Dulles Area Transportation Association

The Dulles Area Transportation Association (DATA) is a Transportation Management Association (TMA) that identifies transportation needs; advocates steps to meet those needs; and provides a forum for members and other concerned parties to be informed of opportunities and to participate in timely actions that will bring about a more effective transportation system.

DATA’s Area of Operations encompasses an approximately 160-square mile area bounded by the Potomac River on the north, Hunter Mill Rd. on the east, by the Route 15 corridor on the west, and the Rt. 66 corridor on the south. A true public-private partnership, DATA members include area businesses, property owners, state and local governments, and other groups and individuals concerned with growing traffic congestion and its resulting effect on the area’s business environment.

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Acknowledgements

The Dulles Area Transportation Association (DATA) would like to acknowledge the contributions of the members of the Technical Review Team. Participants on the Technical Review Team included: James Larsen, Executive Director of DATA; Doug Pickford, DATA Project Manager for Multi-modal Study; Walter Daniel, Fairfax County Department of Transportation; Sharon Affinito, Loudoun County Office of Transportation Services; Christopher Arabia, Virginia Department of Rail and Public Transportation; Steve Coe, Virginia Department of Environmental Quality; and, David Ruble, Virginia Department of Environmental Quality. DATA would also like to acknowledge the contributions of the consultants who provided expertise and guidance to the project and were integral collaborators in developing E3Calc. The consultant team included: John Martin, President/CEO, Southeastern Institute of Research (SIR); Laura Turner Reid, Project Director, SIR; and Lori Diggins, LDA Consulting.
INTRODUCTION

The primary objective of this study was to quantify the benefits that Transportation Demand Management (TDM) related strategies have in reducing greenhouse gas (GHG) emissions and addressing climate change issues. This study has provided important data, and a new tool that will assist local, state and federal agencies and the private sector in quantifying the impact that TDM strategies have in reducing GHG emissions. The development of E³Calc, a calculator that measures greenhouse gas emissions that are associated with employee commutes, represents a significant step forward in documenting the contribution that TDM related strategies have in reducing a region’s carbon footprint. E³Calc is a powerful tool that will assist government agencies and private businesses in benchmarking and monitoring GHG emissions that are related to employee commutes. Moreover, E³Calc can be used as a marketing tool for TDM professionals in their role of advocating TDM strategies as an efficient means for businesses to reduce their carbon footprints.

Over the course of this study, the Dulles Area Transportation Association (DATA) staff, and the Technical Review Team (TRT), set out to accomplish the following objectives:

1) Conduct a literature review of research on how TDM strategies impact vehicle miles traveled and reduce greenhouse gas emissions;
2) Evaluate current methodologies in determining the effects of TDM related strategies in reducing GHG emissions;
3) Develop a new mechanism (based on research during objectives 1& 2) for documenting the effectiveness of TDM related strategies in reducing GHG emissions;
4) Test the new methodology (E³Calc) to evaluate the effectiveness of the new methodology;
5) Conduct a Theoretical Analysis of the Effectiveness of TDM Strategies in Reducing GHG Emissions in the DATA service area; and
6) Produce a Final Report that documents the study and provides recommendations for improving TDM strategies and widening their implementation in the public and private sectors.

In completing the before mentioned objectives, this study has produced a very powerful and well-researched tool in E³Calc. This is a tool that will enhance the capabilities of TDM professionals in documenting the effectiveness that TDM related strategies have in reducing GHG emissions. Recognizing that this is the first step in developing this tool, the foundation that E³Calc establishes in providing a mechanism for businesses to benchmark and monitor their employees GHG emissions is very solid.

“The DATA calculator will be unique. It will make a contribution to the TDM industry.”

Conclusion by SIR after completing literature review.
DULLES AREA TRANSPORTATION ASSOCIATION

Submittal of this report and final invoice signifies the completion of the Multi-Modal Planning Grant awarded to the Dulles Area Transportation Association (DATA). As outlined within the original proposal, DATA believes this is just Phase I of this important project. DATA and its partners (see below) have already sought and have secured partial funding for Phase II of this project, and believe, as a result, that over the course of the next 12 to 18 months the program will become even more robust and more widely used in the TDM community and within the private sector.

STUDY ADMINISTRATION AND PROCESS

Technical Review Team (TRT)
Early in the study DATA established a Technical Review Team (TRT). The primary tasks of the TRT was to assist DATA staff in: 1) Developing a detailed scope of work; 2) reviewing study documents and progress; 3) assist in evaluating and choosing consultants; and 4) providing technical input throughout the project. The TRT met on an as-needed basis, both on conference calls as well as in face-to-face meetings. The Project Status Reports, submitted to VDOT over the course of the study, outline much of the work of the TRT (see Appendix A). Members of the TRT included:

1) James Larsen, Executive Director of DATA;
2) Doug Pickford, DATA Project Manager for Multi-modal Study;
3) Walter Daniel, Fairfax County Department of Transportation;
4) Sharon Affinito, Loudoun County Office of Transportation Services;
5) Christopher Arabia, Virginia Department of Rail and Public Transportation;
6) Steve Coe, Virginia Department of Environmental Quality;
7) David Ruble, Virginia Department of Environmental Quality;
8) John Martin, Southeastern Institute of Research (SIR) ad-hoc member; and
9) Lori Diggins, LDA Consulting ad-hoc member.

Over the course of the study the TRT provided useful and insightful guidance and advice. Their input was invaluable to the process and hopefully all will continue to participate as the project moves into Phase II.

Consultant Selection
A request for qualifications was developed to recruit one or more qualified consultants to assist in the research, design and development of a methodology in which to measure the impacts of TDM related strategies on GHG emission reduction. The solicitation was circulated through the Commonwealth’s qualified consultant’s lists, among the TDM listserv constituency, and to consultants that DATA staff identified as possibly qualified. The RFQ was also advertised in the Washington Post. On February 26, 2009 DATA held a voluntary pre-bid meeting which ten consultants attended. The proposal deadline was set for March 11, 2009. DATA received six proposals by the deadline.

The review process for the proposals received included a quantitative evaluation by the TRT, and a ranking of the proposals based on this evaluation. The top three scoring consultants were brought in for individual interviews. A second evaluation was made.
based on the interviews, and the top-scoring consultants were offered an opportunity to
discuss the project in detail with the TRT. After the second interview the consultants with
the highest scoring proposal, DATA and the TRT (which did not include SIR and LDA
Consulting until after they were selected) chose the team of Southeastern Institute of
Research (SIR) and LDA Consulting as the consultants to assist with the project.

A kick-off meeting with the TRT and the consultants was held on May 21, 2009. The
agenda for the meeting included: 1) Review of project objectives; 2) review schedule;
3) discussion of the research/literature review; 4) discussion of 5 experts to interview;
5) discussion of criteria for businesses to be surveyed; 6) discussion of the cost/benefit
analysis; 7) discussion of the role of other agencies and organizations in the project; and
8) other pertinent issues.

Some of the outcomes from the kick-off meeting included:

A) A slight change to the schedule that would have the interviews and
surveys of the businesses run concurrently throughout the whole project. This would allow for more active input and flexibility in beta testing the calculator.

B) Agreement that the final literature review would only include relevant
information to the study’s tasks, including:
   • Studies that demonstrated cost/benefits of TDM strategies to
     reduce GHG
   • Other calculators
   • Local/regional inputs or source

C) It was decided that a list of about 15 possible experts would be needed to
achieve a result of 5. The initial list of possible experts to interview would
be developed from the literature review, TRT’s discussions, input from
Lori Diggins and potential input from the Metropolitan Washington Council
of Governments.

D) The interview notes/summary will be delivered to DATA with lessons
learned, but the final document would not need to be a polished report
that could be printed professionally.

E) A thorough discussion concerning the criteria and selection process for
the businesses to be included in the project ensued. The TRT agreed on
the following points:
   • The companies will be helpful for selling the calculator into other
     companies.
   • Size is a factor, although the companies chosen should include
     those of different sizes.
   • It is more important that the candidates are already implementing
     some type of TDM, are willing to share, believe in the mission, and
have a recognizable brand name for purposes of best practices.

- Location will also be a factor.
- Candidates will want to know up front what information it is necessary to share: what we’ll need, how we’ll use it, and how it will be promoted.
- Will start looking in the DATA service area and then Northern Virginia or nearby areas, to find candidates.

F) The TRT and the consultants discussed at length the objectives that are associated with analyzing the cost/benefits of TDM strategies and their ability to reduce the carbon footprint of businesses. It was concluded that the following criteria and guidelines be used in analyzing the cost/benefits of TDM strategies:

- Calculator will help determine (for example) “for every 10 employees that do “X” TDM, company will get “Y” benefit.”
- Other useful measures: cost for VMT reduced, cost for emissions reduced, cost for GHG reduced, and cost for pounds of carbon reduced ($ per lb.).
- It may be helpful to compare to another benefit that they understand such as the impact due to the number of light bulbs changed.
- There should be other benefits beyond just reduced carbon and GHG.

G) The TRT concluded that it is important, from both a technical review aspect, but also from a “credibility” point of view, to include other agencies and organizations in the study.

2) In consultation with the Consultants, the Scope of Work and payment schedule were revised according to the discussions that took place during the kick-off meeting. The revise scope of work was forwarded and approved by the Multi-Modal Planning Office.

**PROJECT IMPLEMENTATION**

**Task 1 – Literature Review**

The Dulles Area Transportation Association investigated some of the most recent research in an attempt to ascertain whether any government agencies, non-governmental organizations, universities or private businesses have evaluated the effectiveness and cost efficiency of TDM strategies in reducing GHG emissions. DATA’s research found that although there has been substantial previous research in air quality impacts and techniques for reducing GHG emissions, very little of this research has been specifically focused on TDM’s effectiveness in reducing GHG emissions.
In researching the cost effectiveness of TDM strategies, DATA found some very applicable studies. Specifically, the Los Angeles County Metropolitan Transportation Authority conducted a series of studies in the mid 1990’s that evaluated forty TDM demonstration projects. Among other elements, the studies “determined the cost-effectiveness of TDM strategies that reduce or eliminate vehicle trips, vehicle miles traveled, and vehicular emissions.” The sources of information contained in Appendix D represents DATA’s research into existing studies and sources of information that outlines recent research into the cost-effectiveness of TDM strategies in reducing GHG emissions. In short, DATA found that estimating the cost benefits of TDM strategies in reducing GHG emissions is very complicated. The TRT decided to examine a broader estimate in determining the cost-to-benefit ratio. The results of the cost/benefit analysis discussion are described in more detail under the section that addresses Task 3.

DATA’s literature review was divided into four categories: 1) Case Studies, Analysis and Reports; 2) Useful Websites or GHG Related Calculators; 3) Local Sources of Information; and 4) Miscellaneous Information of Potential Interest.

**Conclusion**

*The overwhelming conclusion for the literature review was that the vast majority of GHG/carbon calculators are designed for individual or personal use – how big is my carbon footprint? There are few working employer-oriented calculators. There are even fewer employer-based carbon-GHG calculators that take into consideration all alternatives to driving alone. The study team concluded that the DATA GHG emissions calculator will be unique and will make a major contribution to the TDM industry.*

**Task 2 – Survey of Professional Experts in Air Quality, TDM and Transportation Science**

Understanding the complexity of compiling a methodology and delivery system that would be fairly simple to use, but would be robust in its capability to analyze the effectiveness of a wide range of TDM strategies in reducing GHG emissions, the project team felt it was necessary to gather insight from experts in the TDM, air quality and transportation sectors. An initial list of 13 potential interviewees was compiled. Six of these were contacted and interviewed at a great length. A complete summary of the interviews, findings and recommendations is included in Appendix B.

**TDM Expert Interviews**

The project team agreed that success of the overall program relied upon an effective marketing program after the calculator has been developed. Otherwise no one will use the tool. The TDM experts interviewed provided valuable insights into their current programs and the lessons learned from a marketing and implementation perspective. A summary of these discussions is below.
**Dulles Area Transportation Association**

**Expert Interviewees**

<table>
<thead>
<tr>
<th>Contact</th>
<th>Title</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TDM Experts</strong></td>
<td></td>
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<tr>
<td>Amy Sturgill</td>
<td>Assistant Executive Director</td>
<td>Buckhead Area Transportation Management Association</td>
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<tr>
<td>Jamie Cheney</td>
<td>Director</td>
<td>Commute Seattle</td>
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<tr>
<td>Rick Williams</td>
<td>Director</td>
<td>Lloyd District Transportation Management Association</td>
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<tr>
<td><strong>Emissions Experts</strong></td>
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<tr>
<td>Robert O’Loughlin</td>
<td>Team Leader</td>
<td>Air Quality Resource Center, Federal Highway Administration, San Francisco, CA</td>
</tr>
<tr>
<td>Douglas Eisinger</td>
<td>Director</td>
<td>Transportation Policy and Planning Group, Sonoma Technology, Petaluma, CA</td>
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</table>

**Commute Seattle**
Jamie Cheney, Director

- Commute Seattle offers commuters, employers and property owners the tools to reduce drive-alone commutes into downtown.
- An alliance of the Downtown Seattle Association, King County Metro, and the City of Seattle, formed to reduce SOVers by 6 percentage points by 2015.
- Nearly 250 worksites in Seattle participate in commuter programs. At worksites that have participated since 1993, the drive-alone rate dropped from 47.4% in 1993 to 40.0% in 2007.
- Focus is employers with less than 100 employees who are not regulated by law to reduce commuters.
- They have also added a pledge component, where commuters can directly register and pledge to reduce their weekly trips in support of its goal.

**Buckhead Area Transportation Management Association (BATMA)**

Amy Sturgill, Assistant Executive Director

- BATMA is a partnership of private businesses, public agencies and residential and civic associations within the Buckhead community. Formed in 1997, BATMA’s mission has been to provide relief to commuters, residents and visitors traveling to & within Buckhead.
- BATMA works with community and regional partners to improve mobility, accessibility and air quality by sponsoring programs and providing incentives to encourage commuters to take transit, carpool, vanpool, telework, bike and walk to work.
- BATMA has a GHG Calculator on their Web site, but use a more complex one
to generate monthly reports to member organizations that include emissions reductions, number of participants, modes logged and money saved by employees.

_Lloyd District TMA_

Rick Williams, Executive Director

- The mission of the Lloyd Transportation Management Association (Lloyd TMA) is to support and promote the economic vitality and livability of the Lloyd District through cooperative, business-supported programs promoting efficient, balanced transportation systems and land use patterns.
- The Lloyd TMA has 71 member businesses representing approximately 9,000 employees.
- Drive alone trips have decreased from 60% in 1997 to 42% in 2007, a 30% decrease over eleven years.
- TMA programs have directly resulted in an annual reduction of 3.8 million peak-hour vehicle miles traveled (2007 figure). That represents the removal of 988 vehicles from our roads and freeways during the peak commute hour every day.

**Marketing Lessons, Implications and Recommendations**
1. **Firm, clear and defined targets** or goals are key to success. Otherwise, how do you frame your effort and quantify goals?
2. Champions of the cause/effort from both the private and public sector are key. Consider a “Charter Board” or other source of feedback and support.
3. An effort like this takes **time**, especially if it requires financial outlays of participating businesses.
4. The easiest programs to implement are ones that create a **financial incentive** for business. As a last resort, a mandate may be an alternative to assure compliance.
5. Other **motivations** for businesses include economic development issues, public relations, information on impact at the organizational level or addition of employee benefits.

_Air Quality and Transportation Expert Interviews_

Lori Diggins interviewed two nationally-recognized experts in vehicle emissions calculation and research. In these interviews they discussed a full range of factors related to rate/amount of pollutants emitted = vehicle type/age, fuel type, vehicle miles travelled (VMT), travel time and time of travel, congestion measure, number of daily “cold starts.” Then the interviewees discussed what was essential to maintain reasonable accuracy in a “simplified input” model – strongly suggesting that we don’t base the model on VMT alone, and must include fuel use:
- Vehicle type (including hybrid) and age
- VMT
- Speed/congestion

A Summary of these discussions is below.

Robert O’Loughlin, Air Quality Resource Center, FHWA
Douglas Eisinger, Sonoma Technology
• Discussed range of emissions included in GHG:
  – CO₂ is 95% of GHG emissions – measure directly
  – Account for other components – Nitrous Oxide, Methane and Hydrofluorocarbon by factoring up CO₂
• Reviewed current standards in reporting results – IPCC reports in carbon dioxide equivalents (CO₂e). This metric translates emissions other than CO₂ into CO₂ equivalents to estimate the combined global warming potential of all GHGs.
• Discussed possible changes to EPA emission models – no major changes that would affect our proposed calculation in the short-term.

The final interview was with Erica Jones, from the University of California-Davis. Ms. Jones has done considerable research into GHG emission calculators, and shared the following information with the project team.
  • Evaluated 30 carbon calculators to define methods.
  • Observed wide range of inputs – from elementary (VMT) to moderately sophisticated (vehicle type, use of alt. modes, city vs. highway conditions).
  • Found substantial variability in results.
  • Found many calculators were “black boxes” with no documentation of methods or assumptions.
  • Key recommendations:
    – Use fuel consumption rather than VMT as basis for emission factors and incorporate time/speed element
    – Include emissions from transit
    – Document results and offer feedback

Emission Recommendations
1. Strive for simplicity, but don’t ignore fundamentals of accuracy.
2. Base calculation on fuel saved, rather than on VMT/trips reduced alone. Requires input of additional details of vehicle type and more complex matrix of emission factors.
3. Try to incorporate some measure of congestion level – perhaps as speed or % of trip on congested roads.
4. Include emissions from transit in the calculator – don’t treat as “zero vehicle” mode.
5. Calculate “CO₂ equivalents” to account for gases other than CO₂ and to conform to international standards.
6. Thoroughly document methodology and assumptions.
7. Capitalize on feedback opportunity to educate employers.

Task 3 – Development of a methodology to evaluate TDM strategies on GHG emission reduction

TDM and Emission Evaluators
The literature review and surveys of professionals within the TDM community led the consulting team to devise solid parameters for developing a methodology to measure the
impact that employee commutes have on GHG emissions. The basic science included an evaluation of vehicle emissions (Figure 1), and the factors that affect emissions from individual vehicles (Figure 2). In short, the amount of fuel consumed during a commute has the most direct impact on GHG emissions. Fuel consumption is driven by mode, distance, frequency and efficiency. All of these factors should be included in the model computations.

GHG Emission Calculators
The study team also examined existing calculators and the methodologies that were employed, when available. In many cases the methodologies for the calculators were unavailable or unknown. The TRT made a conscience decision to be as transparent as possible with any methodology developed during this process. The justification for transparency was two-fold: 1) it leads to a thorough understanding of the basic concepts of the calculator and the factors that are used to determine the outputs; and 2) it provides a “forum” for peer review and scrutiny, which in turn, will eventually lead to a better methodology and tool for professionals and businesses to use.

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Employee mode</td>
<td>• 3 Impact Areas</td>
</tr>
<tr>
<td>• % of trips by mode</td>
<td>(levels reduced based on employees actions)</td>
</tr>
<tr>
<td>• Frequency of use</td>
<td>1. Environmental</td>
</tr>
<tr>
<td>• Home to work travel distance</td>
<td>• Carbon Plus GHG Emissions</td>
</tr>
<tr>
<td>• Travel time</td>
<td>2. Transportation/Traffic:</td>
</tr>
<tr>
<td>• Type of vehicle</td>
<td>• Vehicle Miles Traveled</td>
</tr>
<tr>
<td></td>
<td>• Cars Off the Road</td>
</tr>
<tr>
<td></td>
<td>3. Energy Savings:</td>
</tr>
<tr>
<td></td>
<td>• Fuel Use</td>
</tr>
</tbody>
</table>

Related Issue: Comparison to baseline (either past data or based on SOV only for all employees) to show benefits and savings.
Lastly, the study team recognized that most calculators and methodologies rarely put their outputs into any sort of perspective. There were equivalencies included in the outputs, but no comparisons to existing conditions or previous benchmarks. The study team concluded that making a comparative analysis to some sort of historic benchmark was critical, whether it be a situation in which all employees drove to work alone, or a former survey of employee commuting patterns. It was agreed that a benchmark comparison was critical in terms of making the output from the proposed analysis relevant.

Cost/Benefit Analysis
The study team discussed at length the objectives that are associated with analyzing the cost/benefits of TDM strategies and their ability to reduce the carbon footprint of businesses. It was concluded that the following criteria and guidelines be used in analyzing the cost/benefits of TDM strategies:

- Calculator will help determine, for example, “for every 10 employees that do “X” TDM, company will get “Y” benefit.”
- Other useful measures: cost for VMT reduced, cost for emissions reduced, cost for GHG reduced, and cost for lbs of carbon reduced ($ per lb.).
- It may be helpful to compare to another benefit that consumers might understand such as the impact due to the number of light bulbs changed.
- There should be other benefits beyond just reduced carbon and GHG.

As the project progressed, it became apparent to the TRT that the current resources of the grant were
not sufficient to conduct a comprehensive cost/benefit analysis of TDM strategies and their ability to reduce GHG emissions. However, the TRT did determine that calculations could be included (see Figure 3), should cost information be available, that looked at the cost for VMT reduced, cost for emissions reduced, cost for GHG reduced, and cost for lbs of carbon reduced ($ per lb.).

The study team also determined that some equivalencies should be included in the analysis in order to put the reduction in GHG emissions in perspective with other efforts or initiatives. Task 5 addressed many of these issues and attempted to put the overall reduction numbers into a common perspective.

**Task 4 – Development of Website, E³Calc and beta testing**

**E³Calc.com**  
One objective of the study was to produce either a strategy or a program that would help promote and elaborate benefits that TDM related strategies have on reducing GHG emissions. Many avenues could have been pursued to accomplish this task, however, the study group concluded that the overall methodology and implementation would probably need improving over time, and that the most flexible and accessible medium for publicizing this initiative, would be the internet. As such, the study team decided to develop a website that could be referenced, accessed and used by government agencies, businesses and other organizations. The advantages of this approach included: 1) the website is accessible to everyone, whereby the web address can be included in any ancillary or collateral materials, and can be used during onsite visits; 2) websites are dynamic in that they can be edited, updated and reorganized quickly and cost efficiently, thus providing a marketing medium that can change as quickly as the technology might change with E³Calc; and 3) the internet is fast becoming the medium of choice for marketing and outreach, a fact that was not overlooked by the study team. These three overriding considerations made the development of a website advantageous.

The E³Calc website provides a robust overview of the project, its participants, the purpose of the program and how a business can avail themselves to the resources that exist to promote TDM programs. Located at [www.E³Calc.com](http://www.E³Calc.com), the website is a vehicle that public, private and other organizations can utilize to promote their own activities. Furthermore, the website offers a direct link to the GHG emission calculator. E³Calc.com’s link to the calculator itself provides another tool to TDM professionals and business personnel who are the advocates and technical supporters of TDM programs and initiatives.
Beta Testing E³Calc

From the outset the project team understood that there would be some limitations to the calculator based on budgetary considerations. It became clear that there were some components that would need to be added/included at a later date. The project team also understood that through the process of beta testing, that additional items or issues may arise that would have to be addressed in Phase II or beyond. The project team set out to secure three sites for beta testing. The recommended key criteria set forth for selecting beta testing sites included:

- Human Resources is willing to work with DATA consultants through the development process – formulating the calculator, surveying employees, and refining the calculator’s output.

- Company is large enough to have demonstrable impact on GHG emissions – for use in the future marketing of DATA GHG Calculator.

- Company name is recognizable – for use in the future marketing of DATA GHG Calculator.

- Company is willing to be aggressively profiled as an example for use in the future marketing of DATA GHG Calculator.

- The Company would be willing to ramp up employer-based TDM programs after benchmark use of calculator to hopefully show subsequent gains in output measures (lowering their corporate impact). Resurvey of employees/updated calculation of impact after a set amount of time (6 months to year) to show how much of an additional impact can be achieved (and set up cost-benefit analysis - to be discussed later).

In January 2010 a list of potential firms was developed and an active recruitment campaign was
undertaken. By March the project team had five prospective businesses identified. Two, Parsons Brinckerhoff and Quest Diagnostics had agreed to fully participate. A third, large national firm decided to participate, but choose not to do so publicly. Parsons Brinckerhoff agreed to conduct testing at two sites. As of July 1, 2010 beta testing has yet to be underway at Quest. The project team intends to continue with beta testing of the calculator into Phase II. Components of $E^3$Calc, including the employee survey, calculator spreadsheets, cost/benefit module and the results of the beta testing to date are included in Appendix C.

**Task 5 – Theoretical Analysis of the Effectiveness of TDM Strategies in Reducing GHG Emissions in the DATA Service Area**

To test the new methodology incorporated into $E^3$Calc, the project team suggested that a theoretical analysis examine the impact that TDM related strategies would have on reducing GHG emissions in the Dulles service area. The basis for this theoretical analysis, as well as the default data for $E^3$Calc, were derived from information gathered during the 2007 *State of the Commute Survey Report from the Metropolitan Washington DC Region*. The *State of the Commute Survey* is conducted every three years by Commuter Connections, a program of the Metropolitan Washington Transportation Planning Board. The *State of the Commute Survey* is an extensive undertaking aimed at ascertaining details on the region’s commuting behaviors.

The data gathered from each locality during the 2007 *State of the Commute Survey* was used to determine the effectiveness of the TDM programs and the individual choices made by employees who choose not to drive alone to work, in reducing GHG emissions in the DATA Service Area. The survey information on TDM programs was then compared to a theoretical scenario that assumes that all employees in the DATA Service Area drove alone to work in their vehicle. The results of this comparative analysis are summarized below. A complete copy of the report is included in Appendix --.

**The Impact of TDM Strategies in the DATA Service Area**

On a yearly basis TDM strategies and alternatives to single occupant vehicle use by employees in the DATA Service Area removes more than 396,000 tons of GHG emissions from the region’s atmosphere. TDM programs in the DATA Service Area...
reduce the region’s vehicle miles traveled by more than 2.85 million miles daily, or about 7% of the Northern Virginia’s total daily vehicle miles traveled. The amount of GHG emissions removed by TDM strategies is the equivalent to:

- A reduction in almost 180,000 vehicle trips, a DAY;
- What 68,719 passenger cars driven daily, would emit over the course of a year;
- The annual CO₂ emissions from electricity used in 43,617 homes;
- Removing 2.85 million vehicle miles traveled, DAILY;
- Taking over 89,000 cars off of Northern Virginia’s roads, DAILY, or over 23.3 million vehicles annually;
- Filling all four lanes of the Beltway with cars, every day;
- Filling a four lane highway every year that stretches around the earth’s equator one and a half times; or
- Planting a forest the size of the District of Columbia in order to absorb the same amount of GHG emissions, annually.

Based on 2007 commuting patterns in Fairfax County, the average business that employs 100 workers, reduces its carbon footprint by over 32 tons of GHG emissions annually from those employees who choose other alternatives to driving alone to work.

A Regional Perspective
Employed on a regional basis (all of Northern Virginia), TDM strategies and other alternatives to single occupancy vehicle use (when compared to a scenario where everyone commuted to and from work by single occupancy vehicles) removed over 0.7 million pounds of CO₂ a day! Because commuting patterns, as well as the availability of transit services varies considerably from locality to locality, the impact that TDM measures have on local carbon footprints varies as well. Specifically, the reduction of GHG emissions due to TDM strategies employed by businesses, or those attributed to employees who chose alternatives to driving to work alone, produced the following GHG emission reductions in the region:

- Removed more than 316,000 cars from Northern Virginia roads EVERY DAY;
- Eliminated almost 633,000 trips EVERY DAY;
- Reduced the region’s vehicle miles traveled by over 10 million miles, EVERY DAY; and
- Eliminated almost 1.4 million TONS of GHG emissions from the region’s atmosphere every year!
From a regional perspective, TDM programs and alternatives to driving to work alone offer substantial opportunities for lowering green house gas emissions and easing the amount of traffic congestion on regional road networks. To put the before mentioned numbers in perspective, the reduction in GHG emissions and VMT in the region due to TDM programs include:

- Removing the GHG emissions of more than 1.85 million passenger cars every year;
- Eliminating the CO₂ emissions produced by the electricity generated in over 1.79 million homes, in a single year;
- Removing 316,000 vehicles every day would fill all four lanes of the beltway, and lap it 3.7 times;
- Or on a yearly basis, the cars would fill a two lane highway that would circumvent the equator almost 5 times; and
- Reduce the number of miles driven annually in Northern Virginia by more than 2.6 trillion miles!

**Task 6 – Final Report and Next Steps**

**CONCLUSION**

As is evident in this report, the process and thoroughness that the project team pursued during this study has resulted in a new and very powerful tool that could transform the TDM industry. DATA’s attempt to address the original hypothesis – that TDM strategies provide a cost effective means for businesses and organizations to reduce their greenhouse gas emissions – through the development of a “business oriented” GHG emissions calculator, has essentially created an innovative new marketing tool that can be used for employer outreach, education and analysis. With only two sites serving as beta test sites, it is impossible to conclude that TDM related strategies are a cost effective means for reducing GHG emissions. However, the results of the theoretical analysis certainly allude to the fact the TDM related strategies might certainly be cost effective. As more businesses use E³Calc, more data will be gathered and better insights will be gleaned to demonstrate that TDM strategies are cost effective for reducing GHG emissions.

As illustrated in the findings of the Theoretical Analysis, TDM strategies make a major contribution in reducing the amount of CO₂ being emitted into the region’s atmosphere. In total, TDM strategies remove over 10.7 million pounds of CO₂ a day or 1.4 million tons annually. That is equivalent to eliminating the CO₂ emissions produced by the electricity generated in over 1.79 million homes, in a single year. That is a significant contribution
and one that should increase over time as TDM strategies become more popular with businesses and commuters.

There is significant room for growth in the application of TDM programs in Northern Virginia and the Washington Metropolitan region. The ongoing survey of businesses in the DATA service area illustrates this situation. DATA staff has been able to document that 85 businesses within its service area are implementing TDM programs. These businesses represent only about 12% of the total employee population in the DATA service area, and participation rates of these employees are not documented in the survey, only the programs that the employer has endorsed. With the potential implementation of E³Calc, employee participation rates will be better documented, and will provide a much clearer picture of the contribution that TDM programs make in reducing GHG emissions and vehicle miles traveled.

Next Steps
This report represents the culmination of the Multi-modal Planning Grant received by DATA. However, as the study progressed it became apparent that a new powerful tool was being developed for the TDM industry and the project team recognized the need to continue its development beyond this initial funding cycle. As such, the culmination of the multi-modal grant essentially represents Phase I of the study. DATA pursued, and has secured some additional funding through a grant from the Virginia Department of Rail and Public Transportation. The tasks outlined for Phase II, include:

Task 1 – Calculator Enhancement and Technical Training. DATA will undertake a coordinated effort to provide technical training to Northern Virginia based TMAs, and private businesses in the use of the GHG Calculator. The training program will first focus on transportation professionals who can then use the calculator in their own respective localities. Where appropriate staff will also provide technical training to private businesses in the use of the calculator. The technical training will include briefings on how the methodology behind the calculator, use and analysis of the employee survey, options for customizing the survey instrument, meanings and use of the survey report output, data input and use of the calculator, meanings and use of the calculator output, future scenario development, and benchmarking the businesses GHG emissions and future comparative analysis for monitoring emissions over time.

Task 2 – Expanded Field Implementation, Testing and Marketing in Northern Virginia. Task 2 will be conducted simultaneously with Task 1, as staff trains local transportation professionals in the use and implementation of the GHG Calculator, they will also begin an aggressive marketing campaign to publicize the calculator. Due to budget constraints during the development of the calculator, DATA beta tested the calculator at only three sites. As such, the three sites did not necessarily cover the entire spectrum of possible business types that are typically found in the business community. Phase II will focus on getting the calculator introduced to a much broader variety of businesses. As the calculator is used by a broader range of businesses and agencies, it will also be revised and enhanced to ensure that it continues to meet the needs and demands of the regulatory community.
Task 3 – Calculator Enhancement. As mentioned in Task 2, the GHG Calculator will be continually enhanced as it is tweaked during field-testing. While staff anticipates that these “tweaks” will be relatively minor (changes in survey formats, questions, reports, etc.) DATA also anticipates developing some major embellishments to the calculator in Phase II. Some of the new features will include adding a fleet vehicle component, creating a stand alone version that can be run directly from a CD, looking into other Scope 3 emissions to determine the feasibility of enhancing the GHG Calculator as a tool for benchmarking and measuring those emissions, and examining methods for distributing the calculator more broadly. The scenario creation aspects of the calculator will also be dramatically enhanced during Phase II.
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APPENDIX A

COMPRENDIUM OF STATUS PROJECT STATUS REPORTS
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Accomplishments and Milestones

1) Dulles Area Transportation Association (DATA) staff developed a request for qualifications (RFQ) that outlined the expectations and scope of work that would be used in evaluating the effectiveness of TDM’s in reducing greenhouse gas emissions. The draft RFQ was circulated among some local staff for input and feedback. The draft document was also forwarded to VDOT for review and approval.

2) On February 6, 2009 DATA issued the RFQ, seeking proposals to conduct a study that evaluates the effectiveness and the cost-benefits of transportation demand management (TDM) strategies in reducing greenhouse gas (GHG) emissions in Northern Virginia (see attached document). Proposals were to be submitted to DATA by March 11, 2009.

3) The RFQ was mailed to 58 firms, many of which were listed on the Commonwealth’s DBE list (see attached). The RFQ was also mailed and emailed to a list of consultants that was developed by DATA staff.

4) On February 16, 2009 a notice appeared in the Washington Post announcing the RFQ.

5) On February 26th DATA held a pre-bid meeting for prospective applicants to the RFQ. Although attendance at the pre-bid meeting was voluntary, ten representatives from consulting firms attended the meeting (see attached attendance list and agenda).

6) Between February 6th and the proposal deadline of March 11th, DATA included a copies of the RFQ and a running list of questions and answers on the DATA website (see attached Q&A list).

7) DATA staff continues to conduct a review of literature that is applicable to the project. The research included a call for information on the TDM listserv, as well as investigating numerous sources of information such as, but not limited to: the EPA; National Center for Transit Research located at the Center for Urban Transportation Research at the University of South Florida; the
Transportation Research Board; Victoria Transportation Policy Institute; Washington Council of Governments; FHWA; VDOT; among many other sources.

8) DATA has established the technical review team and distributed copies of the six proposals received on March 11\textsuperscript{th}. The review team will rate the proposals and will meet in late March to discuss the qualifications of the applicants.

9) DATA staff has begun the process of developing criteria that will be used in determining which three companies will be selected to participate in the survey as outlined in the scope of work. This criteria will be vetted and reviewed by the selected consultant in the coming month(s).

**Progress Report # 2**  
Dulles Area Transportation Association  
Multi-Modal Planning Grant  
March - April 2009

**Accomplishments and Milestones**

1) DATA staff continues to conduct a review of literature that is applicable to the project. The research included a call for information on the TDM listserv, as well as investigating numerous sources of information such as, but not limited to: the EPA; National Center for Transit Research located at the Center for Urban Transportation Research at the University of South Florida; the Transportation Research Board; Victoria Transportation Policy Institute; Washington Council of Governments; FHWA; VDOT; among many other sources.

2) DATA developed rating criteria for the RFQ's and distributed evaluation sheets (see attached) and copies of the RFQ's to each of the members of the Technical Review Team. The Technical Review Team includes: Christopher Arabia, Department of Rail and Public Transportation; Sharon Affinito, Loudoun County Office of Transportation Services; James Larsen, Executive Director of DATA; and Doug Pickford, DATA Project Manager for Multimodal Study.

3) The Project Review Team submitted their evaluation sheets to Mr. Pickford, who tallied the scores. On March 23\textsuperscript{rd} the Technical Review Team met at DATAs offices to discuss the proposals. The three highest scoring applicants were selected for interviews. These included: ICF International, Eastern Research Group, Inc. (ERG) in partnership with UrbanTrans; and the Southeastern Institute of Research, Inc. (SIR) in partnership with LDA Consulting.

4) On April 1\textsuperscript{st} and 2\textsuperscript{nd} the Technical Review Team held interviews with the three
highest-ranking applicants. Upon completion of the interviews the Technical Review Committee met to debrief on interviews. Doug Pickford developed an evaluation form to grade the interviews. This was distributed to the Review Team on April 3rd.

5) Review Team members submitted their interview evaluations on April 6th. The consulting team of SIR and LDA were selected as the group most suitable to conduct the study. All applicants were notified that a decision had been made during the week of April 6th.

6) DATA staff developed a contract and scope of work for SIR/LDA (see attached). The contract and SOW were submitted to SIR/LDA on April 16th. Comments from SIR/LDA concerning the Contract and SOW are to be submitted to DATA by April 27th.

Attachments:
1) RFQ Evaluation Sheet
2) Interview Evaluation Sheet
3) Draft Contract and Scope of Work

Progress Report # 3
Dulles Area Transportation Association
Multi-Modal Planning Grant

April – May 2009

Accomplishments and Milestones

1) DATA staff completed its part in conducting a review of literature that is applicable to the project. The research included a call for information on the TDM listserv, as well as investigating numerous sources of information such as, but not limited to: the EPA; National Center for Transit Research located at the Center for Urban Transportation Research at the University of South Florida; the Transportation Research Board; Victoria Transportation Policy Institute; Washington Council of Governments; FHWA; VDOT; among many other sources. The Draft Literature/Research Review was given to the Consultant for their input and use during the project. A final version of the report is expected to be one of the first deliverables from the Consultant. See attached.

2) On May 21st DATA staff convened a “kick off” meeting with SIR and LDA, the consultants selected to assist DATA in the project. All members of the Technical Review Team were in attendance as were additional staff from DATA. The Technical Review Team (TRT) was expanded to include participation from Fairfax County staff. The TRT now includes: Christopher Arabia, Department of Rail and Public Transportation; Walter Daniels, Fairfax County Department of Transportation, Sharon Affinito, Loudoun County Office of Transportation Services; James Larsen, Executive Director of DATA; and Doug Pickford, DATA Project Manager for Multimodal Study.
3) The agenda for the Kick-off meeting included: 1) Review of project objectives; 2) review schedule; 3) discussion of the research/literature review; 4) discussion of experts to interview; 5) discussion of criteria for businesses to be surveyed; 6) discussion of the cost/benefit analysis; 7) discussion of the role of other agencies and organizations in the project; and 8) other pertinent issues.

4) Some of the outcomes from the Kick-off meeting included:

    A) A slight change to the schedule that would have Task 6, the interviews and surveys of the three businesses would run concurrently throughout the whole project. This would allow for more active input and flexibility in beta testing the calculator.

    B) Agreement that the final literature review would only include relevant information to the study's tasks, including:
      • Studies that demonstrated cost/benefits of TDM strategies to reduce GHG
      • Other calculators
      • Local/regional inputs or source

    A) It was decided that a list of about 15 possible experts would be needed to whittle down to 5. The initial list of possible experts to interview will be developed from the literature review, our discussions, input from Lori Diggins and potential input from COG.

    B) The interview notes/summary will be delivered to DATA with lessons learned, but the final document does not need to be a polished report that could be printed professionally.

    C) A thorough discussion concerning the criteria and selection process for the businesses to be included in the project ensued. The TRT agreed on the following points:
      • These three companies will be helpful for selling the calculator into other companies.
      • Size is a factor, although the companies chosen should not be limited to those of different sizes.
      • It is more important that the candidates are already implementing some type of TDM, are willing to share, believe in the mission, and have a recognizable brand name for purposes of best practices.
      • Location will also be a factor.
      • National Wildlife and CGI may be good candidates.
      • Candidates will want to know up front what information it is necessary to share: what we’ll need, how we’ll use it, and how it will be promoted.
      • Will start looking in the DATA service area and then Northern Virginia to find candidates.
D) The TRT and the consultants discussed at length the objectives that are associated with analyzing the cost/benefits of TDM strategies and their ability to reduce the carbon footprint of businesses. It was concluded that the following criteria and guidelines be used in analyzing the cost/benefits of TDM strategies:

- Calculator will help determine (for example) “for every 10 employees that do X TDM, company will get Y benefit.”
- Other useful measures: cost for VMT reduced, cost for emissions reduced, cost for GHG reduced, and cost for lbs of carbon reduced ($ per lb.).
- It may be helpful to compare to another benefit that they understand such as the impact due to the number of light bulbs changed.
- There should be other benefits beyond just reduced carbon and GHG.

E) The TRT concluded that it is important, from both a technical review aspect, but also from a “credibility” point of view, to include other agencies and organizations in the study. Some agencies that were specifically mentioned included: Virginia Department of Environmental Quality, the Washington Metropolitan Council of Governments, Society of Human Resource Managers, AAA, and Virginia Tourism.

5) In consultation with the Consultants, the Scope of Work and payment schedule were revised according to the discussions that took place during the Kick-off meeting. The revise scope of work is attached.

Attachments:
1) Preliminary Research/Literature Review
2) Kick-off Meeting Agenda
3) Kick—off Meeting Summary
4) Final Contract and Scope of Work

Progress Report #4
Dulles Area Transportation Association
Multi-Modal Planning Grant

June 2009

Accomplishments and Milestones

1. The consultant completed the literature review and is in the process of developing “lessons learned” from the process. This will be part of a presentation anticipated for the next Project Team Meeting scheduled for July 9th.
2. DATA staff, in conjunction with the consultant, researched numerous greenhouse gas calculators and the methodologies that each employed in their calculations. In some instances, the organization or company that was “sponsoring” the calculator was contacted to ascertain additional information. This work addresses the mathematical foundations of greenhouse gas calculators and the development and marketing of GHG calculators. The next step will be a discussion of what factors will be used as inputs and what information will be derived as outputs.

3. Developed a potential list of national transportation and air quality experts to interview about the potential methodologies we are developing and to be briefed on “lessons learned” in their past endeavors. The preliminary list of interviewees includes (listed in no particular order): Bill Cowards, ICF International; Robert O’Loughlin, FHA, San Francisco Office; Eric Jones, University of California, Davis; Douglas Eisinger, Sonoma Technology; Caroline Rodier, University of California, Berkeley; Dan Sperling, University of California, Davis; Ed Coe, US EPA; Tina Hodges, U.S. DOT, FTA; Charlie Cunniff, Seattle Climate Partnership, Office of Sustainability & Environment; Amy Sturgill, Buckhead Area Transportation Management Assoc.; Kevin Afflerbaugh, ClimateSmart at Work, Boulder, CO; Kathryn Tholin, TravelMatters, Center for Neighborhood Technology; and, Jamie Cheney, Commute Seattle, Wash.

4. Developed a list of criteria for vetting the three test businesses/organizations that will be used as beta sites for the GHG calculator and employee survey. The criteria includes:
   a. Human Resources is willing to work with DATA consultants through the development process – formulating the calculator, surveying employees, and refining the calculator’s output.
   b. Company is large enough to have demonstrable impact on GHG emissions – for use in the future marketing of DATA GHG Calculator.
   c. Company name is recognizable – for use in the future marketing of DATA GHG Calculator.
   d. Company is willing to be aggressively profiled as an example for use in the future marketing of DATA GHG Calculator.
   e. The Company would be willing to ramp up employer-based TDM programs after benchmark use of calculator to hopefully show subsequent gains in output measures (lowering their corporate impact). Re-survey of employees/updated calculation of impact after a set amount of time (6 months) to show how much of an additional impact can be achieved (and set up cost-benefit analysis - to be discussed later).

Attachments:
1) Invoice For June, 2009
Accomplishments and Milestones

1. SRI and LDA staff conducted interviews of prominent national and international experts in clean air issues, GHG calculator development, and GHG program marketing. Interviews are proceeding with both the technical and marketing focuses. Highlights of these interviews will be presented to the Project Team in September.

2. On August 19th, members of the Project Team met with staff from the Virginia Department of Environmental Quality (DEQ). The objective for the meeting was to brief staff on the project and to explore the possibility of establishing DEQ support and eventual endorsement of GHG Calculator. Project Team members (Jim Larsen, Chris Arabia, and John Martin) met with DEQ staff members Steve Coe and David Ruble. The meeting went extremely well, with DEQ expressing great interest in the development and use of the calculator.

3. In a Project Team conference call on 8/26, members were briefed on the status of the expert interviews and were given a chance to discuss the criteria being used to identify and select beta sites. DATA staff continued to review information in the ACT Database to compile a list of ten prospective businesses to serve as participants in the study. The list of businesses was discussed among the Project Team and prioritized according to the criteria. DATA has been approaching these businesses to discuss the expectations that will be required of them, and to gauge their interest in participating as beta sites for the study.

4. Project Team members reviewed the presentation assembled to be used in introducing and recruiting businesses to participate as beta sites for the study. The presentation was also presented to DEQ staff during the 8/19 meeting. Several suggestions for improving the presentation were noted. A revised version of the presentation was subsequently distributed to Project Team members.

5. Development of the GHG Calculator is also currently underway. The Project Team will review calculator prototype at a meeting scheduled to be held on September 22 at the offices of SRI in Richmond.

Attachments:
1) Invoice For August 2009
2) Project Overview Presentation
3) August 26, 2009 Project Team Meeting Summary
Accomplishments and Milestones

1. SRI and LDA staff concluded interviews of prominent national and international experts in clean air issues, GHG calculator development, and GHG program marketing. A summary report of the interviews is being compiled, but an overview of the lessons learned were presented to the Project Team at the September 22nd meeting. From a marketing perspective, the lessons learned included: 1) Need to establish clear and defined targets; 2) Public/private participation is key; 3) Financial incentive programs are the easiest to implement; and 4) Other motivations for businesses include economic development, public relations, and improving organizational/employee benefits. From the technical interviews, the lessons learned included: 1) Strive for simplicity, but don’t sacrifice accuracy; 2) Base calculations on fuel saved rather than VMT/trips reduced; 3) Incorporate some measure of congestion; 4) Include emissions from transit; 5) Calculate CO2 equivalents; 6) Document methodology; and 7) Capitalize on feedback. A more detailed summary can be reviewed in the attached presentation that was presented at the meeting.

2. DATA staff has been contacting employers in the region to ascertain their interest in serving as a Beta site for the calculator. In early October staff will be meeting with three of the best candidates.

3. On September 22nd the Project Team met at SIR’s offices in Richmond. In attendance were Jim Larsen and Doug Pickford with DATA; Steve Coe and David Ruble with Virginia DEQ; Chris Arabia, DRPT; John Martin and Laura Turner Reid with SIR; and Lori Diggins, LDA Consulting. The meeting agenda included presentation on findings from the expert interviews (see #1 above), discussion of the methodologies and components of the GHG Calculator, recruitment of businesses for beta testing, schedule and next steps. Most of the meeting was dedicated to discussing the nuts and bolts of the calculator. A few important factors were highlighted that will differentiate the DATA Calculator from those that exist elsewhere today. These factors/elements include: 1) We will use data collected directly from employee surveys; 2) We will not use national statistics when relying on assumptions – instead we will incorporate regional data as defaults; 3) Most existing calculators use broad assumptions concerning non-SOV travel patterns – we will apply real results from local/regional data; 4) We will allow users access to a detailed explanation of the methodology behind the calculator; 5) We hope to have our calculator “endorsed” or “certified” by through either DEQ, TRB or other reputable organizations/agencies; and 5) We will include antidotal information that will spur businesses to action to reduce their carbon footprint; A meeting summary is attached with more details.
4. A letter was drafted and sent from Chris Arabia, DRPT to be sent to the Virginia Department of Environmental Quality formally asking for their participation in the project. The Project Team is hopeful that we will have VaDEQ officially involved with the project by mid Fall.

Attachments:
1) Invoice For September 2009
2) Presentation for September 22nd Project Team Meeting
3) September 22, 2009 Project Team Meeting Summary

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**Progress Report # 8**
**Dulles Area Transportation Association**
**Multi-Modal Planning Grant**

**October 2009**

**Accomplishments and Milestones**

1. SRI and LDA staff continued to develop the GHG Calculator. Data has been gathered for the Northern Virginia region to serve as default factors. A draft of the web-based calculator interface is underway, as well as the development of output reports.

2. A draft letter (see attached) was developed for DRPT to send to the Virginia Department of Environmental Quality (DEQ) formally requesting their participation in the project. The letter was reviewed and discussed by the Project Team during the October 10th teleconference.

3. On October 2nd, DATA staff met with Quest Diagnostic, Inc. to brief their Human Resources staff on the project and to ascertain their interest in serving as a beta testing site. After the briefing, DATA staff developed a Memorandum of Agreement and a Mutual Non-disclosure Agreement for Quest’s use. The two agreements are currently being reviewed by Quest’s management and it is very likely that Quest will serve as one of three testing sites.

4. The Project Team held a teleconference meeting on October 10th to review progress and gather comments and feedback on the base elements of the GHG Calculator. Jim Larsen and Doug Pickford with DATA; Steve Coe with Virginia DEQ; Chris Arabia, DRPT; John Martin and Laura Turner Reid with SIR; and Lori Diggins, LDA Consulting all participated in the conference call. The meeting agenda is attached.

5. On October 21st DATA staff conducted a briefing on the project for the DATA Executive Committee. The Executive Committee was informed of the progress made to date and solicited for determining if any of the companies present were interested in serving as a beta testing site. A few acknowledged interest and staff intends to meet with company representatives soon.
6. The consulting team produced the first draft to the employee survey for Project Team review. The survey instrument is being designed to be primarily web-based, whereby employees of any given company will be given a unique URL to access and fill out the survey. Paper copies of the survey can and will be produced if businesses prefer (or need) that method for dissemination. Staff is stressing that the survey be as brief as possible to increase the chances that employees will participate in the process. Staff and the consultants are also exploring having optional “modules” available that would be attached to the survey and would permit the business or agency to collect additional information.

7. On October 26th the Project Team met at SIR’s offices in Richmond. Jim Larsen and Doug Pickford with DATA; Steve Coe and David Ruble with Virginia DEQ; Chris Arabia, DRPT; John Martin and Laura Turner Reid with SIR; Stephen Evanko, Business Director; Environmental Sustainability Office for Capital One; and Lori Diggins, LDA Consulting were in attendance. The meeting focused on the first draft of the employee survey and the graphic user interface (GUI) being developed for the GHG calculator. A summary of the meeting is attached for more details.

Attachments:
1) Invoice For October 2009
2) Draft Letter From DRPT to VaDEQ
3) Draft Employee Survey Dated 10/29/09
4) Draft Employee Survey Highlights Report Dated 10/23/09
5) Draft Employee Survey Report Dated 10/23/09
6) Meeting Agenda October 26, 2009
7) October 26, 2009 Project Team Meeting Summary

Progress Report # 9
Dulles Area Transportation Association
Multi-Modal Planning Grant
November 2009

Accomplishments and Milestones

1. SRI and LDA staff continued to develop the GHG Calculator. Data has been gathered for the Northern Virginia region to serve as default factors. A draft of the web-based calculator interface is 95% complete, as well as the development of output reports. Draft copies of these products will be sent to the beta testing sites for review in December.

2. DATA staff participated in a conference call on November 6th with the staff from PB America (formerly Parsons Brinckerhoff) to ascertain their interest in serving as a beta testing site. PB America staff indicated that their corporate office was fully engaged in studying how to reduce their carbon footprints at numerous office sites.
across the U.S., but that their Herndon office was not currently one of those sites. They expressed a lot of interest in serving as a beta testing site as a means to get the Herndon office moving in the same direction as their other corporate locations. Subsequent to the conference call, a draft Memorandum of Agreement and a Mutual Non-disclosure Agreement were sent to PB America staff. On November 12th DATA received signed copies of the MOA and NDA, signaling PB America’s official inclusion as a beta testing site for the GHG calculator.

3. On November 18th DATA staff briefed the DATA Executive Committee on the progress of the project.

4. On November 19th DATA staff met with representatives of George Washington University to discuss their interest in serving as a beta testing site. Staff met with Meghan Chapple-Brown, Director of the Office of Sustainability, and Wendy Martino, Director of Real Estate Administration and Services. Both expressed great interest in the project. Subsequently a draft Memorandum of Agreement and Mutual Non-disclosure Agreements were sent to them for their review and consideration. DATA staff is hopeful that GW University’s Virginia Campus will serve as the third beta testing site.

5. A letter drafted for DRPT to be sent to the Virginia Department of Environmental Quality (DEQ) formally requesting their participation in the project was transmitted on November 23. DATA hopes to have a formal response from DEQ by the end of the calendar year indicating they are officially involved with the project.

6. On October 30th, DATA received signed copies of the Memorandum of Agreement and the Mutual Non-Disclosure Agreement from Quest Diagnostics, Inc. signaling their formal agreement to serve as one of DATA’s beta testing sites for the calculator.

7. Members of the Project Team held a teleconference meeting on October 5th to review progress on the project and to discuss next steps and future funding possibilities. Jim Larsen and Doug Pickford with DATA; John Martin and Laura Turner Reid with SIR; and Lori Diggins, LDA Consulting all participated in the conference call.

Attachments:
1) Invoice For November 2009

Progress Report # 11
Dulles Area Transportation Association
Multi-Modal Planning Grant

April 2010

Accomplishments and Milestones

DATA is pleased to provide for you an update on the progress made to date and tasks that yet need to be completed concerning the VDOT Multi-modal Planning Grant that DATA is
overseeing. Tasks completed to date include:

1) Research and summary of literature associated with the development of greenhouse gas emission calculators, methodologies for measurements, and studies that have examined the impact that transportation demand management strategies have on reducing a business or organization’s carbon footprint.

2) Interviews with nationally renowned technical and policy experts in the fields of greenhouse gas emissions, modeling and emission calculator development.

3) Development of an employee commuter survey instrument and report. Incorporation of the survey into a self-sustaining web-based application that can be accessed by a businesses employees through a unique url. The information gathered by the survey provides the basis for inputs into the GHG emissions calculator.

4) Development of a measurement methodology and a GHG emissions calculator that calculates the impact that TDM strategies have in reducing the GHG emissions as they relate to a businesses employee commutes. The Microsoft Excel based calculator was also uploaded and integrated into a web-based application.

5) Development of E³Calculator website. The website hosts the GHG emissions calculator and provides information on the project, participating organizations, why the effort is important and links to additional resources.

6) Two formal and one informal agreements with businesses to serve as beta testing sites for the website, survey and calculator. These businesses have agreed to participate in the project and to help identify issues and concerns as they utilize the website, survey and calculator.

Tasks that remain to be completed for the first phase of the project include:
1) Working with the beta test sites to workout the bugs in the website, survey and calculator;
2) Final revisions to the website, survey and calculator based on beta testing and internal review; and
3) Development of a final report that includes some baseline data for businesses in the DATA service area that examines the level of TDM use. The report will also include some hypothetical scenario(s) based on beta testing of the calculator that will examine the “what if” all businesses in Fairfax (or Loudoun) improved their carpools or another TDM strategies. What would the impact on GHG emissions in that jurisdiction? The report will also address next steps, including the development of a marketing strategy to be used in Phase II of the project that will ensure widespread publicity and distribution of the Calculator.

Attachments:
1) Invoice For December 2009 to March 30, 2010
APPENDIX B

SUMMARY OF EXPERT INTERVIEWS
As part of the DATA TDM Greenhouse Gas Emissions Project, SIR and LDA Consulting presented a recommended list of interview candidates derived from and based on literature review and knowledge of industry experts. The interview candidates were from three main areas of focus: science and calculation, government or regulatory, and marketing case studies.

The main goal of these interviews was to gain an understanding of the key issues to consider and any potential obstacles to anticipate, particularly among the experts in the area of science and calculation.

The marketing case study experts were interviewed to gain a better understanding of the strategies and successes/failures of outreach and marketing efforts by other organizations that have worked to engage businesses, property owners and commuters in reducing their carbon or GHG emissions through TDM or similar means.

SIR and LDA agreed to complete interviews among five candidates and provide a summary report of the interviews to DATA. Six interviews were completed. The following is a summary report of those interviews.

**INTERVIEWS WITH TDM EXPERTS:**

SIR conducted three interviews with key leaders of organizations identified in the background research as having and/or using GHG or carbon calculators to assess the impact of commutes on the environment. We made every attempt to seek organizations that are somewhat different geographically, and include different levels of transit access and use.
These interviews focused on:

- Organization Background
- Target Audience Engagement
- Incentives and Messaging

Amy Sturgill, Assistant Executive Director
Buckhead Area Transportation Management Association

Organization Background

The Buckhead Area Transportation Management Association (BATMA) is a partnership of businesses, public agencies and associations within the Buckhead community of Metro Atlanta. Since its inception in 1997, BATMA’s mission has been to provide relief to commuters, residents and visitors traveling to and within Buckhead. It employs a staff of six that supports employers, residents and property owners in the metro Atlanta area in outreach and enrollment to incentivize TDM for commuters.

Target Audience Engagement

While BATMA finds that initial interest is fueled by corporate Facilities and Human Resources departments, the data tends to be favored by leadership in Corporate Responsibility, Sustainability and Public Relations.

BATMA had a couple of busy years when gas prices spiked, as employer inquiries were fueled by employee demands and interest. In the current economy, interest has waned as employees have focused on their jobs and employers are cutting benefits and staff. Last year at ACT, they sponsored a panel with HR managers that addressed the implementation of their plans.

The enrollment process involves a meeting or series of meetings to understand employer needs and the extent to which they want to be involved in the process. Often, BATMA is simply brought in to provide informational materials or presentations for employees, whereas others result in full TDM plans. A BATMA TDM plan includes a survey of employees that discovers commute patterns, employee willingness to change and perceptions of incentives, and the likely success of subsidies and programs among that employee group. BATMA then makes a recommendation based on what the employer is able to contribute in terms of resources and subsidies, and potential participation by employees.

Incentives and Messaging

BATMA works with community and regional partners to improve mobility, accessibility and air quality by sponsoring programs and providing incentives to encourage commuters to take transit, carpool, vanpool, telework, bike and walk to work. Commuters who currently drive alone and begin carpooling, teleworking, using transit, walking or biking to work are
eligible to earn rewards including gift cards, gas cards and other discounts and prizes. They are also eligible to receive parking discounts for carpools or occasional drive alone days and free rides home via taxi in the event of an emergency.

The calculator on its Web site is used to drive interest, but enrolled participants (membership is not required) receive monthly reports on the emissions reductions, number of participants, number of commute modes used and the money saved by their employees commuting. This information is driven by reporting by employers and employees. This data has generated greater interest recently, as it also supports credits/points toward LEED certification.

The other benefits touted to employers include increased productivity, cost savings, free alternative work arrangement consulting, improved employee recruitment and retention, improved organizational morale, improved corporate image, enhanced perceptions of environmental commitment and reduced parking demand and costs.

There is a new Georgia Telework tax credit that allows employers to receive a tax credit for implementing a telework program at their worksite. Additionally, the Clean Air Campaign, in conjunction with BATMA, provides free consulting services to employers who are interested in starting or expanding a telework, flex-time and/or a compressed work week program.

Jamie Cheney, Director
Commute Seattle

Organization Background

Commute Seattle is an initiative of the Downtown Transportation Alliance (Downtown Seattle Association, King County Metro and the City of Seattle), a partnership formed to increase access to, through, and from the Center City. It is funded by the Downtown Transportation Alliance (DTA) to operationalize one key objective. The DTA established a significant goal to increase the use of non-single occupancy vehicle modes by six percentage points by 2015. Commute Seattle’s mission is to reduce drive-alone commutes into downtown Seattle by 4,185 by 2011, building to a total of 15,970 trips by 2015.

Target Audience Engagement

While Commute Seattle has been providing services since 2005 as the Urban Mobility Group, since January 2009 it has operated as Commute Seattle. The organization currently provides services to commuters, employers and property owners that enable the use or establishment of programs for transit.

In Seattle, employers with 100 or more employees are required by law to have a commute reduction plan in place, and therefore the target of Commute Seattle is small employers with less than 100 employees.
Commute Seattle offers commuters, employers and property owners the tools to reduce drive-alone commutes into downtown. Through their Web site and on-site programs, they provide tools and information to help employers and property owners establish a Commute Trip Reduction plan. They also provide commute and transit information to commuters.

**Incentives and Messaging**

Commute Seattle has also added a pledge component, where commuters can directly register and pledge to reduce their weekly trips in support of its goal.

Nearly 250 worksites in Seattle participate in commuter programs. At worksites that have participated since 1993, the drive-alone rate dropped from 47.4% in 1993 to 40.0% in 2007.

Commute Seattle primarily provides resources to employers about how they can use or establish programs to encourage employee participation in commute reduction programs. Generally, the two benefits that appeal to employers are the business component – such a program is a benefit to employees, or a PR component – supporting an interest in green measures or reduction of environmental impact.

**Rick Williams, Director**
Lloyd District Transportation Management Association

**Organization Background**

The Lloyd Transportation Management Association (TMA) began in 1994 to manage growth and economic development of an area of Portland with significant geographic, traffic and parking resource limitations. Its mission is to support and promote the economic vitality and livability of the Lloyd District through cooperative, business-supported programs promoting efficient, balanced transportation systems and land use patterns.

**Target Audience Engagement**

The Lloyd TMA has 71 member businesses representing approximately 9,000 employees. As a result of its efforts, drive alone trips have decreased from 60% in 1997 to 42% in 2007, a 30% decrease over eleven years.

Property owners and businesses in the Business Improvement District pay a fee, and as a result, all tenants and business in the area are members.

**Incentives and Messaging**

As benefits, members have access to a significantly discounted transit pass that
employers can purchase for employees, partnership opportunities, and significant bicycle infrastructure. In trade, when the organization was developed, the area property owners gave up the rights to develop parking and removed all free parking from the district.

Lloyd District TMA programs have directly resulted in an annual reduction of 3.8 million peak-hour vehicle miles traveled (2007 figure). That represents the removal of 988 vehicles from roads and freeways during the peak commute hour every day.

Mr. Williams wrote a white paper summarizing the impact of the Lloyd District TMA and it is provided as an Appendix.

**KEY MARKETING IMPLICATIONS**

1. Firm, clear and defined targets or goals are keys to success. Both Commute Seattle and Lloyd District areas have not only set goal targets for commute mode split, but they also calculated the impact and infrastructure needs that would result from not doing anything.

2. Champions of the cause/effort from both the private and public sector are key. Consider a “Charter Board” or other source of feedback and support, and invite not only employers but also local government to participate. The idea that our project was already planning to incorporate “beta” companies into our launch was very well received and praised for being part of the work plan.

3. An effort like this takes time, especially if it requires financial outlays of participating businesses. The Lloyd District TMA was established three years before its programs were implemented.

4. The easiest programs to implement are ones that create a financial incentive for employers. As a last resort, a mandate may be an alternative to assure compliance. However, there are also creative ways to illustrate the financial impact, in terms of encouraging property owners to separate parking from building leases, so that employers can better compare the costs of alternatives.

5. Other motivations for businesses include economic development issues, public relations, information on impact at the organizational level or addition of employee benefits. With many such programs providing documentation for LEED certification, outreach or case study profiles of “green” businesses, there are other opportunities to add value for employers.

**INTERVIEWS WITH EMISSIONS EXPERTS:**

Robert O’Loughlin, Team Leader, Air Quality Resource Center, Federal Highway Administration, San Francisco, CA
- Also Chair, Transportation Research Board’s Transportation and Air Quality Committee
- Primary expertise in mobile source modeling and air quality technologies
Douglas Eisinger, Director, Transportation Policy and Planning Group, Sonoma Technology, Petaluma, CA
- Broad expertise on air quality impacts from transportation programs.
- Selected as a national air quality expert by the AASHTO, Center for Environmental Excellence.
- Program Manager for the Univ. of California, Davis-Caltrans Air Quality Project.
- Previously Mobile Sources Section Chief for the US EPA.

These interviews focused on the following:
- Overall approach to calculation
- Variables important to “accurate” emission calculations
- Variables that could be excluded/adjusted to simplify calculation, without substantially degrading accuracy
- Current best practices for reporting GHG results
- Likely enhancements in emissions calculation that the calculation should accommodate

**Overall approach to calculation**
Both experts approved of the overall approach proposed for the calculator:
1) Survey employees to define current travel patterns
2) Compare mode split to previous/default patterns to determine change
3) Calculate the emissions reduced using emission factors specific to the types of changes made (e.g., mode change, time change, location change)

**Variables important to accurate calculations**
Most emissions calculators estimate emissions using driving VMT and aggregate emission factors. Both experts said this method, although simple and a reasonable approximation for regional use, leaves room for inaccuracies when applied at a site-level. A more accurate approach, using EPA-approved emission models (MOBILE6.2, EMFAC) incorporates measures of fuel consumption, determined by the following:
- Vehicle type (auto, SUV, light truck, hybrid)
- Age of vehicle
- Fuel type (e.g., diesel, premium or regular gasoline, hybrid)
- Distance of travel (VMT)
- Level of congestion on roads used/speed of travel
- Number of cold starts during the day (e.g., midday use of vehicle and drive alone access to rideshare/transit modes)

Emission models define the mix of vehicle and fuel types in the fleet and apply emission generation rate factors specific to this mix and to known travel conditions to determine emissions from particular cases.

**Variables that could be excluded/adjusted to simplify calculation**
Including all of these variables adds a significant layer of complexity to the calculation
and to the data that must be input to the calculation. They felt employers could provide some of these data for fleet vehicles but agreed that employers would not know any of this information about employee commuting. Further, even if they could determine the variables from employee surveys, it would be cumbersome to input the data. So they agreed some compromises were needed to make the models easy to use. The three “must have” inputs included:

- Vehicle type (auto, SUV, light truck, hybrid)
- Vehicle age
- Distance of travel (VMT)
- Level of congestion on roads used/speed of travel

They believed it was acceptable to omit fuel type, since the overwhelming share of commuting vehicles currently use gasoline and the emission factors don’t vary dramatically between regular and premium gasoline. One expert noted that the popularity of hybrid vehicles could require a change in the calculation over time, but felt this could be handled by including hybrid as a vehicle type.

They also felt the calculation could omit number of cold starts, since CO\textsubscript{2} emissions are primarily VMT-driven, rather than trip-driven. But both noted that if the calculation included some other pollutants (e.g., VOC and NOx), the calculation should include trips as well as VMT.

We discussed the issue of level of congestion at some length, due to concerns about how to measure it. Emission models typically define the percentages of travel/VMT that occur at various speeds, because emissions vary by travel speed. One expert felt it would be acceptable to use commuters’ average speed for this variable, defined as the travel time divided by the travel distance. The other expert felt it was important to try to incorporate a variable that defined “percent of trip on congested roads,” if it was possible to obtain the data from the employee survey.

**Current best practices for reporting GHG results**

The discussion on reporting included two components: what emissions should be reported and in what terms/units should emissions be reported?

On the first element – emissions included, the two experts agreed that CO\textsubscript{2} was overwhelming component of GHG – it accounts for 95% of GHG emissions – and must be measured directly. The other components of GHG – Nitrous Oxide-N\textsubscript{2}O, Methane-CH\textsubscript{4}, and Hydrofluorocarbon-HFCs – account for most of the remaining 5% of emissions. Because they are a small segment of the total and because it is much more complex to calculate these emissions directly, a widely accepted method is to factor the CO\textsubscript{2} emissions up to account for these additional pollutants. This method is approved by US EPA.

The second element related to the terms/units that should be reported. Three typical measures are currently used: carbon dioxide (CO\textsubscript{2}), carbon dioxide equivalents (CO\textsubscript{2}e) equivalent (CO2e) and carbon equivalents (CE). Both experts said either CO\textsubscript{2} or CO\textsubscript{2}e
equivalent would be appropriate. US EPA has used carbon equivalents for some applications but their Office of Transportation and Air Quality (OTAQ) is moving toward the CO$_2$ equivalent to be consistent with the international standard practice, approved by the Intergovernmental Panel on Climate Change (IPCC). With this metric, emissions other than CO$_2$ are translated into CO$_2$ equivalents to estimate the combined global warming potential of all GHGs.

**Likely enhancements in emissions calculation that the calculation should accommodate**

Both experts noted that the EPA will soon shift to a new emissions model, MOVES for transportation analysis. The model has several differences compared to MOBILE and EMFAC, with two additions being the inclusion of a hybrid vehicle option and changes in how cold starts are analyzed. The primary issue for the GHG calculator will be that the emission factors will change, but factors change annually anyway, due to changes in the fleet mix, so this would not require major adjustments to the calculator.

The only other change noted was increased use of ethanol and renewable fuels. One expert suggested these were not likely to be major issues in the short-term, so they could be omitted for now.

**Erica Jones**

*Researcher, Department of Civil and Environmental Engineering*

*University of California, Davis, Davis CA*

Erica Jones presented her paper, “So You Want to Calculate Your Footprint? Quality of Online Carbon Calculators?,” at the 2009 Transportation Research Board meeting. This paper evaluated methodologies and feedback mechanisms behind a range of carbon calculators to explain the reasoning for varied calculation results between calculators, looking at the transportation emissions in detail. The authors suggest some basic information that should be readily available for any calculator and provide a summary of calculator effectiveness based on user feedback and depth/breadth of calculator algorithms.

In the interview, we discussed
- Types of calculators
- Variables and issues covered in the emission calculations
- Minimum variables that should be included
- Observations on best practices and issues with potential relevance to employers and commuting travel

**Types of calculators**

All but one of the calculators estimated household carbon footprint, so most were much broader than our employer-focused calculator would be. But all included a component related to household travel, so this element was comparable to the commute travel objective of the DATA calculator.
Variables and issues covered

The travel elements of the calculators ranged from very elementary inputs (how many miles traveled annually) to moderately sophisticated inputs (type of vehicles, city vs. highway driving, level of vehicle maintenance, use of transit and rideshare/carpool in the calculation).

The author felt some of these advanced elements were important to include: type of vehicle, use of transit/ridesharing, city vs. highway (as measure of congestion); but that others, such as maintenance activities added complexity without value. With respect to ridesharing, however, she noted the potential difficulty of collecting vehicle details for cars/vans owned by rideshare partners.

A major issue observed was the wide range of results that were obtained. As noted, some models included few inputs, so the authors assumed the calculation applied emission factors, but many of the calculators did not include sufficient documentation for the researchers to determine what underlying calculation methodology was being used. For this reason, the author could not assess if a calculator’s results were based on reliable methods.

Variables that should be included

In her opinion, the calculation should account for vehicle type and some measure of fuel consumption, rather than be based solely on VMT. She also strongly recommended accounting for use of transit, if the calculator was to be applied in an urban area where transit was available. TDM analyses typically exclude transit as a “no vehicle” mode, but she felt it shouldn’t be omitted if transit is used by a significant segment of the population.

She also encouraged incorporating a time/speed of travel element, because it has a measurable impact on emissions produced but also because the time of travel can be influenced by employers through telework and work hours strategies.

Observations on best practices and employer/commuting issues

Single city vs. multiple cities – Some calculators were marketed as nationally-relevant, but the author felt these omitted too many variables that would be significant elements in emission calculation (e.g., congestion level, transit use, vehicle mix).

Documentation – The author noted the importance of defining the method used for the calculation and citing the source of assumptions and default values applied to simplify the method.

Use of survey data – The author agreed that using travel survey data could improve the accuracy of the calculation, but suggested some employees might be reluctant to report
data about personal vehicles and travel patterns in a survey that their employer sponsored. Most of the calculators reviewed were administered on-line with “anonymous” inputs. She thought that might produce greater reliability in inputs.

Other employer applications – We also discussed various additional employer travel activities the might be appropriate for the DATA calculator. She suggested that the EPA had defined a method to include business travel (or telecommunications replacement of business travel) in carbon footprint calculation. She also noted the growing interest among employers for LEEDs certification credits and said this could be an opportunity to market the calculator to employers.

Feedback – Finally, on a topic unrelated to emission calculation, the author noted that only a handful of the calculators offered feedback on how to reduce emissions. She considered this a lost opportunity to use the calculator as a teaching tool.

KEY CALCULATOR METHODOLOGY IMPLICATIONS

1. Strive for simplicity, but don’t ignore fundamentals of accuracy.
2. Base calculation on fuel saved, rather than on VMT/trips reduced alone. This requires input of additional details of vehicle type and more complex matrix of emission factors.
3. Try to incorporate some measure of congestion level – perhaps as speed or % of trip on congested roads.
4. Include emissions from transit in the calculator – don’t treat as “zero vehicle” mode.
5. Calculate “CO₂ equivalents” to account for gases other than CO₂ and to conform to international standards.
6. Thoroughly document methodology and assumptions.
7. Capitalize on feedback opportunity to educate employers.
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APPENDIX C

$E^3$CALC COMPONENTS AND BETA TEST SITE RESULTS
E³Calc Employee Survey (Paper Version)

1. Which of the following best describes your work schedule? (Mark your response with an “X”)
   - ___ Part-time schedule, fewer than 35 hours per week
   - ___ Full-time, 5 days per week, 35 or more hours per week
   - ___ Full-time, 4 days per week (4/40 compressed schedule)
   - ___ Full-time, 3 days per week (3/36 compressed schedule)
   - ___ 80 hours in two weeks with one weekday off every other week (9/80 compressed schedule)
   - ___ Other schedule, specify: __________________________________________________________

2. In a typical week, how many days are you assigned to work?
   [ENTER 0-7] __________

3. In a typical week, how many days do you work at your primary work location, for all or part of the day? If the number of days varies from one week to another, please enter the number that is most typical.
   [ENTER 0-7] __________

4. Thinking about a TYPICAL WEEK, Monday through Sunday, how do you get to work?

   In the top section of the table below, enter the number of days you typically use each of the listed types of transportation to get to your primary work location. If you use more than one type on a single day (e.g., walk to the bus stop, then ride the bus), count only the type you use for the longest distance part of your trip.

   In the bottom section of the table, report days you do NOT typically travel to your primary work location according to the reasons you don’t travel to that location (e.g., regular day off, telework, compressed schedule day off). If you are typically assigned to work only Monday through Friday, please mark 2 “regular days off” to account for Saturday and Sunday.

<table>
<thead>
<tr>
<th>Type of Transportation</th>
<th>Number of Days Used (0 to 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days you travel to your primary work location</td>
<td></td>
</tr>
<tr>
<td>a. Drive alone in a car, truck, SUV or ride in a taxi</td>
<td></td>
</tr>
<tr>
<td>b. Carpool or vanpool (with others 16 years or older)</td>
<td></td>
</tr>
<tr>
<td>c. Ride a bus, train, or subway</td>
<td></td>
</tr>
<tr>
<td>d. Walk or bicycle (entire trip from home to work)</td>
<td></td>
</tr>
<tr>
<td>e. Other(describe)</td>
<td></td>
</tr>
<tr>
<td>Days you do not travel to your primary work location</td>
<td></td>
</tr>
<tr>
<td>f. Telework all day at home</td>
<td></td>
</tr>
<tr>
<td>g. Work at another worksite in the Washington area or work out of the area (e.g., business trip)</td>
<td></td>
</tr>
<tr>
<td>h. Compressed schedule day off</td>
<td></td>
</tr>
<tr>
<td>i. Regular day off</td>
<td></td>
</tr>
<tr>
<td>Total Days</td>
<td>/</td>
</tr>
</tbody>
</table>

5. How often do you telework; that is, work at home or at a telework center for an entire work day, instead of traveling to your primary work location? (Mark your response with an “X”)
   - ___ Never                                    
   - ___ Occasionally, but less than once per month  
   - ___ 1–2 days a week                           
   - ___ 3–4 days a week                           
   - ___ 5 or more days a week                     
   - ___ Other                                    
   - ___ Don’t know                               
   - ___ Don’t know                               

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Dulles Area Transportation Association

IF YOU CARPOOL ONE OR MORE DAYS, PLEASE ANSWER QUESTIONS 6-8. OTHERWISE SKIP TO 9.

6 How do you usually get to your bus stop, train station, or where you meet your pool partners? (Circle your response)

___ Drive in my car and park
___ Walk
___ Am dropped off by friend/family member
___ Ride a bus
___ Ride a bicycle
___ Other, specify: ________________________

7 How far it is from your home to this location? _____ miles or ______ blocks

8 Including yourself, how many people usually ride in your carpool or vanpool? _____ people

9 When you work at your primary work location, at what time do you usually arrive at work and what time do you leave work? If your arrival or departure times vary from one day to the next, please enter what is most typical.

Arrive at work ___ : ___ a.m./p.m. Leave work ___ : ___ a.m./p.m.

10 How many minutes does your trip to this location usually take you? _____ minutes

11 For about how many minutes of your trip do you drive or ride on a road at less than 35 mph? If you travel at less than 35 miles per hour your entire trip, please enter the time of your entire commute.

Number of minutes at less than 35 miles per hour: _____ minutes

12 About how many miles is it from your home to your primary work location? _____ miles

13 How long have you been using the type(s) of transportation you currently use? _____ years/months

14 In the past year, did you make any of the following changes in the types of transportation you use to get to work? (Mark your response with an “X”)

<table>
<thead>
<tr>
<th>Type of Transportation</th>
<th>Started or tried</th>
<th>Used more</th>
<th>Did not start, try, or use more</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Drive alone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Carpool or vanpool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Ride a bus, train, or subway</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Walk or bicycle (entire trip to work)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Telework from home all day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Compressed work schedule</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IF YOU MADE ANY CHANGES, PLEASE ANSWER QUESTIONS 15-16. OTHERWISE SKIP TO 18.
15 Before you made this change, how many days in a typical week, Monday through Sunday, did you use each of the following types of transportation to get to work? Also indicate how many days you did NOT typically travel to your primary work location and the reasons for not traveling to that location.

<table>
<thead>
<tr>
<th>Type of Transportation</th>
<th>Number of Days Used (0 to 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days you traveled to your primary work location</td>
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</tr>
<tr>
<td>d. Walk or bicycle (entire trip from home to work)</td>
<td></td>
</tr>
<tr>
<td>e. Other (describe)</td>
<td></td>
</tr>
<tr>
<td>Days you <strong>did not</strong> travel to your primary work location</td>
<td></td>
</tr>
<tr>
<td>f. Telework all day at home</td>
<td></td>
</tr>
<tr>
<td>g. Work at another worksite in the Washington area or work out of the area (e.g., business trip)</td>
<td></td>
</tr>
<tr>
<td>h. Compressed work schedule day off</td>
<td></td>
</tr>
<tr>
<td>i. Regular day off</td>
<td></td>
</tr>
<tr>
<td><strong>Total Days</strong></td>
<td></td>
</tr>
</tbody>
</table>

16 What motivated you to make this change in how you traveled to work? ___________________________

17 How important were economic reasons, such as saving money or reducing your gas expense, in motivating you to make that switch? *(Circle your response)*

| ___ Very important | ___ Somewhat important | ___ Not at all important |

The following questions are for classification purposes ONLY. They will not be used to identify you personally in any way.

18 What is your zip code at home? ____________

19 Do you have a car available to you on a regular basis for your travel to work?

| ___ Yes |
| ___ No |
| ___ Available sometimes |

20 What year is that vehicle? ____________

21 What type is that vehicle?

| ___ Hybrid |
| ___ Small Car/Wagon |
| ___ Mid-size Car/Wagon |
| ___ Large Car/Wagon |
| ___ Small Van/SUV |
| ___ Mid-Large Van/SUV |
| ___ Small Pickup |
| ___ Mid-Large Pickup |
### A – Enter details of the types of transportation employees use to get to work now:

1. How many employees work at your work location?  
2. What types of transportation do employees use to travel to this work location now?  
   Enter percentages (in whole numbers) of employees' weekly commute trips made by the following types of transportation.  
   - Drive alone, including taxi  
   - Carpool or vanpool  
   - Ride a bus, train, subway  
   - Walk or bicycle  
   - Telework  
   - Compressed schedule days  
3. Average number of riders in carpools/vanpools:  
4. How do employees who use carpool/vanpool or transit get to the meeting point or the transit stop/station?  
   Percentage of employees who drive alone to the meeting point:  
   Average distance to the meeting point (miles):  

### B - Enter details of employees' travel distance and time:

5. How far do employees travel from home to work?  
   Average commute distance (miles):  
6. How long does it take employees to travel to work?  
   Average commute time (minutes):  
7. How much commute time do employees spend in congested traffic?  
   Average percentage of commute at less than 35 mph:  
8. What percentage of employees travel to work during the morning rush hour?  
   % of employees who arrive at work between 6:30 am and 9:30 am:  

### C – Enter details of employees’ vehicles:

9. What types of vehicles do employees who drive use for commuting?  
   - Hybrid  
   - Economy car  
   - Mid-size car  
   - Full-size car  
   - Small SUV or van  
   - Medium to large SUV or van  
   - Small pick-up truck  
   - Medium large pick-up truck  
10. Estimated average fuel economy  
   Average miles per gallon of employees’ vehicles (if known):
Step 1 - Enter information about employees current commute travel in the ORANGE highlighted boxes from your employee survey Summary Page (sections A, B, C)

Step 2 - Choose your comparison scenario (e.g., previous year survey, regional average, etc.) (Section D)

Step 3 - Enter the data for your comparison scenario in the GREEN highlighted boxes (Section E or F)

Step 4 - Enter expected commute changes from new transportation initiatives in the PURPLE highlighted boxes (Section G)

### A -

1. How many employees work at your work location
   - **100**

2. What types of transportation do employees use to travel to this work location
   - **Use Typical**
   - **Value**
   - **Drive alone** 71% Y
   - **Carpool or vanpool** 7% Y
   - **Ride bus, train,** 14% Y
   - **Walk or bicycle** 2% Y
   - **Telework** 5% Y
   - **Compressed** 1% Y
   - **Total** 100% Y

3. Average number of riders in carpools/vanpools
   - **3.0** Y

4. How do employees who use carpool/vanpool or transit get to the pool
   - **Percentage of employees who drive alone to the meeting point** 2% Y
   - **Average distance to the meeting point (miles)** 1.7 Y

### B -

5. How far do employees travel from home to work?
   - **Average commute distance (miles)** 13.8 Y

6. How long does it take employees to travel to work?
   - **Average commute time (minutes)** 31 Y

7. How much commute time do employees spend in congested traffic?
   - **Average percentage of commute at less than 35 mph** 45% Y

8. What percentage of employees travel to work during the morning rush hour
   - **Percentage of employees who arrive at work between 6:30 am and 9:30 am** 78% Y

### C -

9. What types of vehicles do employees who drive use for commuting?
   - **Use Typical**
   - **Value**
   - **Percentages of employees who use the following vehicle types to get to work**
### Estimated average fuel economy (mpg)

Average miles per gallon of employees' vehicles (if known)

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>Percentage</th>
<th>YN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid</td>
<td>7%</td>
<td>Y</td>
</tr>
<tr>
<td>Economy car</td>
<td>20%</td>
<td>Y</td>
</tr>
<tr>
<td>Mid-size car</td>
<td>16%</td>
<td>Y</td>
</tr>
<tr>
<td>Full-size car</td>
<td>8%</td>
<td>Y</td>
</tr>
<tr>
<td>Small SUV or van</td>
<td>8%</td>
<td>Y</td>
</tr>
<tr>
<td>Medium to large</td>
<td>28%</td>
<td>Y</td>
</tr>
<tr>
<td>Small pick-up truck</td>
<td>3%</td>
<td>Y</td>
</tr>
<tr>
<td>Medium to large</td>
<td>10%</td>
<td>Y</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

#### Ozone Pollutant Emissions

- **NOx - Oxides of Nitrogen (daily pounds)**: 1.91
- **VOC - Volatile Organic Compounds (daily pounds)**: 1.23

#### Greenhouse Gases

- **CO2 * (annual pounds)**: 2070

#### Types of transportation used by employees in the [COMPARISON]

Percentages of employees' weekly commute trips made by the following types

<table>
<thead>
<tr>
<th>Mode of Transportation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>100%</td>
</tr>
<tr>
<td>Carpool or vanpool</td>
<td>0%</td>
</tr>
<tr>
<td>Ride bus, train, or</td>
<td>0%</td>
</tr>
<tr>
<td>Walk or bicycle</td>
<td>0%</td>
</tr>
<tr>
<td>Telework</td>
<td>0%</td>
</tr>
<tr>
<td>Compressed</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

#### Average number of riders in carpools/vanpools

- **0.0**

#### Employees' access to carpool/vanpool meeting point or transit stop/station
### Dulles Area Transportation Association

<table>
<thead>
<tr>
<th>Percentage of employees who drove alone to the meeting point</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average distance to the meeting point (miles)</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15 Commute distance from home to work</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average commute distance (miles)</td>
<td>15.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>16 Home to work travel time</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average commute time (minutes)</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>17 Commute time spent in congested traffic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average percentage of commute at less than 35 mph</td>
<td>76%</td>
</tr>
</tbody>
</table>

### How many vehicle trips do your employees remove from the roads?

<table>
<thead>
<tr>
<th>Current daily vehicle trips to and from your location</th>
<th>147.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous/comparison daily vehicle trips to and from your location</td>
<td>200.0</td>
</tr>
<tr>
<td>Daily one-way vehicle trips reduced by your employees</td>
<td>52.5</td>
</tr>
<tr>
<td>Daily “cars off the road”</td>
<td>26.2</td>
</tr>
</tbody>
</table>

### Commute Vehicle Miles Traveled (VMT) Reduced

<table>
<thead>
<tr>
<th>Current daily commute miles driven by your employees</th>
<th>2,036</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous/comparison daily commute miles driven by your employees</td>
<td>3,020</td>
</tr>
<tr>
<td>Daily commute miles reduced by your employees</td>
<td>984</td>
</tr>
</tbody>
</table>

### Ozone Pollutant Emissions Reduced

<table>
<thead>
<tr>
<th>NOx - Oxides of Nitrogen (daily pounds)</th>
<th>0.90</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC - Volatile Organic Compounds (daily pounds)</td>
<td>0.53</td>
</tr>
</tbody>
</table>

### Greenhouse Gases Reduced

| CO₂* (annual pounds)                                      | 1000.14 |

### What types of transportation did employees use to travel to this work

<table>
<thead>
<tr>
<th>Percentage of employees' previous weekly commute trips made by the</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>77%</td>
</tr>
<tr>
<td>Carpool or vanpool</td>
<td>9%</td>
</tr>
<tr>
<td>Ride bus, train,</td>
<td>5%</td>
</tr>
<tr>
<td>Walk or bicycle</td>
<td>4%</td>
</tr>
<tr>
<td>Telework</td>
<td>3%</td>
</tr>
<tr>
<td>Compressed</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Average number of riders in carpool/vanpools

| 3.2 |

### How did employees who used carpool/vanpool or transit get to the pool

<table>
<thead>
<tr>
<th>Percentage of employees who drove alone to the meeting point</th>
<th>52%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average distance to the meeting point (miles)</td>
<td>3.2</td>
</tr>
</tbody>
</table>
### Dulles Area Transportation Association

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How far did employees travel from home to work?</td>
<td>15.1</td>
</tr>
<tr>
<td>How long did it take employees to travel to work?</td>
<td>35</td>
</tr>
<tr>
<td>How much commute time did employees spend in congested traffic?</td>
<td>45%</td>
</tr>
</tbody>
</table>

#### How many vehicle trips do your employees remove from the roads?

<table>
<thead>
<tr>
<th>Type</th>
<th>Current</th>
<th>Previous/Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily vehicle trips to and from your location</td>
<td>147.5</td>
<td>160.3</td>
</tr>
<tr>
<td>Daily one-way vehicle trips reduced by your employees</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td>Daily “cars off the road”</td>
<td>6.4</td>
<td></td>
</tr>
</tbody>
</table>

#### Commute Vehicle Miles Traveled (VMT) Reduced

<table>
<thead>
<tr>
<th>Type</th>
<th>Current</th>
<th>Previous/Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current daily commute miles driven by your employees</td>
<td>2,036</td>
<td></td>
</tr>
<tr>
<td>Previous/comparison daily commute miles driven by your employees</td>
<td>2,420</td>
<td></td>
</tr>
<tr>
<td>Daily commute miles reduced by your employees</td>
<td>384</td>
<td></td>
</tr>
</tbody>
</table>

#### Ozone Pollutant Emissions Reduced

<table>
<thead>
<tr>
<th>Type</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx - Oxides of Nitrogen (daily pounds)</td>
<td>0.34</td>
</tr>
<tr>
<td>VOC - Volatile Organic Compounds (daily pounds)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

#### Greenhouse Gases Reduced

<table>
<thead>
<tr>
<th>Type</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 - (annual pounds)</td>
<td>389.99</td>
</tr>
</tbody>
</table>

#### What types of transportation will employees use to travel to this work

<table>
<thead>
<tr>
<th>Type</th>
<th>Expected</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>60%</td>
<td>71%</td>
</tr>
<tr>
<td>Carpool or vanpool</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>Ride bus, train,</td>
<td>20%</td>
<td>14%</td>
</tr>
<tr>
<td>Walk or bicycle</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>Telework</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Compressed</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

| Average number of riders in carpools/vanpools | 0.0 | 3.0 |

<table>
<thead>
<tr>
<th>How will employees who use carpool/vanpool or transit get to the pool</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of employees who drive alone to the meeting point</td>
<td>0%</td>
<td>12%</td>
</tr>
<tr>
<td>Average distance to the meeting point (miles)</td>
<td>0.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>

How far will employees travel from home to work?
### Dulles Area Transportation Association

<table>
<thead>
<tr>
<th>Question</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average commute distance (miles)</td>
<td>15.1</td>
</tr>
<tr>
<td>Average commute time (minutes)</td>
<td>35</td>
</tr>
<tr>
<td>Average percentage of commute at less than 35 mph</td>
<td>35%</td>
</tr>
</tbody>
</table>

**How many vehicle trips do your employees remove from the roads?**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current daily vehicle trips to and from your location</td>
<td>147.5</td>
</tr>
<tr>
<td>Expected daily vehicle trips to and from your location</td>
<td>127.5</td>
</tr>
<tr>
<td>Daily one-way vehicle trips reduced by your employees</td>
<td>20.0</td>
</tr>
<tr>
<td>Daily “cars off the road”</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**Commute Vehicle Miles Traveled (VMT) Reduced**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current daily commute miles driven by your employees</td>
<td>2,036</td>
</tr>
<tr>
<td>Previous/comparison daily commute miles driven by your employees</td>
<td>1,926</td>
</tr>
<tr>
<td>Daily commute miles reduced by your employees</td>
<td>110.5</td>
</tr>
</tbody>
</table>

**Ozone Pollutant Emissions Reduced (daily pounds)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx - Oxides of Nitrogen</td>
<td>0.12</td>
</tr>
<tr>
<td>VOC - Volatile Organic Compounds</td>
<td>0.11</td>
</tr>
</tbody>
</table>

**Greenhouse Gases Reduced (daily pounds)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2 *</td>
<td>112.38</td>
</tr>
</tbody>
</table>

**Enter your estimated annual cost for each of the following commute program**

**Staff - Directly Assigned to Commute Program**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary for staff responsible for program development, promotion,</td>
<td>$-</td>
</tr>
<tr>
<td>Fringe benefit cost for program staff</td>
<td>$-</td>
</tr>
</tbody>
</table>

**Administrative Support**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office space and equipment for program staff</td>
<td>$-</td>
</tr>
<tr>
<td>Office expenses dedicated to program (e.g., phone, copies, supplies, etc)</td>
<td>$-</td>
</tr>
<tr>
<td>Training / education / publications for program staff</td>
<td>$-</td>
</tr>
<tr>
<td>Support time from other departments (e.g., personnel, marketing, web support)</td>
<td>$-</td>
</tr>
<tr>
<td>Payments to outside vendors for administrative support (e.g., subsidy)</td>
<td>$-</td>
</tr>
</tbody>
</table>

**Marketing / Promotional Expenses**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside vendor development of informational materials</td>
<td>$-</td>
</tr>
<tr>
<td>Production / printing of informational materials</td>
<td>$-</td>
</tr>
<tr>
<td>Special events (e.g., food, rentals, displays, prizes, give-aways)</td>
<td>$-</td>
</tr>
</tbody>
</table>

**Commute Financial Incentives / Program Services**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing cash subsidies (e.g., monthly transit pass discounts, vanpool</td>
<td>$-</td>
</tr>
<tr>
<td>Other incentives (e.g., quarterly carpool oil change vouchers, free cafeteria)</td>
<td>$-</td>
</tr>
<tr>
<td>Guaranteed Ride Home taxi / rental car trips (vendor cost)</td>
<td>$-</td>
</tr>
</tbody>
</table>

**Facilities / Vehicles / Equipment**
### Dulles Area Transportation Association

- Vehicle leasing / insurance / maintenance / depreciation (e.g., vanpools, bicycle racks / support facilities, signs / striping (e.g., parking facilities), telework equipment, transit stop signs / shelters, information kiosks / displays)

**Other**
- Other costs not defined above

**Estimated Total Annual Cost**

**Annual Cost Savings**

*You might generate cost savings from your program, such as reduced or productivity increases. If so, enter these annual savings here:*

**ESTIMATED NET COST (Expenses - Cost savings)**

**Program Cost Per Benefit**
- Cost per vehicle trip reduced
- Cost per commute mile reduced
- Cost per pound of NOx reduced
- Cost per pound of VOC reduced
- Cost per pound of greenhouse gases (CO2) reduced
Summary Report

Parsons Brinckerhoff
Employee Commute Survey and Emissions Analysis

DULLES AREA TRANSPORTATION ASSOCIATION
August 4, 2010
Background
Between June 1 and June 18, 2010, employees at Parson Brinckerhoff’s Herndon and District of Columbia offices participated in a survey to ascertain how they travel to and from work. The results of this survey are summarized in this report, and were used as input to E³Calc, a calculator that analyzes the employee commute information to: 1) establish a baseline for the amount of CO₂ that is emitted as a result of employee commutes; 2) determines the impact that non-single occupant vehicle travel has on the businesses CO₂ emissions; and 3) allows for comparisons to a situation where everyone at the site drove alone to work, or to an average business in the locality in which the business is located. Overall, E³Calc allows a business to analyze the impact that transportation demand management (TDM) strategies have in reducing the carbon footprint of office locations.

For this summary, the employee survey data was analyzed in E³Calc and compared to what the carbon footprint would be at each location if all employees drove to work alone in a vehicle. The results are summarized below.

Employee Survey Highlights

- The response rates to the surveys conducted at the Herndon and DC offices were very good. DATA collected responses from 56.25% of the employees in Herndon, and 47.61% in DC.

- Seven percent of the DC employees reported regularly using telework, only 1 percent of the employees at Herndon used telework.

- Nine out of ten (92%) of Herndon employees drive alone to work. One in ten at the DC office drive alone to work.

- The average distance that Herndon employees commute to work is almost double the distance that DC employees commute (18.1 v. 9.7 miles). However, the average time that DC employees commute to work is longer than their Herndon counterparts. (36 v. 34.9 minutes).

- Eight percent of the DC employees and 5% of the Herndon employees commute via hybrid vehicle. The average fuel economy for employee vehicles in Herndon was 19.8 mpg, and 21.4 mpg in DC.
Emissions Analysis Highlights

- Current emissions from employee commute’s at the Herndon office contribute 679 tons of CO$_2$ to the region’s atmosphere annually, which is approximately 6% less than if all employees drove alone to work everyday.

- Current emissions from employee commute’s at the DC office contribute 14 tons of CO$_2$ to the region’s atmosphere annually, an 88% reduction in emissions if all DC employees drove alone to work every day.

- Current commuting patterns at the Herndon office reduce total daily vehicle trips by 16 (removing 8 daily cars) and reduce daily vehicle miles traveled (VMT) by 288 miles. Annually, that reduces daily vehicle trips by 4,160 and VMT by 74,880 miles.

- Current commuting patterns at the DC office reduce total vehicle trips by 74 (removing 37 cars from the road) and reduce VMT by 718 miles. Annually, the DC employees eliminate 19,240 daily vehicle trips and VMT in the region by 186,680 miles.

### Parsons Brinckerhoff - Employee Commute Emissions Analysis

<table>
<thead>
<tr>
<th></th>
<th>Total Daily Vehicle Trips</th>
<th>Annual Vehicle Trips</th>
<th>Daily “Cars off Road”</th>
<th>Annual “Cars off Road”</th>
<th>Commute Miles Driven (VMT) By Employees</th>
<th>Annual VMT By Employees</th>
<th>Daily Pounds of GHG Emissions (CO$_2$ Equivalents)</th>
<th>Annual Tons of GHG Emissions (CO$_2$ Equivalents)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Herndon Office</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Drive Alone</td>
<td>288</td>
<td>74,880</td>
<td>5,184</td>
<td>1,347,840</td>
<td>5,533</td>
<td>719</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Commuting Status</td>
<td>272</td>
<td>70,720</td>
<td>4,896</td>
<td>1,272,960</td>
<td>5,226</td>
<td>679</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction Due to TDM Strategies</td>
<td>16</td>
<td>4,160</td>
<td>8</td>
<td>7,040</td>
<td>288</td>
<td>107</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td><strong>DC Office</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Drive Alone</td>
<td>84</td>
<td>21,840</td>
<td>815</td>
<td>211,900</td>
<td>870</td>
<td>113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Commuting Status</td>
<td>10</td>
<td>2,600</td>
<td>97</td>
<td>25,220</td>
<td>104</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction Due to TDM Strategies</td>
<td>74</td>
<td>19,240</td>
<td>37</td>
<td>9,620</td>
<td>718</td>
<td>766</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
### A - Enter details of the types of transportation employees use to get to work now:

1. How many employees work at your work location? 144 Respondents
   Margin of error +/- 7.2

2. What types of transportation do employees use to travel to this work location now?
   Enter percentages (in whole numbers) of employees' weekly commute trips made by the following types of transportation.

   - Drive alone, including taxi: 92
   - Carpool or vanpool: 6
   - Ride a bus, train, subway: 1
   - Walk or bicycle: 1
   - Telework: 1
   - Compressed schedule days: 1

3. Average number of riders in carpools/vanpools: 2

4. How do employees who use carpool/vanpool or transit get to the meeting point or the transit stop/station?
   Percentage of employees who drive alone to the meeting point: 17

   Average distance to the meeting point (miles): 8.4

### B - Enter details of employees' travel distance and time:

5. How far do employees travel from home to work?
   Average commute distance (miles): 18.1

6. How long does it take employees to travel to work?
   Average commute time (minutes): 34.9

7. How much commute time do employees spend in congested traffic?
   Average percentage of commute at less than 35 mph: 45

8. What percentage of employees travel to work during the morning rush hour?
   % of employees who arrive at work between 6:30 am and 9:30 am: 92

### C - Enter details of employees' vehicles:

9. What types of vehicles do employees who drive use for commuting?

   - Hybrid: 5
   - Small car/wagon: 33
   - Mid-size car/wagon: 23
   - Full-size car/wagon: 3
   - Small SUV or van: 18
   - Medium to large SUV or van: 13
   - Small pick-up truck: 2
   - Medium large pick-up truck: 3

10. Estimated average fuel economy
    Average miles per gallon of employees' vehicles (if known): 19.8

Office Location: Herndon
E³Calc
The Best Practice in Calculating Employee Emissions and Environmental Impact

Calculator Results for Your Worksite
These results represent typical commute characteristics based on 144 employees commuting to work in your area.

- How many vehicle trips do your employees take?
  - Current daily vehicle trips to and from your location: 272
  - Daily one-way vehicle trips by your employees: 136
  - Commute Vehicle Miles Traveled (VMT)
  - Current daily commute miles driven by your employees: 4856

- Ozone Pollutant Emissions (daily pounds)
  - NOx (Oxides of Nitrogen) emissions, in pounds: 4.49
  - VOC (Volatile Organic Compounds) emissions, in pounds: 2.68

- CO₂ equivalent emissions (includes CO₂ and other greenhouse gases):
  - 5226

If you have questions about how to use this calculator, please contact the Southeastern Institute of Research, Inc. at Feedback4@iresearch.com.

© 2006, 2010 Dulles Area Transportation Association
Calculator Results For Your Worksite

These results represent typical commute characteristics based on 144 employees commuting to work in your area.

How many vehicle trips do your employees remove from the roads?

Current daily vehicle trips to and from your location: 272
Comparison daily vehicle trips to and from your location: 288
Daily one-way vehicle trips reduced by your employees: 16
Percent of daily one-way vehicle trips reduced by your employees: 6%
Daily “cars off the road”: 8

Commute Vehicle Miles Traveled (VMT) Reduced

Current daily commute miles driven by your employees: 4896
Comparison daily commute miles driven by your employees: 5184
Percent daily commute miles driven by your employees: 6%
Daily commute miles reduced by your employees: 288

Ozone Pollutant Emissions Reduced (daily pounds)

NOx (Oxides of Nitrogen) reduced, in pounds: 0.26
Percent NOx (Oxides of Nitrogen) reduced: 6%
VOC (Volatile Organic Compounds) reduced, in pounds: 0.15
Percent VOC (Volatile Organic Compounds) reduced: 6%
CO2 equivalent emissions (Includes CO2 and other greenhouse gases) reduced: 367.4
Percent CO2 equivalent emissions (Includes CO2 and other greenhouse gases) reduced: 6%

Continue
## A - Enter details of the types of transportation employees use to get to work now:

1. **How many employees work at your work location?**
   - 42 Respondents
   - Margin of error +/- 16.0

2. **What types of transportation do employees use to travel to this work location now?**
   - Enter percentages (in whole numbers) of employees' weekly commute trips made by the following types of transportation:
     - 10 Drive alone, including taxi
     - 3 Carpool or vanpool
     - 56 Ride a bus, train, subway
     - 24 Walk or bicycle
     - 7 Telework
     - Compressed schedule days

3. **Average number of riders in carpool/vanpool:**
   - 2

4. **How do employees who use carpool/vanpool or transit get to the meeting point or the transit stop/station?**
   - Percentage of employees who drive alone to the meeting point:
   - 25
   - Average distance to the meeting point (miles):
   - 3.8

## B - Enter details of employees' travel distance and time:

5. **How far do employees travel from home to work?**
   - Average commute distance (miles):
   - 3.7

6. **How long does it take employees to travel to work?**
   - Average commute time (minutes):
   - 36

7. **How much commute time do employees spend in congested traffic?**
   - Average percentage of commute at less than 35 mph:
   - 45

8. **What percentage of employees travel to work during the morning rush hour?**
   - % of employees who arrive at work between 6:30 am and 9:30 am:
   - 35

## C - Enter details of employees' vehicles:

9. **What types of vehicles do employees who drive use for commuting?**
   - 8 Hybrid
   - 31 Small car/wagon
   - 31 Mid-size car/wagon
   - Full-size car/wagon
   - 30 Small SUV or van
   - Medium to large SUV or van
   - Small pick-up truck
   - Medium large pick-up truck

10. **Estimated average fuel economy**
    - Average miles per gallon of employees' vehicles (if known):
    - 21.4

Office Location: District of Columbia
Calculator Results for Your Worksite

These results represent typical commute characteristics based on 42 employees commuting to work in your area.

How many vehicle trips do your employees take?
Current daily vehicle trips to and from your location: 10
Daily one-way vehicle trips by your employees: 5
Commute Vehicle Miles Traveled (VMT)
Current daily commute miles driven by your employees: 97
Ozone Pollutant Emissions (daily pounds)
NOx (Oxides of Nitrogen) emissions, in pounds: 0.09
VOC (Volatile Organic Compounds) emissions, in pounds: 0.07
CO₂ equivalent emissions (includes CO₂ and other greenhouse gases): 104

Continue
### E3Calc

The Best Practice In Calculating Employee Emissions and Environmental Impact

**Calculator Results For Your Worksite**

These results represent typical commute characteristics based on 42 employees commuting to work in your area.

**How many vehicle trips do your employees remove from the roads?**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current daily vehicle trips to and from your location:</td>
<td>10</td>
</tr>
<tr>
<td>Comparison daily vehicle trips to and from your location:</td>
<td>84</td>
</tr>
<tr>
<td>Daily one-way vehicle trips reduced by your employees:</td>
<td>74</td>
</tr>
<tr>
<td>Percent of daily one-way vehicle trips reduced by your employees:</td>
<td>88%</td>
</tr>
<tr>
<td>Daily &quot;cars off the road&quot;:</td>
<td>37</td>
</tr>
</tbody>
</table>

**Commute Vehicle Miles Traveled (VMT) Reduced**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current daily commute miles driven by your employees:</td>
<td>97</td>
</tr>
<tr>
<td>Comparison daily commute miles driven by your employees:</td>
<td>815</td>
</tr>
<tr>
<td>Percent daily commute miles driven by your employees:</td>
<td>88%</td>
</tr>
<tr>
<td>Daily commute miles reduced by your employees:</td>
<td>718</td>
</tr>
</tbody>
</table>

**Ozone Pollutant Emissions Reduced (daily pounds)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx (Oxides of Nitrogen) reduced, in pounds:</td>
<td>0.7</td>
</tr>
<tr>
<td>Percent NOx (Oxides of Nitrogen) reduced:</td>
<td>778%</td>
</tr>
<tr>
<td>VOC (Volatile Organic Compounds) reduced, in pounds:</td>
<td>0.5</td>
</tr>
<tr>
<td>Percent VOC (Volatile Organic Compounds) reduced:</td>
<td>714%</td>
</tr>
<tr>
<td>CO2 equivalent emissions (includes CO2 and other greenhouse gases) reduced:</td>
<td>766.38</td>
</tr>
<tr>
<td>Percent CO2 equivalent emissions (includes CO2 and other greenhouse gases) reduced:</td>
<td>737%</td>
</tr>
</tbody>
</table>

[Continue]

If you have questions about how to use this calculator, please contact the Southeastern Institute of Research, Inc. at Feedback@drresearch.com.

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APPENDIX D

LITERATURE REVIEW
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Evaluating the Effectiveness of Transportation Demand Management (TDM) Strategies in Reducing Greenhouse Gas (GHG) Emissions in Northern Virginia

Research/Literature Review

June 30, 2010

Funded by:
The Virginia Department of Transportation’s Multi-Modal Grant Program
OVERVIEW

The Dulles Area Transportation Association (DATA) investigated some of the most recent research in an attempt to ascertain whether any government agencies, non-governmental organizations, universities or private businesses have evaluated the effectiveness and cost efficiency of transportation demand management (TDM) strategies in reducing greenhouse gas (GHG) emissions. Although there has been substantial previous research in air quality impacts and techniques for reducing GHG emissions, very little of this research has been specifically focused on TDM’s effectiveness in reducing GHG emissions.

In researching the cost effectiveness of TDM strategies, DATA found some very applicable studies. Specifically, the Los Angeles County Metropolitan Transportation Authority conducted a series of studies in the mid 1990’s that evaluated forty TDM demonstration projects. Among other elements, the studies “determined the cost-effectiveness of TDM strategies that reduce or eliminate vehicle trips, vehicle miles traveled, and vehicular emissions.” The sources of information contained herein represents DATA’s research into existing studies and sources of information that outline recent research into the cost-effectiveness of TDM strategies in reducing GHG emissions.

This preliminary literature review is divided into four categories: 1) Case Studies, Analysis and Reports; 2) Useful Websites or GHG Related Calculators; 3) Local Sources of Information; and 4) Miscellaneous Information of Potential Interest.

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Miscellaneous Information of Potential Interest ..................................... 14
DULLES AREA TRANSPORTATION ASSOCIATION

CASE STUDIES, ANALYSIS AND REPORTS


Provides a brief review of climate action at the state level. It also provides information and a table on eighteen specific TDM strategies and their effectiveness in six states’ plans.


This two-page report argues that using public transportation saves households more money than driving. It provides a table of the top twenty U.S. metropolitan areas household average annual and monthly savings as well as methodology used to back up their statistics and claims.


An analysis of car sharing. Chapter four, in particular (starting on page 104) discusses the impacts of car-sharing on transportation costs.


This study was conducted to examine potential for University California, Davis (UCD) to invest in expanding TDM programs. The study researches a baseline, or “status quo” scenario, in which UCD would maintain their programs at current per capita level and compare it to several idea scenarios in order to calculate whether UCD can realizes a net savings by increasing expenditures on TDM programs and decreasing expenditures on new parking. The study includes TDM expansion options and a comprehensive cost analysis. It also includes a comprehensive appendix including parking projections, comparison of TDM projects at different universities and cost analysis calculations and background data.

This report focuses on demand side strategies to address transportation issues due to urban growth. This study provides an overview of demand-side strategies, and also includes a substantial amount of case studies including TDM applications in: cities (including those who utilize employee based commute programs and transportation corridor planning and construction mitigation); universities; tourist sites; and special events (i.e. Olympics and concerts). These case studies report on the role of TDM costs and benefits and ridership and tax incentives. It also includes a section on international experiences using demand-side management.


This report explains how communities benefit from public transportation via increased value and income for property owners (since they argue public transportation increases land value) and enhanced tax revenues for local governments.


This study examines the impact of telecommuting on VMT of personal transportation through a multivariate time series analysis of aggregate nationwide data spanning 1966-1999 for all variables with the intention of providing new insight into the relationship between tele-commuting and travel at the aggregate level. The results suggest a reduction in annual VMT at .8% or less and the authors argue that even though the impacts are small, when informally compared to similar reductions in VMT due to public transportation ridership, tele-commuting appears to be far more cost-effective in terms of public sector experiences.


This analysis includes results of initiatives led by federal agencies promoting programs to encourage federal employees to get to and from work other than by single occupancy vehicles. Programs include transit passes/cash subsidies
and/or providing spaces for bicyclists. The report includes a description of the Commission’s Mass Transit Subsidy Program as well as an analysis of a survey they conducted (including charts and statistics) on the costs and benefits of five mass transit subsidy alternatives. The report concludes with several alternatives to what is currently (at the time of this report) being done and its cost/benefits as well as recommendations for future programs.


This report summarizes the current trends and demographics of telecommuting. It also examines the literature and data related to telecommuting as well as discusses the environmental, energy and economic related benefits of telecommuting with general macro-level statistics. It also compares the transportation impacts on the basis of flexibility, general tax subsidies and commuter costs of telecommuting to other modes of alternative transportation such as public transportation and bike riding.


A guidebook for employee transportation coordinators (ETC) that provides different TDM options/programs for a business. The guidebook also instructs the ETC on how to create a tailored specific program, how one should measure and track success. It also describes the benefits and impact of commute alternatives. This report may be most beneficial in that it provides several testimonials from businesses who already implement alternative commute programs (including costs and savings).


A presentation given by two Transportation Directors from the LA/San Francisco area. The presentation is a case study that focuses on UCLA’s (including their five campuses and two hospitals) current TDM methods and future TDM goals. Not only do they include historical transportation trends but also current facts and statistics on existing TDM programs and costs/savings and annual trips saved. It also includes an environmental, social and economic assessment of their current TDM strategies. The authors also express their new TDM goals (including strategies such as a bike loaner program) and how to improve existing ones. They also touch on new views for parking lot construction.
This report touches on several relationships between businesses and TDM strategies. Not only does it discuss the correlation between how businesses can not only help reduce congestion but also focuses on the savings and benefits businesses can accrue by implementing TDM practices. First, the authors discuss eight factors that determine businesses profitability followed by how TDM can affect one or more of them while using several specific examples of businesses already doing this. Next, several case studies of major leading businesses are summarized, including how each one values TDM and how it contributes (via benefits seen/measured) to their business goals. Following the case studies are very detailed descriptions of major models used to measure business savings. The EPA’s COMMUTER model, which analyzes the impacts of TDM programs in regard to mode share, vehicle miles, and vehicle trips/emissions, can be used to estimate the number of vehicle trips reduces to help estimate the savings by reducing need to construct parking garages. It can also be used to measure changes in alternative work hour programs as well as change in mode splits due to change in parking and/or commuter subsidies. There is also a detailed description of the EPA’s Business Benefit’s Calculator. This calculator can be found at www.commuterchoice.gov. It is a comprehensive calculator that obtains information about the worksite and then determines the best practices/ savings from several TDM strategies. It also lays out the guidelines to be regarded as part of the National Standard of Excellence.

  A brief report that profiles the 2004 “Diamond Award Winners.” These are local Washington State businesses that were recognized as efficiently implementing TDM programs for their employees.

  Lengthy fact sheet regarding public transportation economic and social opportunities; includes general facts on costs/benefits on public transportation

  This link, provided by Washington State, discusses various individual tax advantages for those who use alternative methods (i.e. transportation subsidies) for commuting.
Brief overview of Washington State’s Vanpool Investment Program. Includes goals, results, future goals, state savings, trips reduced and gallons of fuel saved statistics.


The fact sheet discusses tax savings for employee and employer-paid benefits, federal workers benefits and shared cost benefits.


A “white paper” that argues that TDM programs, if planned correctly, can increase economic productivity and development. The author argues that TDM strategies improve transportation choice and competition, efficient pricing and more neutral planning and tax policies.


This guidebook is, “… a comprehensive study of transportation benefit and costing, and a guidebook for applying this information. It includes detailed analysis of various transport costs and benefits. These impacts are described in detail and categorized by various attributes: whether they are internal or external, fixed or variable, market or nonmarket. Using the best available data, it provides monetized estimates of twenty three costs for eleven travel modes under three travel conditions.


A literature review of four previous small-scale studies (pilot-programs) of telecommuting. The authors present the major findings (costs and benefits), methodology and limitations of each report. The findings are then compared to claims found in promotional literature.
The Contra Costa Commute Alternative Network (CC CAN) in Northern California implemented a comprehensive TDM Program including: carpool incentive programs, employer based trip reduction programs, vanpool incentive program, transit incentive program, guaranteed ride homes, school pool ride home and countywide bicycle/locker program. This paper includes brief descriptions of each program along with corresponding methodologies for determining the cost-effectiveness of each that can be replicated for other TDM programs nationwide. They measure not only vehicle trips/miles reduced but also emissions reductions and cost/savings for transit programs.

The author argues that rail transit uses more energy per passenger mile and may generate more greenhouse gases than average auto use. He also argues that technical alternatives including hybrid buses, more efficient and tailored bus routes, better road policies and better avocation for fuel efficient cars will prove to do more to reduce energy use and CO2 outputs than rail transit, at a lower cost. He compares different mode of public transportation and includes tables on energy consumption and CO2 emissions per passenger mile. He also discusses modal trends and includes figures and charts on (but not limited to): energy intensity (BTUs per passenger mile) of different passenger transport modes (bus, rail, car, etc.); comparisons of transit line energy consumption and CO2 emissions per passenger miles in top urban areas; different modes of public transportation BTUs/passenger miles vs. the average for cars, etc.; transits share of commuting over time for major urban areas. He finds that there are alternatives to rail transit that are more efficient and effective at saving energy and preventing CO2 and greenhouse emissions than transit.

The third of three reports (see also Schreffler, Eric N. "MTA TDM Demonstration Program – Third Pary Evaluation, Final Report" and Zarifi, Sina “Second Tier Evaluation Final Report”) for the Los Angeles County Metropolitan Transportation Authority (MTA) that presents project-specific evaluation findings for eleven Transportation Demand Management Projects and comparative findings for 28 projects with quantifiable trip reduction information.
Using data from three urban areas (LA, Tucson and Washington), this study analyzes TDM programs and transit services to see if there is a variation and/or reduction in site trip generation. It uses trip reduction plans from employers to predict change in vehicle trips due to worksite TDM policies.


This report discusses the economic impacts of public transportation such as job creation, business revenue impacts, at the national level. It also argues there are broader economic benefits due to the “multiplier effect”.


The first of three reports (see also Pansing, Cynthia – “MTA Transportation Demand Management Evaluation” and Zarifi, Sina “Second Tier Evaluation Final Report”) for the Los Angeles County Metropolitan Transportation Authority (MTA) that evaluated forty transportation demand management (TDM) demonstration projects to assess their cost-effectiveness in reducing or eliminating vehicle trips, vehicle miles traveled, and vehicular emissions.


Shaheen conducts surveys to evaluate the CarLink II program—a commuter based car sharing pilot program. The surveys include people’s perceptions,
likes, dislikes, etc. with the program as well as current costs of the program vs. the costs of owning/ using an automobile.


This study explains the need to quantify TDM programs and strategies in order to correctly ascertain the benefits and dis-benefits of such programs. The objective of this study is to “…developed a standardized methodology for calculating costs and benefits of TDM for comparative assessment and public decision making”. The model the authors developed allows one to effectively compare a wide range of costs and benefits that can be selected for analysis.


“The study goal was to develop a methodology that 1) measures the impacts of TDM programs on the overall transportation system, and 2) clearly communicates these impacts to policy makers and transportation decision makers. The hypothesis of the study was that a wide-scale adoption of employer-based TDM strategies is likely to have a noticeable effect on the transportation system performance of a corridor. The project’s main objective was to establish the relationship between these strategies and corridor traffic performance expressed in terms of commonly used measures of effectiveness (MOEs).” *(taken directly from their introduction)*


The Second of three reports (see also Pansing, Cynthia “MTA Transportation Demand Management Evaluation,” and Schreffler, Eric N. “MTA TDM Demonstration Program – Third Party Evaluation) for the Los Angeles County Metropolitan Transportation Authority (MTA) that presents the evaluation of seventeen Transportation Demand Management projects. It supplements the Third Party Evaluation as part of an overall effort to develop and implement MTA’s Countywide Transportation Demand Management Program.
USEFUL WEBSITES AND GHG RELATED CALCULATORS

http://www.commuterchallenge.org/cc/csintro2.html

General link to a myriad of case-study links on telework and flexible work schedule programs and why they work for those who are implementing them—listed by program type AND industry. When you click on the link (when listed by industry) — it directs one to a general fact sheet including statistics, overview and benefits to the employer and the respective program(s) they are implementing.

http://www.ivc.ca/studies/europe/index.htm

A “Stats and Facts” page on the European tele work scene—also includes several links to brief newspaper articles concerning telework in Europe.

http://www.ivc.ca/studies/us/index.htm

A “Stats and Facts” page on the U.S. telework scene—also includes several links to studies and brief newspaper articles concerning telework in the U.S.

http://www.fhwa.dot.gov/Planning/toolbox/costbenefit_forecasting.htm

This Federal Highway Administration page provides over eight links for cost-benefit analysis models which, “…calculate user benefits and external costs for alternative transportation networks or projects and compare them with capital, operating, and maintenance costs.”

http://www.mrsc.org/Subjects/Transpo/TDM.aspx

A huge database for numerous links concerning brief TDM case studies, policies, reports, programs, etc. provided by Washington State.


A very brief summary of Texas Instrument’s Alternative Transportation programs. Also includes their 2007 performance statistics including cars kept off the road, CO2 and NOx aversions due to their programs.

http://www.nctr.usf.edu/worksite/

This is the combined worksite trip reduction model; this neural network model allows one to learn the non-linear relationships among various combinations of strategies for a business.
http://www.climatecrisis.net/takeaction/carboncalculator/

A calculator that measures an individual’s carbon footprint.

http://www.climatecrisis.net/takeaction/carboncalculator/howitwascalculated.html

A brief explanation on how a person’s impact (CO2) is calculated from the carbon dioxide calculator above.

http://www.terrapass.com/carbon-footprint-calculator/

Another calculator that allows measures a persons carbon footprint.

http://www.bestworkplaces.org/resource/calc.htm

This calculator, developed by the EPA, enables an employer to estimate the financial, environmental, traffic-related and other benefits to TDM strategies.

http://www.nctr.usf.edu/spreadsheet/TRIMMS_1.0.xls

Spreadsheet illustrating the TRIMMS model.

http://www.tredis.com/

An interactive system of tools that allows transportation planners to conduct economic development impact evaluation and cost/benefit analysis for transportation investments.

www.ops.fhwa.dot.gov/PrimerDSS/index.htm

The Commuter Choice Decision Support System (CCDSS) is a comprehensive checklist for businesses that allows them to determine the top five suitable TDM strategies based on workplace characteristics, employer motivations and management style.

http://www.nctr.usf.edu/clearinghouse/software.htm

A link to various software that assist TDM programs.

http://www.commuterchallenge.org/tool/CCtool_content.html

A telework cost/benefits analysis tool for the individual.


A spreadsheet that allows a person to enter their personal data to assess the costs/benefits of telecommuting from both the employee and employers perspective.
http://www.commuterchallenge.org/commute_costcalc.html

A calculator that allows the user to compare the costs of SOV commuting to six different modes of employee subsidized commuter programs


A driving costs calculator.

http://www.worldcommute.com/

Personal commute tracking program that calculates miles traveled, fuel saved, money saved, carbon offsets and “health points” (for walking/biking instead of driving, etc.).

http://www.publictransportation.org/contact/stories/calculator_08.asp

A calculator that allows the user to calculate gas and parking savings if one decided to stop driving to work.

http://www.metrokc.gov/kcdot/alts/employer/resources/drivingcosts.htm

Link to King County, Washington’s driving and commuting costs calculator.

http://www.commuterpage.com

Car Free Diet Calculator produced by Arlington County. Provides specific information on cost savings and carbon reductions.

http://www.teletrips.com

Tracking and Capturing Carbon Emissions produced by Facet-Teletrips. Using a 3BL platform this Canadian company charts savings with trips, no-trips and other relevant criteria.

http://www.tripconvergence.co.nz

Saving energy through flexible car/van pooling produced by: Trip Convergence Ltd. This New Zealand based site provides energy saving information with charts and excellent references.

http://www.cleanair-coolplanet.org

Campus Carbon Calculator produced by: Cleanair-Coolplanet. More than 1200 campuses across the country use this calculator to determine emissions.
HOV lanes and climate change website produced by: Washington State DOT. The state has provided details of savings on greenhouse gas emissions through the use of HOV lanes.


The U.S. Climate Change Technology Program is a multi-agency research and development program for the development of climate change technology. Produced by: Department of Energy. A wealth of information and links on climate change.

Best Foot Forward uses the ecological footprint methodology to help businesses and other organizations measure, monitor and reduce their impacts. This site has been developed to demonstrate how our individual behavior influences the impact we make on the environment. Enter information on your lifestyle to assess your current impacts, or see what choices make the biggest differences.

A think-tank consortium based in England. The Tyndall Centre brings together scientists, economists, engineers and social scientists, who together are working to develop sustainable responses to climate change through trans-disciplinary research and dialogue on both a national and international level - not just within the research community, but also with business leaders, policy advisors, the media and the public in general. The website is a source of a lot of good and relevant information. The consortium also created the Greenhouse Gas Regional Inventory Project (GRIP). This project included the development of scenario-based calculators.

Carbonetworks is a software platform that helps organizations understand how they can participate in global carbon markets, even in unregulated
markets. Our Emissions Management Platform lets companies manage their emissions as assets or liabilities and connects them to a global network of carbon reductions.

**LOCAL SOURCES OF INFORMATION**

http://www.mwcog.com/publications


http://www.commuterconnections.org

Commuter monitoring and evaluation in DC area produced by Metro Washington Council of Governments

http://www.mwcog.org/commuter2

Commuter calculator, listing of alternative transportation organizations, contacts for the DC area….see February 2009 draft work program re VT and VMT reductions. Also Commuter Connections Reduction Measures (TERM) Analysis Report is available on the above website. Hard Copies available from swalker@mwcog.org. Report produced by LDA Consulting, Washington DC 202-548-0205. Lori Diggins is a contact.

http://www.thinkoutsidethecar.org/homepage.asp

Archives of transportation studies back to 1967, produced by: Northern Virginia Transportation Commission, Richard Taube, Executive Director ric@nvtdc.org

http://www.transaction2030.com

Alternative Transportation and Land Use Study produced by: Northern Virginia Transportation Coordinating Council, now the Northern Virginia Transportation Authority (NVTA). This study was initiated in 2001.

**MISCELLANEOUS INFORMATION OF POTENTIAL INTEREST**

“Connecting TDM and Climate Change” Netconference

On February 12, 2009, the National Center for Transit Research’s National TDM and Telework Clearinghouse at the University of South Florida and
the Association for Commuter Transportation held a netconference entitled Connecting TDM and Climate Change.

Summary: Does this sound familiar?

* The cost to commute is impacting my company’s ability to recruit and retain employees.
* The parking at my college or hospital campus is maxed out – additional parking is cost or land-use prohibitive.
* Our community is concerned about reducing our carbon footprint and expanding mobility options.

According to the US EPA, the transportation sector directly accounted for approximately 28 percent of the total U.S. GHG emissions in 2005 – higher than that of industrial, commercial, and residential sectors. Transportation is the largest end-use of carbon, which is most prevalent in GHG. Simultaneously, our urban and suburban areas are expanding causing an increase in vehicle miles traveled. VMT per household has increased from 12,400 miles (20,000 km) per year in 1969 to 21,200 miles (34,000 km) per year in 2001, a 70% increase. During the same period, VMT for commuting to work increased from 4,180 miles to 5,720 miles (6,730 km to 9,200 km), or 37%. As energy prices sky rocket and global climate change becomes an increasing concern, there has been a focus on alternative fuels and smart-growth land-use practices to address greenhouse gas emissions. Both are valuable tools in tackling climate change. But these are only two legs of a three-legged stool. Many businesses, organizations, and communities are focusing their efforts on providing alternative options, incentives, and enhanced infrastructure that promotes and fosters non-single-occupant vehicle commuting – in other words, TDM.

The Association for Commuter Transportation (ACT) is an organization whose members are in the forefront of researching and implementing sustainable transportation demand management (TDM) programs across the U.S. ACT provides the opportunity and resources for its members to work together and share knowledge to support their individual and corporate/institutional growth.

The panel framed the connection between TDM and climate change and showcased businesses and communities that have developed and implemented sustainable TDM programs that reduce mobile source greenhouse gas emissions creating improved access, reducing energy consumption, and achieving cost savings.

Speakers:

* Dr. Daniel Rodriguez, University of North Carolina provided the overview and context.
* Paulo Nunes-Ueno, Seattle Children’s Hospital provided details about their
Corporate TDM Program and associated carbon benefit.
* Erika Vandenbrande, City of Redmond, WA planning department presented information on an excellent municipal TDM program that promotes TDM and collects CO2 reductions.

This 74 minute netconference was moderated by Donna Smallwood, MassRides/ URS

Click here to view the streaming media replay
(You need Windows Media Player™ to view)

* Copy of all the PowerPoint slides (pdf) (8 Mb)

Provide your feedback and topic suggestions for future events
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DULLES AREA TRANSPORTATION ASSOCIATION

APPENDIX E

MISCELLANEOUS STUDY RELATED DOCUMENTS AND PRESENTATIONS