live or work in Maryland. This component of telework comprises about 43% of regional telecommuting. Commuter Connections continues to provide telework information and assistance to commuters in other parts of the Washington metropolitan region, but the impacts of these efforts are now counted under the Commuter Operations Center.

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. More than seven in ten (73%) telecommuters said they learned of teleworking from their employer. While employers could have learned of telework from many sources, the Commuter Connections Employer Outreach TERM also promotes telework to employers. So this response likely indicates additional telecommuters 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

The GRH TERM also did not meet the adopted goals, falling about 40% short in the goals for vehicle trips reduced and VMT reduced. The shortfall primarily resulted because the number of new GRH registrants has dropped substantially since 2008. 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 2014 was about 57% of the participant goal. 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 2013 State of the Commute survey found that only 23% 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, nine percent of GRH impacts were assigned to the Mass Marketing TERM to recognize that some GRH applicants were influenced to 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. Nearly 1,200 employers were participating in Employer Outreach in June 2014 and more than half of these employers had either new programs or expanded programs since 2011. Employer Outreach, both the overall program and the New/Expanded component, exceeded its vehicle trip and VMT goals by a substantial margin. Employer Outreach did not meet the emission goals, but this was due to the change in emission factors described earlier in the report.

Despite these notable increases in employer participation, the Employer Outreach TERM vehicle trip and VMT impacts declined about 13% in 2014 when compared with 2011. This is entirely due to a change in the calculation that led to a more conservative estimate of impacts. In the 2014 evaluation, the coefficients used in the EPA COMMUTER Model to estimate impact of this TERM were updated to match those used in the new MWCOG regional travel model approved by the TPB. The new coefficients for cost were considerably smaller than those from the previous model, so the COMMUTER Model calculated significantly lower estimates of vehicle trip and VMT reductions in 2014, even though the number of participating employers rose substantially and the mix and levels of commute strategies implemented by employers remained very robust.

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. A total of 472 employers offered bicycle strategies in their worksite programs, about five 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 six primary groups of commuters:

1) All commuters in the Commuter Connections service area
2) Commuter Connections rideshare applicants who were influenced by the marketing campaign to request Commuter Connections services
3) GRH applicants who were influenced by the marketing campaign to request Commuter Connections services
4) Commuters who participated in the 'Pool Rewards carpool incentive program
5) Commuters who participate in the Bike-to-Work Day event
6) Commuters who participate in Car Free Day

The Mass Marketing (MM) TERM generated vehicle trip reduction 33% above its goal and VMT reduction 23% above the goal. This results is due in part to the expansion of the MM TERM to include additional components (e.g., Car Free Day), but also due to the shift in additional credit from GRH and the Commuter Operations Center (15%) compared to the 2011 TERM share of 3% for the COC and 10% for GRH.

Goals were not established for any of the individual elements that comprised the Mass Marketing TERM (direct influence, indirect ridematch and GRH influences, 'Pool Rewards, BTW Day, Car Free Day, and indirect GRH influence). But the analysis determined that direct ad influences accounted for 68% of Mass Marketing vehicle trips reduced, 'Pool Rewards and the Bike-to-Work and Car Free Day events accounted for about 20% of the total, and the ridematch and GRH referrals contributed the remaining 12%.

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 TERMs, including GRH, Integrated Rideshare, and Employer Outreach. The COC received more than 87,000 applications between from July 2011 and June 2014. About 40% of the requests were from new applicants or re-applicants and 60% represented additional follow-up assistance to existing applicants who needed a new or additional rider to maintain or expand existing ridesharing arrangements.

The COC greatly exceeded both its travel and emissions goals, largely due to the shift of non-Maryland telework credit from the Telework Assistance TERM to the COC. Telework accounted for 53% of the total COC vehicle trips reduced and 38% of the VMT reduction. But the number of commuter applicants on whom the basic COC calculation is based has declined in recent years, particularly when compared with applicant counts between 2005 and 2008. 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 or were no longer interested in receiving ridematch information.

Second, the basic 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 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 2014 analysis. The extent of the impact undercounting cannot be estimated at present.

Finally, in recent years, several external factors could have influenced commuters' interest in alternative mode use. One such factor is gasoline prices, which fell significantly in 2010 and which have remained relatively stable, eliminating a prime motivations to seek a rideshare arrangement. A second factor could be the large reduction by Federal agencies in the amount of transit and vanpool financial incentives that are available to employees. These subsidies had been set at $230 per month during 2011 and 2012, but were cut in half in 2012; this likely reduced the attractiveness of transit and vanpooling for many Federal employees. It also is possible that some private employers that offered subsidies reduced these benefits to be consistent with the change in the benefit provisions.

LIST OF APPENDICES

APPENDIX 1 – CALCULATION OF TELEWORK ASSISTANCE IMPACTS

Populations of Interest

All regional telecommuters	676,053	(from SOC survey)
Teleworkers with MD home or work	287,630	43% (from SOC survey)
Teleworkers not in MD	388,423	57% (from SOC survey)
Employees at TW assisted worksites	26,620	(from TW assistance survey)

Commuter Connections TW Placement Rates

Directly assisted TW

• Within Maryland	9.1%	(% of TC assisted by CC, from SOC survey)
• Not in Maryland	9.1%	(% of TC assisted by CC, from SOC survey)

TW at assisted worksites (MD only

• Within Maryland	0.6%	(% of new TC at sites, from TW assistance survey)
• Not in Maryland	0.0%	Program not in effect outside of Maryland

TW Placements (Mixed home and Non-home based)

Maryland (credited to Telework TERM)

• Directly assisted telecommuters	26,174	(regional TC x directly assisted placement rate)
• Telecommuters at TW assisted sites	160	(employees at assisted sites x assisted site placement rate)
Total assisted telecommuters - MD	**26,334**	

Not Maryland (to be credited to COC)

• Directly assisted telecommuters	35,346	(regional TC x directly assisted placement rate)
• Telecommuters at TW assisted sites	0	(employees at assisted sites x assisted site placement rate)
Total assisted telecommuters – Not MD	**35,346**	

Placements by Location (home-based and non-home-based)

• % Home-based telecommuters	99%	(from SOC survey)
• % Non-home (NH)-based telecommuters	1%	(from SOC survey)

Maryland (credited to Telework TERM)

• Home-based telecommuters	26,071	(total assisted TW x % Home-based TW)
• NH-based telecommuters	263	(total assisted TW x % NH-based TW)

Not Maryland (credited to COC)

• Home-based telecommuters	34,993	(total assisted TW x % Home-based TW)
• NH-based telecommuters	353	(total assisted TW x % NH-based TW)

Appendix 1, continued

Daily Vehicle Trips Reduced

VTR Factors

• Home-based factor - MD	0.37	(from SOC survey)
• Home-based factor – Not MD	0.35	(from SOC survey)
• NH-based factor – MD and Not-MD	0.02	(from SOC survey)

Maryland (credited to Telework TERM)

• Home-based VT reduced	9,646	(HB TW x HB VTR factor)
• NH-based VT reduced	5	(NH-based TW x NH VTR factor)
Daily Vehicle Trips Reduced - MD	**9,651**	

Not Maryland (credited to COC)

• Home-based VT reduced	12,248	(HB TW x HB VTR factor)
• NH-based VT reduced	7	(NH-based TW x NH VTR factor)
Daily Vehicle Trips Reduced – Not MD	**12,255**	

Daily VMT Reduced

Ave one-way trip distance (mi) to main workplace

• Home-based – MD	21.3	(SOC survey)
• Home-based – Not MD	15.3	(SOC survey)

Ave one-way trip distance (mi) for non-home based TW (MD and Not-MD)

• Non-home based – to main workplace	20.3	(SOC survey)
• Non-home based – to TW location	10.2	(SOC survey)
• Non-home based – net VMT reduced	10.1	(SOC survey)

VMT reductions on TW days

Maryland (credited to Telework TERM)

• Home-based VMT reduced	205,460	(HB VT reduced x average OW miles to main workplace)
• NH-based VMT reduced	51	(NHB VT reduced x net OW miles reduced per trip)
Daily VMT Reduced - MD	**205,511**	

Not Maryland (credited to COC)

• Home-based VMT reduced	187,394	(HB VT reduced x average OW miles to main workplace)
• NH-based VMT reduced	71	(NHB VT reduced x net OW miles reduced per trip)
Daily VMT Reduced – Not MD	**187,465**	

Appendix 1, continued

Maryland (credited to Telework TERM)

Daily Emissions Reduced – NOx and VOC

NOx	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	9,651	1.5408			14,870	0.0164
• From Running			205,511	0.3737	76,799	0.0847
Total NOx reduced (tons)					**Daily**	**0.1011**

VOC	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	9,651	2.8573			27,576	0.0304
• From Running			205,511	0.0915	18,804	0.0207
Total VOC reduced (tons)					**Daily**	**0.0511**

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	9,651	0.0367			354	0.0004
• From Running			205,511	0.0170	3,494	0.0039
Total PM 2.5 reduced (tons)					**Daily**	**0.0043**
					Annual	**1.075**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	9,651	1.7510			16,899	0.0186
• From Running			205,511	0.3663	75,278	0.0830
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.1016**
					Annual	**25.400**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	9,651	239.26			2,309,098	2.55
• From Running			205,511	404.17	83,061,179	91.56
Total CO2 reduced (tons)					**Daily**	**94.11**
					Annual	**23,527.5**

Appendix 1, continued

Not Maryland (credited to COC)

Daily Emissions Reduced – NOx and VOC

NOx	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	12,255	1.5408			18,883	0.0208
• From Running			187,465	0.3737	70,056	0.0772
Total NOx reduced (tons)					**Daily**	**0.0980**

VOC	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	12,255	2.8573			35,016	0.0386
• From Running			187,465	0.0915	17,153	0.0189
Total VOC reduced (tons)					**Daily**	**0.0575**

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	12,255	0.0367			450	0.0005
• From Running			187,465	0.0170	3,187	0.0035
Total PM 2.5 reduced (tons)					**Daily**	**0.0040**
					Annual	**1.000**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	12,255	1.7510			21,459	0.0237
• From Running			187,465	0.3663	68,668	0.0757
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.0994**
					Annual	**24.850**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	12,255	239.26			2,932,131	3.23
• From Running			187,465	404.17	75,767,608	83.52
Total CO2 reduced (tons)					**Daily**	**86.75**
					Annual	**21,687.5**

APPENDIX 2 – CALCULATION OF GUARANTEED RIDE HOME IMPACTS

Populations of Interest		
• New GRH registrants (FY12-FY14)	13,255	(GRH database)
• Re-registrants from FY2012	7,610	
• One-time exceptions	291	(GRH database)
Total GRH base	**21,156**	
Within MSA	63%	12,281
Outside MSA	37%	7,212
GRH Placement Rates (continued rate only)		
• Within MSA placement rate	61.3%	(GRH survey)
• Outside MSA placement rate	61.1%	(GRH survey)
Placements (continued only)		
• Within MSA	**8,170**	(Within MSA base x within MSA placement rate)
• Outside MSA	**4,783**	(Outside MSA base x outside MSA placement rate)
Total Placements	**12,953**	
Daily Vehicle Trips Reduced		
VTR Factors (continued only)		
• Within MSA	0.68	(GRH survey)
• Outside MSA	0.61	(GRH survey)
VT Reduced (continued only)		
• Within MSA	**5,556**	**(**Within MSA placements x within MSA VTR factor)
• Outside MSA	**2,918**	(Outside MSA placements x outside MSA VTR factor**)**
Total Daily Vehicle Trips Reduced	**8,474**	
Daily VMT Reduced		
• Ave one-way trip distance (mi)		
• Within MSA	27.6	(from GRH survey)
• Outside MSA	27.6	(discounted from actual 50.1 miles from GRH survey)
VMT reduced		
• Within MSA	153,346	(Within MSA VT reduced x trip distance)
• Outside MSA	80,537	(Outside MSA VT reduced x trip distance)
Total Daily VMT Reduced	**233,883**	

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 70% (GRH survey)
- SOV access distance (mi) 5.3 (GRH survey)

Outside MSA – not applicable – all access outside MSA

Adjusted VT Reduction – net of VMT access

- Within MSA 1,667 (Within MSA VT x (1 - SOV access %))
- Outside MSA 2,918 (Outside MSA VT x (1 - SOV access %))

Total VT for AQ analysis **4,585**

Adjusted VMT Reduction – net of VMT access

- Total VMT reduced 233,883
- Access VMT (deduct) 20,612 (SOV Access VT x SOV access distance)

Total VMT for AQ analysis **213,271**

Daily Emissions Reduced – NOx and VOC

NOx	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	4,585	1.5408			7,065	0.0078
• From Running			213,271	0.3737	79,699	0.0879
Total NOx reduced (tons)					**Daily**	**0.0957**

VOC	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	4,585	2.8573			13,101	0.0144
• From Running			213,271	0.0915	19,514	0.0215
Total VOC reduced (tons)					**Daily**	**0.0359**

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	4,585	0.0367			168	0.0002
• From Running			213,271	0.0170	3,626	0.0040
Total PM 2.5 reduced (tons)					**Daily**	**0.0042**
					Annual	**1.0455**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	4,585	1.7510			8,028	0.0088
• From Running			213,271	0.3663	78,121	0.0862
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.0950**
					Annual	**23.7409**

Appendix 2, continued

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

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	4,585	239.26			1,097,007	1.2092
• From Running			196,483	404.17	86,197,740	95.0167
Total CO2 reduced (tons)					**Daily**	**96.2259**
					Annual	**24,056.5**

Correction for Overlap with MM TERM

Total GRH apps FY 12, 13, 14	21,156	
New GRH apps FY 12, 13, 14	13,255	63%
Estimated MM share of new GRH	15%	
Estimated MM share of GRH impact	9%	

Net GRH = GRH Base – Mass Marketing credit

	Net GRH	GRH Base	Mass Mkt
Placements	11,787	12,953	1,166
VMT reduced	7,711	8,474	763
VMT reduced (mi)	212,834	233,883	21,049
Daily Emissions Reduced			
NOx (T)	0.0871	0.0957	0.0086
VOC (T)	0.0327	0.0359	0.0032
Annual Emissions Reduced			
PM 2.5 (T)	0.9514	1.0455	0.0941
PM 2.5 Precursor NOx (T)	21.6042	23.741	2.1367
CO2 (T)	21,891.4	24,056.5	2,165.1

APPENDIX 3 – CALCULATION OF EMPLOYER OUTREACH

Populations of Interest

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

	Employers	Employees
• 2011 unchanged programs	626	228,720
• Expanded programs in 2014	329	179,374
• New programs in 2014	801	241,354
• Deleted programs since 2011	150	42,426

Average Vehicle Occupancy (AVO)

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

	Starting AVO	Ending AVO
• 2011 unchanged programs	1.26	1.36
• Expanded programs – continued base	1.23	1.31
• Expanded programs – new impacts	1.31	1.33
• New programs	1.29	1.42
• Deleted programs	1.29	1.21

Daily person trips

Total employees x 2 one-way trips per day
Starting (pre-program) and ending (with-program)

	Starting	Ending
• 2011 unchanged programs	457,440	457,440
• Expanded programs – continued base	358,748	358,748
• Expanded programs – new impacts	358,748	358,748
• New programs	482,708	482,708
• Deleted programs	84,852	84,852

Daily vehicle trips

Total employees / starting AVO)
Starting (pre-program) and ending (with-program)

	Starting	Ending	Difference
• 2011 unchanged programs	363,048	336,353	26,694
• Expanded programs – maintained base	291,665	273,853	17,812
• Expanded programs – new impact	273,853	269,735	4,118
• New programs	374,192	339,935	34,257
• Deleted programs	65,777	70,126	(4,349)

Total Daily Vehicle Trips Reduced

• 2011 maintained impacts	44,507
• New/expanded impacts	38,375
Net 2014 reduction	**82,882**

Appendix 3, continued

Daily VMT reduced

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

- 2011 unchanged programs 426,893
- Expanded programs – maintained base 258,725
- Expanded programs – new impact 25,143
- New programs 542,935
- Deleted programs (73,348)

Total Daily VMT Reduced

- 2011 continued impacts 685,618
- New/expanded impacts 568,078

Net 2011 reduction 1,253,696

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

- SOV access percentage 29% (from 2013 SOC survey)
- SOV access distance (mi) 2.9 (from 2013 SOC survey)

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

(VT reduced x non-SOV access %)

- 2011 maintained impacts 31,600
- New/expanded impacts 27,246

VMT Reduction without SOV access

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

- 2011 maintained impacts 648,188
- New/expanded impacts 535,804

Emissions Reduced – Maintained from 2011

Daily Emissions Reduced – NOx and VOC

NOx	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	31,600	1.5408			48,689	0.0537
• From Running			648,188	0.3737	242,228	0.2670
Total NOx reduced (tons)					**Daily**	**0.3207**

VOC	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	31,600	2.8573			90,291	0.0995
• From Running			648,188	0.0915	59,309	0.0654
Total VOC reduced (tons)					**Daily**	**0.1649**

Appendix 3, continued

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	31,600	0.0367			1,160	0.0013
• From Running			648,188	0.0170	11,019	0.0121
Total PM 2.5 reduced (tons)					**Daily**	**0.0134**
					Annual	**3.356**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	31,600	1.7510			55,332	0.0610
• From Running			648,188	0.3663	237,431	0.2617
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.3227**
					Annual	**80.679**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	31,600	239.26			7,560,616	8.3342
• From Running			648,188	404.17	261,978,144	288.7814
Total CO2 reduced (tons)					**Daily**	**297.116**
					Annual	**74,278.9**

Emissions Reduced - New / Expanded

Daily Emissions Reduced – NOx and VOC

NOx	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	27,246	1.5408			41,981	0.0463
• From Running			535,804	0.3737	200,230	0.2207
Total NOx reduced (tons)					**Daily**	**0.2670**

VOC	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	27,246	2.8573			77,850	0.0858
• From Running			535,804	0.0915	49,026	0.0540
Total VOC reduced (tons)					**Daily**	**0.1398**

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	27,246	0.0367			1,000	0.0011
• From Running			535,804	0.0170	9,109	0.0100
Total PM 2.5 reduced (tons)					**Daily**	**0.0111**
					Annual	**2.786**

Appendix 3, continued

Emissions Reduced - New / Expanded (cont)

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

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	27,246	1.7510			47,708	0.0526
• From Running			535,804	0.3663	196,265	0.2163
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.2689**
					Annual	**67.234**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	27,246	239.26			6,518,878	7,1858
• From Running			535,804	404.17	216,555,903	238,7120
Total CO2 reduced (tons)					**Daily**	**245.8978**
					Annual	**61,474.5**

Distribution of Employer Outreach Impacts to EO Base and EO for Bicycling

	Total EO	EO w/o bike	EO-bike
Vehicle Trips Reduced	78,533	78,210	323
VMT Reduced (miles)	1,327,044	1,325,107	1,937
Daily Emissions Reduced			
NOx (tons)	0.5340	0.5327	0.0013
VOC (tons)	0.3047	0.3035	0.0012
Annual Emissions Reduced			
PM 2.5 (T)	6.1419	6.1295	0.0124
PM 2.5 Precursor NOx (T)	147.9125	147.5612	0.3513
CO2 (T)	135,753.3	135,516.3	237.0

Appendix 3, continued

COMMUTER CONNECTIONS
EMPLOYER SERVICES PARTICIPATION LEVELS
(EFFECTIVE July 1, 2013)

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
- Installs electronic screens or desktop feed of real-time travel information for transit and/or other alternative mode availability.
- Participates in the Capital Bikeshare Program as a Corporate Partner
- 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, Federal Bicycle Benefit, 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, or a Capital Bikeshare Station)

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 (direct influence)
- Part 2 – Pool Rewards carpool incentive participants
- Part 3 – Car Free Day event
- Part 4 – Bike to Work Day event
- Part 5 – Commuters influenced by ads to contact CC (referred influence)
- Part 6 – GRH credit

PART 1 – Direct Ad Influence

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

Total commuters in region	2,481,673	(SOC)
• % recall any commute message	41%	(SOC)
• % recall CC/COG commute message	21%	(SOC)
• % chg to alt mode after CC/COG ads	2.8%	(SOC)
• % changers influenced by ad	84%	(SOC)
Placements – no contact with CC	**12,257**	(Commuters x CC recall X change % x influence %)
Placement Rates		
• Continued placement rate	40%	(SOC)
• Temporary placement rate	60%	(SOC)
Placements		
• Continued placements	4,903	(Placements x continued placement rate)
• Temporary placements	7,354	(Placements x temporary placement rate)
Daily Vehicle Trips Reduced		
• Continued VTR factor	0.70	(SOC)
• Temporary VTR factor	0.62	(SOC)
• Continued VT reduced	3,432	(Continued placements x continued VTR factor)
• Temporary VT reduced	3,511	(Temporary placements x temporary VTR factor x 77% credit for temporary use)
Total Daily Vehicle Trips Reduced	**6,943**	
Daily VMT Reduced		
• Ave one-way trip dist (mi)	15.8	(SOC)
Total Daily VMT Reduced	**109,699**	

Appendix 4, continued

PART 1 (Direct Ad Influence) (cont.)

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

• SOV access percentage	30%	(from SOC – transit riders)
• SOV access distance (mi)	2.7	(from SOC – transit riders)

Adjusted VT Reduction

• SOV access VT	2,083	(VT x SOV access %)
• VT with no SOV access	4,860	(Total VT – SOV access VT)

Adjusted VMT Reduction

• SOV access VMT	5,624	(VT x SOV % x trip distance)
• VMT with no SOV access	104,075	(Total VMT – SOV access VMT)

Total VT for AQ analysis	**4,860**
Total VMT for AQ analysis	**104,075**

PART 2 – Pool Rewards Participants

Program participants (through June 2014) 359

Placement Rates – by retention after program ended

• Continued placement rate (June 2014)	65%	(2014 'Pool Rewards follow-up survey)
• Temporary placement rate	35%	(2014 'Pool Rewards follow-up survey)

Placements

• Continued placements	233	(Placements x continued placement rate)
• Temporary placements	126	(Placements x temporary placement rate)
Total placements	**359**	

Daily Vehicle Trips Reduced

• Continued VTR factor	0.72	(2014 'Pool Rewards follow-up survey)
• Temporary VTR factor	0.64	('Pool Rewards logging data for program period)
• Temporary discount	50%	(assumes 13 weeks of program + 13 weeks after program)
• Continued VT reduced	168	(Continued placements x continued VTR factor)
• Temporary VT reduced	41	(Temporary placements x temporary VTR factor x 25% credit for temporary use)
Total Daily Vehicle Trips Reduced	**209**	

Daily VMT Reduced

• Ave one-way trip dist (mi)	31.2	(2014 'Pool Rewards follow-up survey)
Total Daily VMT Reduced	**6,521**	

Appendix 4, continued

PART 2 ('Pool Rewards) (cont.)

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	

Adjusted VT Reduction

• SOV access VT	105	(VT x SOV access %)
• VT with no SOV access	104	(Total VT – SOV access VT)

Adjusted VMT Reduction

• SOV access VMT	578	(VT x SOV % x trip distance)
• VMT with no SOV access	5,943	(Total VMT – SOV access VMT)

Total VT for AQ analysis	**104**
Total VMT for AQ analysis	**5,943**

PART 3 – Car Free Day Event

Pledges (estimate 75% participation of pledges)

Fall 2011 – 12,000	9,000
Fall 2012 – 6,572	4,929
Fall 2013 – 4,188	3,141
Total Placements	**17,070**

Event Impacts

Daily Vehicle Trips Reduced

• % driving alone on non-Car Free days	46%	(Pledge data)
• Event VTR factor	0.85	(Pledge data)
• Event VT reduced	14,510	(Pledges x event VTR factor)
• Equivalent daily VT	19	(Event VT reduced / 750 days over 3 years)

Daily VMT Reduced

• Ave one-way trip distance (mi)	19.4	(Pledge data)
• Event VMT reduced	281,494	(Event VT reduced x distance)
• Equivalent daily VMT	375	(Event VMT reduced / 750 days over 3 years)

Ongoing Impacts

Daily Vehicle Trips Reduced

• Estimate continued use after CFD	5%	
Ongoing placements	**854**	(Total participants x continued rate)
• Ongoing VTR factor (after CFD)	0.34	
• Ongoing daily VT reduced	290	(Ongoing participants x ongoing VTR factor)
Total Daily VT Reduced	**309**	(Event equivalent daily VT + ongoing daily VT)

Appendix 4, continued

PART 3 (Car Free Day) (continued)

Ongoing Impacts (cont)

Daily VMT Reduced

• Trip distance	19.4	
• Ongoing daily VT	5,626	(Ongoing daily VT x trip distance)
Total Daily VMT Reduced	**6,001**	(Event equivalent daily VMT + ongoing daily VMT)

Summary of Travel Impacts for Parts 2, 2, 3

	Total 1, 2, 3	Direct Ads	'Pool Rewards	Car Free Day
Placements	13,470	12,257	359	854
Vehicle Trips Reduced	7,461	6,943	209	309
VMT Reduced (miles)	122,221	109,699	6,521	6,001
Air Quality Adjusted VT / VMT				
Vehicle Trips Reduced	5,273	4,860	104	309
VMT Reduced (miles)	116,019	104,075	5,943	6,001

Daily Emissions Reduced – NOx and VOC – Parts 1, 2, 3

NOx	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	5,273	1.5408			8,125	0.0090
• From Running			116,019	0.3737	43,356	0.0478
Total NOx reduced (tons)					**Daily**	**0.0568**

VOC	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	5,273	2.8573			15,067	0.0166
• From Running			116,019	0.0915	10,616	0.0117
Total VOC reduced (tons)					**Daily**	**0.0283**

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	5,273	0.0367			194	0.0002
• From Running			116,019	0.0170	1,972	0.0022
Total PM 2.5 reduced (tons)					**Daily**	**0.0024**
					Annual	**0.597**

Appendix 4, continued

Annual Emissions Reduced – PM 2.5, Precursor NOx, and CO2 (continued) – Parts 1, 2, 3

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	5,273	1.7510			9,233	0.0102
• From Running			116,019	0.3663	42,498	0.0468
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.0570**
					Annual	**14.256**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	5,273	239.26			1,261,618	1.3907
• From Running			116,019	404.17	46,891,399	51.6889
Total CO2 reduced (tons)					**Daily**	**53.0896**
					Annual	**13,269.9**

PART 4 - Bike to Work Day Credit

Participants' riding percentage and frequency

Number of riders	19,707	(BTWD registration data, 2012, 2013, 2014)
% biking to work before event	82.6%	(BTWD survey)
% new riders	10.7%	(BTWD survey)
Number of new riders	2,109	
% who increase riding days	21.8%	
Number of increased riders	4,296	
Total placements	**6,405**	(Total new + increased riders)

Change in Bike Days

Summer Biking		
% new riders in summer	10.2%	(BTWD survey)
Weekly new bike days summer	1.4	(BTWD survey)
Weekly new bike days summer	2,814	
% increased riders in summer	20.3%	(BTWD survey)
Weekly inc bike days summer	1.6	(BTWD survey)
Weekly inc bike days summer	6,401	
Winter Biking		
% new riders biking winter	8.5%	(BTWD survey)
Weekly new bike days winter	1.4	(BTWD survey)
Weekly new bike days winter	2,345	
% increased riders biking winter	13.9%	(BTWD survey)
Weekly increased bike days winter	1.8	(BTWD survey)
Weekly increased bike days winter	4,931	

Appendix 4, continued

PART 4 (Bike to Work Day) (continued)

Additional Bike Days (New and Increased Riding)

• Total additional bike days summer	258,020	(weekly summer days x 28 weeks – Apr-Oct)
• Total additional bike days winter	160,072	(weekly winter days x 22 weeks – Nov-Mar)
• Total additional bike days - year	418,092	(summer bike days + winter bike days)
• Additional bike trips - year	836,184	(annual bike days x 2 trips per day)

Additional Bike Trips and Vehicle Trip and VMT Reductions

• Ave new daily bike trips	3,345	(Annual new bike trips / 250)
• % Drive alone/CP/VP on non-bike days	47%	(BTWD survey)
BTWD Daily Vehicle Trips Reduced	**1,572**	(daily new bike trips x DA/CP/VP percentage)

Daily VMT Reduced

• Ave trip distance (mi)	10.4	(BTWD survey)
BTWD Daily VMT Reduced	**16,349**	(vehicle trips reduced x average trip distance)

Daily Emissions Reduced – NOx and VOC – Bike to Work Day

		15 Emission		15 Emission		
NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• From Starts	1,572	1.5408			2,422	0.0027
• From Running			16,349	0.3737	6,110	0.0067
Total NOx reduced (tons)					**Daily**	**0.0094**

		15 Emission		15 Emission		
VOC	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• From Starts	1,572	2.8573			4,492	0.0050
• From Running			16,349	0.0915	1,496	0.0016
Total VOC reduced (tons)					**Daily**	**0.0066**

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

		15 Emission		15 Emission		
PM 2.5	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• From Starts	1,572	0.0367			58	0.0001
• From Running			16,349	0.0170	278	0.0003
Total PM 2.5 reduced (tons)					**Daily**	**0.0004**
					Annual	**0.093**

PM 2.5 Precursor NOx	**Trips**	**Factor**	**VMT**	**Factor**	**Tot gm**	**Tot ton**
• From Starts	1,572	1.7510			2,753	0.0030
• From Running			16,349	0.3663	5,989	0.0066
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.0096**
					Annual	**2.409**

Appendix 4, continued

PART 4 (Bike to Work Day) (continued)

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

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	1,572	239.26			376,117	0.4146
• From Running			16,349	404.17	6,607,775	7.2838
Total CO2 reduced (tons)					**Daily**	**7.6984**
					Annual	**1,924.6**

PART 5 – Referred Influence (Commuter Operations Center)

Populations of Interest – commuters influenced by ads to contact CC

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

• FY 2012	6,241	(CC database)
• FY 2013	5,736	(CC database)
• FY 2014	4,721	(CC database)
Total new applicants	**16,698**	
Total CC applicants	87,247	(includes new, re-apply, and follow-up)
New apps 12-14 as % of total	19.1%	(new apps FYs 12-14 / total CC apps)
% influenced by ads to contact CC	15%	(COC – monthly applicant analysis)
% all apps influenced by ads	2.9%	

CC Impacts – FY 12-14

Travel Impacts	MM Share	COC base	
• CC placements	1,024	35,310	
• CC Vehicle trips reduced	498	17,172	
• CC VMT reduced	13,650	470,691	
Emissions Impacts	**MM Share**	**COC base**	
• NOx reduced (daily tons)	0.0060	0.2052	Daily
• VOC reduced (tons)	0.0024	0.0811	Daily
• PM2.5 reduced (tons)	0.0647	2.2304	Annual
• PM2.5-NOx reduced (tons)	1.4801	51.0371	Annual
• CO2 reduced (tons)	1,480.8	51,060.9	Annual

Appendix 4, continued

PART 6 – GRH Credit – From GRH Analysis

Total GRH apps FY 12, 13, 14	21,156	
New GRH apps FY 12, 13, 14	13,255	63% of total applications
Estimated MM share of new GRH	15%	
Estimated MM share of GRH impact	9.0%	

GRH Impacts – FY 12-14

Travel Impacts	MM Share	GRH base
• GRH placements	1,166	12,953
• GRH Vehicle trips reduced	763	8,474
• GRH VMT reduced	21,049	233,883

Emissions Impacts	MM Share	Total	
• NOx reduced (daily tons)	0.0086	0.0957	Daily
• VOC reduced (tons)	0.0032	0.0359	Daily
• PM2.5 reduced (tons)	0.0941	1.0455	Annual
• PM2.5-NOx reduced (tons)	2.1367	23.7409	Annual
• CO2 reduced (tons)	2,165.1	24,056.5	Annual

Mass Marketing – Summary

Total – PART 1, PART 2, PART 3, PART 4, PART 5, PART 6

	Total MM	Direct Ad Infl	'Pool Rewards	Car Free Day	BTW	COC Credit	GRH Credit
Placements	22,065	12,257	359	854	6,405	1,024	1,166
VT reduced	10,294	6,943	209	309	1,572	498	763
VMT reduced	173,269	109,699	6,521	6,001	16,349	13,650	21,049
		67%	2%	3%	15%	5%	7%
Daily Emissions Reduced							
NOx (T)	0.0808						
VOC (T)	0.0239						
Annual Emissions Reduced							
PM 2.5 (T)	0.8481						
PM 2.5 Precursor (T)	20.281						
CO2 (T)	18,840.4						

APPENDIX 5 – CALCULATION OF COMMUTER OPERATIONS CENTER IMPACTS

PART 1 – Commute Information Requests

Populations of Interest – Commuter Connections Rideshare Applicants

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

• FY 2012	31,209	(CC database)
• FY 2013	30,656	(CC database)
• FY 2014	25,382	(CC database)
Total assisted commuters	**87,247**	

Within MSA (56%)	48,858
Outside MSA (44%)	38,389

COC Placement Rates	**In MSA**	**Out MSA**	
• Continued rate	32.8%	38.6%	
• Temporary rate	6.0%	4.0%	
• Total	38.8%	42.6%	
Placements			
• Continued	16,025	14,818	(Apps x cont. rate)
• Temporary	2,931	1,536	(Apps x temporary rate)
Total placements 35,310			

Daily Vehicle Trips Reduced

VTR Factors			
• Continued	0.51	0.58	
• Temporary	0.53	0.53	
• Temporary discount	17.1%	17.1%	
• Continued trips reduced	8,173	8,594	(Placements x cont. VTR factor)
• Temporary trips reduced	266	139	(Placements x temp VTR factor)
Total VT reduced 17,172			

Daily VMT Reduced

Ave one-way trip distance (mi)			
• Continued	27.5	27.5	(Actual Outside dist. 50.6 miles)
• Temporary	23.7	23.7	(Actual Outside dist. 43.2 miles)
• Continued VT reduced	224,758	236,335	(Vehicle trips x ave distance)
• Temporary VT reduced	6,304	3,294	
Total VMT Reduced 470,691			

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	71%	0%	(CC placement survey)
• SOV access dist (mi) – Continued	3.2	0.0	(CC placement survey)
• Non-SOV access % - Temporary	41%	0%	(CC placement survey)
• SOV access dist (mi) – Temporary	3.2	0.0	(CC placement survey)

Outside MSA – not applicable – all access outside MSA

VT Reduction

• Continued SOV access VT	5,803	0	(Cont VT x SOV access)
• Temporary SOV access VT	109	0	(Temp VT x SOV access)
• Continued VT (without SOV access)	2,370	8,594	(Total Cont VT – SOV access VT)
• Temporary VT (without SOV access)	157	139	(Total Temp VT- SOV access VT)

Total VT (net of SOV access) 11,260

VMT Reduction

• Continued SOV access VMT	18,570	0	(Cont VT x SOV % x access dist)
• Temporary SOV access VMT	349	0	(Cont VT x SOV % x access dist)
• Continued VMT (without SOV access)	206,188	236,335	(Total Temp VMT- SOV access VMT)
• Temporary VMT (without SOV access)	5,955	3,294	(Total Temp VMT- SOV access VMT)

Total VMT (net of SOV access) 451,772

Total VT for AQ analysis 11,260
Total VMT for AQ analysis 451,772

<u>Daily Emissions Reduced</u> – NOx and VOC

NOx	**Trips**	**15 Emission Factor**	**VMT**	**15 Emission Factor**	**Tot gm**	**Tot ton**
• From Starts	11,260	1.5408			17,349	0.0191
• From Running			451,772	0.3737	168,827	<u>0.1861</u>
Total NOx reduced (tons)					**Daily**	**0.2052**

VOC	**Trips**	**15 Emission Factor**	**VMT**	**15 Emission Factor**	**Tot gm**	**Tot ton**
• From Starts	11,260	2.8573			32,173	0.0355
• From Running			451,772	0.0915	41,337	<u>0.0456</u>
Total VOC reduced (tons)					**Daily**	**0.0811**

Appendix 5, continued

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

PM 2.5	Trips	15 Emission Factor	VMT	15 Emission Factor	Tot gm	Tot ton
• From Starts	11,260	0.0367			413	0.0005
• From Running			451,772	0.0170	7,680	0.0085
Total PM 2.5 reduced (tons)					**Daily**	**0.0090**
					Annual	**2.230**

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	11,260	1.7510			19,716	0.0217
• From Running			451,772	0.3663	165,484	0.1824
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.2041**
					Annual	**51.037**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	11,260	239.26			2,694,068	2.9697
• From Running			451,772	404.17	182,592,689	201.2739
Total CO2 reduced (tons)					**Daily**	**204.2436**
					Annual	**51,060.9**

Correction for Overlap between COC Base and Integrated Rideshare and GRH TERMs
Net COC Base = COC Base – Mass Marketing credit – Software Upgrades credit – GRH credit

	Net COC Base	COC base	MM	Soft Upg	GRH
Placements	22,796	35,310	1,024	4,681	6,809
Vehicle Trips Reduced	11,007	17,172	498	2,379	3,288
VMT Reduced (miles)	300,761	470,691	13,650	66,442	89,838
Daily Emissions Reduced					
NOx Reduced (tons)	0.1316	0.2052	0.0060	0.0283	0.0393
VOC Reduced (tons)	0.0520	0.0811	0.0024	0.0112	0.0155
Annual Emissions Reduced					
PM 2.5 (T)	1.4307	2.2304	0.0647	0.3077	0.4273
PM 2.5 Precursor (T)	32.7379	51.0371	1.4801	7.0402	9.7789
CO2 (T)	32,753.5	51,060.9	1,480.8	7,043.1	9,783.5

Notes:
MM influenced commuters – from MM analysis
GRH – 59% of new apps/reapps who made an alt mode change registered for GRH = 23% of COC credit to GRH (59% x 39 new/reapply share of total apps)

Appendix 5, continued

PART 2 – Telework Credit (Non Maryland origin / destination)

- Credit for telework assistance provided directly to commuters who do not live or work in Maryland; credit for Maryland residents/workers is assigned to the Telework Assistance TERM

Calculation details shown on Telework Assistance Worksheets

Number of teleworkers (non-MD)	388,423	
Share of TW credited to COC	9.1%	Learned of telework from Commuter Connections
Total TW placements credited to COC	35,346	
Vehicle trips reduced	12,255	
VMT reduced	187,465	
Daily NOx reduced (tons)	0.0980	
Daily VOC reduced (tons)	0.0575	
Annual PM2.5 reduced (tons)	1.0000	
Annual PM2.5-NOx reduced (tons)	24.850	
Annual CO2 reduced (tons)	21,687.5	

Total Commuter Operations Center – Including Base COC and Telework Credit
Net COC = Net COC Base + Non-MD TW

	Net COC	Net COC base	Non-MD TW
Placements	58,142	22,796	35,346
Vehicle Trips Reduced	23,262	11,007	12,255
VMT Reduced (miles)	488,226	300,761	187,465
Daily Emissions Reduced			
NOx Reduced (tons)	0.2293	0.1316	0.0980
VOC Reduced (tons)	0.1095	0.0520	0.0575
Annual Emissions Reduced			
PM 2.5 (T)	2.4307	1.4307	1.0000
PM 2.5 Precursor (T)	57.5879	32.7379	24.850
CO2 (T)	54,441.0	32,753.5	21,687.5

APPENDIX 6 – CALCULATION OF SOFTWARE UPGRADE IMPACTS

Populations of Interest – Commuter Connections Rideshare Applicants

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

• FY 2012	31,209	(CC database)
• FY 2013	30,656	(CC database)
• FY 2014	25,382	(CC database)
Total assisted commuters	**87,247**	

Within MSA (56%)	48,858
Outside MSA (44%)	38,389

COC Placement Rates	**In MSA**	**Out MSA**	
• Continued rate	4.7%	5.2%	
• Temporary rate	0.7%	0.5%	
• Total	5.4%	5.7%	
Placements			
• Continued	2,296	1,996	(Applications x continued rate)
• Temporary	342	192	(Applications x temporary rate)
Total placements 4,826			

Daily Vehicle Trips Reduced

VTR Factors			
• Continued	0.50	0.63	
• Temporary	0.54	0.50	
• Temporary discount	17.1%	17.1%	
• Continued trips reduced	1,148	1,257	(Placements x cont. VTR factor)
• Temporary trips reduced	32	16	(Placements x temp VTR factor)
Total VT reduced 2,453			

Daily VMT Reduced

Ave one-way trip distance (mi)			
• Continued	28.0	28.0	(Actual Outside dist. 48.6 miles)
• Temporary	24.1	24.1	(Actual Outside dist. 53.8 miles)
• Continued VT reduced	32,144	35,196	(Vehicle trips x ave distance)
• Temporary VT reduced	771	386	
Total VMT Reduced 68,497			

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	73%	0%	(CC placement survey)
• SOV access dist (mi) – Continued	5.0	0.0	(CC placement survey)
• Non-SOV access % - Temporary	41%	0%	(CC placement survey)
• SOV access dist (mi) – Temporary	5.0	0.0	(CC placement survey)

Outside MSA – not applicable – all access outside MSA

VT Reduction

• Continued SOV access VT	838	0	(Cont VT x SOV access)
• Temporary SOV access VT	13	0	(Temp VT x SOV access)
• Continued VT (without SOV access)	310	1,257	(Total Cont VT – SOV access VT)
• Temporary VT (without SOV access)	19	16	(Total Temp VT- SOV access VT)

Total VT (net of SOV access) 1,602

VMT Reduction

• Continued SOV access VMT	4,190	0	(Cont VT x SOV % x access dist)
• Temporary SOV access VMT	65	0	(Cont VT x SOV % x access dist)
• Continued VMT (without SOV access)	27,954	35,196	(Total Temp VMT- SOV access VMT)
• Temporary VMT (without SOV access)	706	386	(Total Temp VMT- SOV access VMT)

Total VMT (net of SOV access) 64,242

Total VT for AQ analysis 1,602
Total VMT for AQ analysis 64,242

Daily Emissions Reduced – NOx and VOC

NOx	**Trips**	**15 Emission Factor**	**VMT**	**15 Emission Factor**	**Tot gm**	**Tot ton**
• From Starts	1,602	1.5408			2,468	0.0027
• From Running			64,242	0.3737	24,007	0.0265
Total NOx reduced (tons)					**Daily**	**0.0292**

VOC	**Trips**	**15 Emission Factor**	**VMT**	**15 Emission Factor**	**Tot gm**	**Tot ton**
• From Starts	1,602	2.8573			4,577	0.0050
• From Running			64,242	0.0915	5,878	0.0065
Total VOC reduced (tons)					**Daily**	**0.0115**

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

PM 2.5	**Trips**	**15 Emission Factor**	**VMT**	**15 Emission Factor**	**Tot gm**	**Tot ton**
• From Starts	1,602	0.0367			59	0.0001
• From Running			64,242	0.0170	1,092	0.0012
Total PM 2.5 reduced (tons)					**Daily**	**0.0013**
					Annual	**0.317**

Appendix 6, continued

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

PM 2.5 Precursor NOx	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	1,602	1.7510			2,805	0.0031
• From Running			64,242	0.3663	23,532	0.0259
Total PM 2.5 Precursor NOx reduced (tons)					**Daily**	**0.0290**
					Annual	**7.258**

CO2	Trips	11 Emission Factor	VMT	11 Emission Factor	Tot gm	Tot ton
• From Starts	1,602	239.26			383,295	0.4225
• From Running			64,242	404.17	25,964,689	28.6212
Total CO2 reduced (tons)					**Daily**	**29.0437**
					Annual	**7,260.9**

Correction for Overlap with MM TERM

Total CC applications FY 12, 13, 14	87,247	
New CC applications FY 12, 13, 14	16,698	19%
Estimated MM share of new CC	15%	
Estimated MM share of IR impact	3.0%	

Net Software Upgrade = Software Upgrade Base – Mass Marketing credit

	Net SU	SU Base	MM Share
Placements	4,681	4,826	145
VT reduced	2,379	2,453	74
VMT reduced	66,442	68,497	2,055
Daily Emissions Reduced			
NOx reduced (T)	0.0283	0.0292	0.0009
VOC reduced (T)	0.0112	0.0115	0.0003
Annual Emissions Reduced			
PM 2.5 (T)	0.3077	0.3172	0.0095
PM 2.5 Precursor (T)	7.0402	7.2579	0.2177
CO2 (T)	7,043.1	7,260.9	217.8