

# Measuring The Effectiveness of TDM Strategies in Reducing Greenhouse Gas Emissions

A Preview of E<sup>3</sup>Calc<sup>®</sup>



# The Premise

- TDM's offer businesses an effective and cost efficient means to reduce their employee based greenhouse gas (GHG) emissions.

# Project Objectives

- Conduct a literature review of research on how TDM strategies impact vehicle miles traveled and reduce greenhouse gas emissions;
- Evaluate current methodologies in determining the effects of TDM related strategies in reducing GHG emissions;
- Develop a new mechanism (based on research during objectives 1& 2) for documenting the effectiveness of TDM related strategies in reducing GHG emissions;

# Project Objectives (continued)

- Test the new methodology (E<sup>3</sup>Calc<sup>®</sup>) to evaluate the effectiveness of the new methodology;
- Conduct a Theoretical Analysis of the Effectiveness of TDM Strategies in Reducing GHG Emissions in the DATA service area; and
- 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.

# Research & Literature Review Findings

The overwhelming conclusions from the literature review is 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.

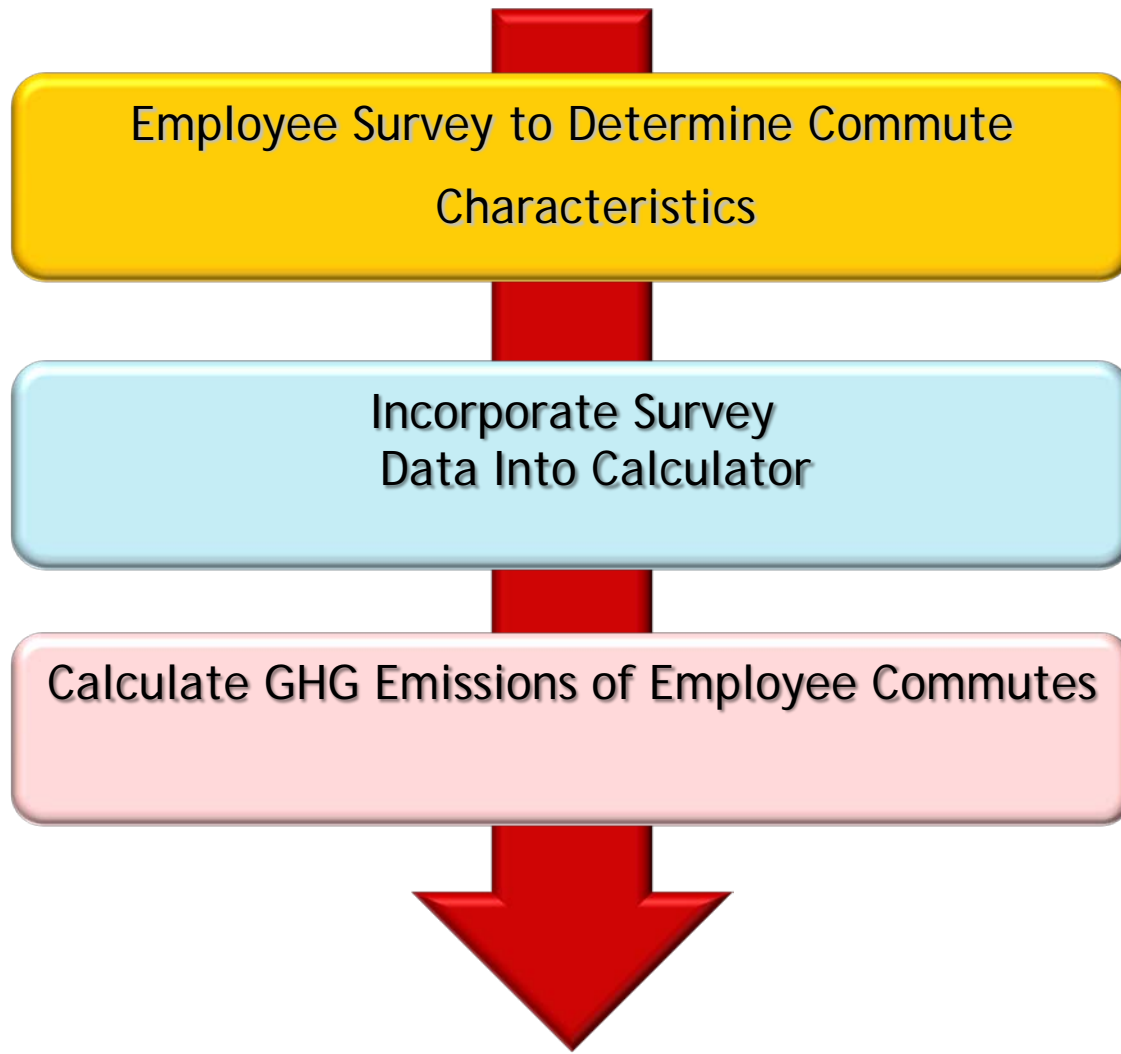
## Our Conclusion:

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

# Results of Literature Review & Expert Interviews

Key Components to GHG Emissions Calculator	
<p><b><u>Inputs</u></b></p> <ul style="list-style-type: none"><li>•Employee mode</li><li>•% of trips by mode</li><li>•Frequency of use</li><li>•Home to work travel distance</li></ul> <p>•<b><u>Travel time</u></b></p> <p>•<b><u>Type of vehicle</u></b></p>	<p><b><u>Output</u></b></p> <ul style="list-style-type: none"><li>•3 Impact Areas (levels reduced based on employees actions)</li></ul> <ol style="list-style-type: none"><li>1. Environmental<ul style="list-style-type: none"><li>•Carbon Plus GHG Emissions</li></ul></li><li>2. Transportation/Traffic:<ul style="list-style-type: none"><li>•Vehicle Miles Traveled</li><li>•Cars Off the Road</li></ul></li><li>3. Energy Savings:<ul style="list-style-type: none"><li>•Fuel Use</li></ul></li></ol> <p><i>Related Issue: Comparison to baseline (either past data or based on SOV only for all employees) to show benefits and savings.</i></p>

# How The DATA GHG Calculator Will Work



# Calculator Components

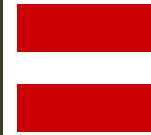
## Employee Survey

1. Commute Mode
  - ✓ Carpool
  - ✓ Vanpool
  - ✓ Train/bus
  - ✓ Telework
  - ✓ Compressed schedule
  - ✓ Bike
  - ✓ Walk
2. % of Mode Use
3. Frequency of Use
4. Vehicle Type
5. Travel Distance
6. Travel Time
7. Access Mode



## Company-Specific GHG Calculations

1. Incorporate Discounts as Default Factors
2. Project Data to Employee Universe
3. Localized Commute Data Defaults Based on Site Location
4. Cost of TDM Program Implementation



## Company Report

1. Energy Impacts - Fuel and Energy Savings
2. Environmental Impacts - GHG and Other Emissions
3. Transportation & Traffic Impacts - VMT, Trips, Cars on Road
4. Cost/GHG or VMT Reduced



# Development of E<sup>3</sup>Calc<sup>®</sup>



The Best Practice In Calculating Employee Emissions and Environmental Impact

## Branding & Simplicity

# Informational Website

Employee Commute Emissions Calculator

http://www.e3calc.com/

## E<sup>3</sup>Calc

The Best Practice In Calculating Employee Emissions and Environmental Impact

- Home
- About
- Calculator
- Why this matters
- How to participate
- Now what?
- Resources
- Contact

Welcome to E<sup>3</sup>Calc – the easy and accurate way to assess greenhouse gas emissions (GHG) related to your employees' commute.

This calculator helps your organization:

- Estimate its current employee commute-related GHG footprint;
- Compare its commute-related GHG footprint to that of other like-size organizations; and
- Explore how implementing voluntary employee commute services can reduce your GHG footprint.

The output from E<sup>3</sup>Calc reports on several travel-related impacts for your organization:

- Emissions: Greenhouse gas emissions (CO<sub>2</sub> - Carbon Dioxide) and ozone pollutant emissions (NO<sub>x</sub> - Oxides of Nitrogen and VOC - Volatile Organic Compounds);
- Commute Vehicle Miles Traveled (VMT): Daily commute miles driven by employees and the number as reduced by employees' use of transit or other non-drive alone types of travel; and
- Vehicle Trips: Total vehicle trips made by employees and the daily cars removed from the road by use of non-drive alone types of travel.

E<sup>3</sup>Calc was created by the Dulles Area Transportation Association (DATA) through a grant from the Virginia Department of Transportation (VDOT) Multimodal Program. Click [About](#) to learn more about this service and click [Why This Matters](#) to learn why organizations like yours are calculating their own GHG footprints.

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# Employee Survey

GHG Survey

http://www.logicdepot.com/surveys/run/Next.cfm

Getting Started Latest Headlines Apple Yahoo! Google Maps YouTube Wikipedia News Popular Doug's Sites SCYC Blog

## E<sup>3</sup>Calc

The Best Practice In Calculating Employee Emissions and Environmental Impact

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.

**Days you travel to your primary work location:**

Drive alone in a car, truck, SUV OR ride in a taxi	<input type="text"/>
Carpool or vanpool (with others 16 years or older)	<input type="text"/>
Ride a bus, train, or subway	<input type="text"/>
Walk or bicycle (entire trip from home to work)	<input type="text"/>
Other	<input type="text"/>

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.

**Days you do not travel to your primary work location:**

Telework all day at home	<input type="text"/>
Work at another worksite in the Washington area or work out of the area (e.g., business trip)	<input type="text"/>
Compressed schedule day off	<input type="text"/>
Regular day off	<input type="text"/>

If you have questions concerning this survey, please contact the Southeastern Institute of Research, Inc. by clicking [here](#).

# Employee Survey Reports



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

1 How many employees work at your work location?  81 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.

<input type="text" value="92"/>	Drive alone, including taxi
<input type="text" value="6"/>	Carpool or vanpool
<input type="text" value="-"/>	Ride a bus, train, subway
<input type="text" value="1"/>	Walk or bicycle
<input type="text" value="1"/>	Telework
<input type="text" value="-"/>	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?

<input type="text" value="5"/>	Hybrid
<input type="text" value="33"/>	Small car/wagon
<input type="text" value="23"/>	Mid-size car/wagon
<input type="text" value="3"/>	Full-size car/wagon
<input type="text" value="18"/>	Small SUV or van
<input type="text" value="13"/>	Medium to large SUV or van
<input type="text" value="2"/>	Small pick-up truck
<input type="text" value="3"/>	Medium large pick-up truck

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

Office Location: Herndon

# Online Calculator Input

GHG Calculator

http://www.logicdepot.com/surveys/run/Next.cfm

## E<sup>3</sup>Calc

The Best Practice In Calculating Employee Emissions and Environmental Impact

[back to the E3Calc main site](#)

**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  
 Carpool or vanpool  
 Ride 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 pool meeting point or the transit stop/station?

Percentage (in whole numbers) of employees who drive alone to the meeting point:

Average distance to the meeting point (in miles):

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

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

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

7 - How much commute time do employees spend in congested traffic?  
Average percentage (in whole numbers) of commute at less than 35 mph:

8 - What percentage of employees travel to work during the morning rush hour?  
Percentage (in whole numbers) 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?

# Customized Employer Reports



## 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 Parsons 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 E<sup>3</sup>Calc, a calculator that analyzes the employee commute information to: 1) establish a baseline for the amount of CO<sub>2</sub> that is emitted as a result of employee commutes; 2) determine the impact that non-single occupant vehicle travel has on the businesses CO<sub>2</sub> emissions; and 3) allows for comparisons to a situation where everyone at the site drive alone to work, or to an average business in the locality in which the business is located. Overall, E<sup>3</sup>Calc 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 E<sup>3</sup>Calc 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.

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#### Emissions Analysis Highlights

- Current emissions from employee commute's at the Herndon office contribute 670 tons of CO<sub>2</sub> 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<sub>2</sub> to the region's atmosphere annually, an 85% 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									
Office	Mode	Annual Vehicle Trips	Annual Vehicle Miles Traveled (VMT)	Annual Fuel Consumption (Gallons)	Annual CO <sub>2</sub> Emissions (Tons)	Annual CO <sub>2</sub> Emissions (Tons) if all employees drove alone to work	Annual CO <sub>2</sub> Emissions (Tons) if all employees drove alone to work	Annual CO <sub>2</sub> Emissions (Tons) if all employees drove alone to work	Annual CO <sub>2</sub> Emissions (Tons) if all employees drove alone to work
Herndon Office	Hybrid	700	12,500	4,100	1,200	1,200	1,200	1,200	1,200
Herndon Office	Gasoline	2,100	37,500	12,300	3,600	3,600	3,600	3,600	3,600
DC Office	Hybrid	100	1,700	600	180	180	180	180	180
DC Office	Gasoline	300	5,100	1,800	540	540	540	540	540
<b>Total</b>		<b>3,100</b>	<b>55,800</b>	<b>18,800</b>	<b>5,420</b>	<b>5,420</b>	<b>5,420</b>	<b>5,420</b>	<b>5,420</b>

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

1 How many employees work at your work location?  61 Employees  
Margin of error +/-: 7.2

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

82 Drive alone, including car, carpool or vanpool  
 8 Mass transit, including bus, trolley, subway, light rail, or commuter rail  
 1 Walk or bicycle  
 1 Telework  
 1 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:   
% of employees who arrive at work between 6:30 am and 9:30 am:

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

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

<input type="checkbox"/> 6 Hybrid
<input type="checkbox"/> 35 Small car/passenger
<input type="checkbox"/> 23 Midsize car/passenger
<input type="checkbox"/> 3 Full-size car/passenger
<input type="checkbox"/> 18 Small SUV or van
<input type="checkbox"/> 13 Medium to large SUV or van
<input type="checkbox"/> 2 Small pick-up truck
<input type="checkbox"/> 3 Medium large pick-up truck

10 Estimated average fuel economy  
Average miles per gallon of employees' vehicles (if known):   
Office Location: Herndon

ERG Calculator <http://naa.logdps.com/ServiceSystem/Exec.htm>



#### Calculator Results For Your Worksite

These results represent 100% of the employees who use the calculator based on 144 employees commuting to work at your office.

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  
Commuter Vehicle Miles Traveled (VMT)  
Current daily commute miles driven by your employees: 4936  
Greenhouse Gas Emissions (daily pounds)  
NOx (Oxides of Nitrogen) emissions, in pounds: 4.43  
VOC (Volatile Organic Compounds) emissions, in pounds: 2.69  
CO<sub>2</sub> equivalent emissions (includes CO<sub>2</sub> and other greenhouse gases): 5226

1 of 1

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ERG Calculator <http://naa.logdps.com/ServiceSystem/Exec.htm>



#### Calculator Results For Your Worksite

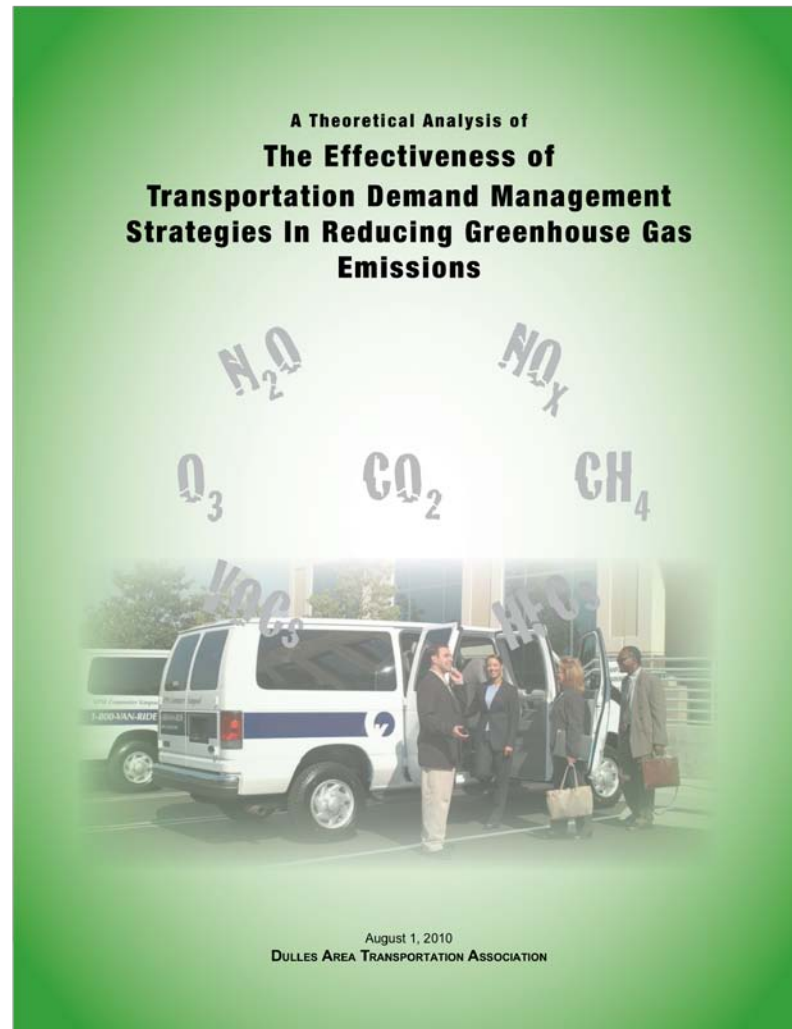
These results represent 100% of the employees who use the calculator based on 144 employees commuting to work at your office.

How many vehicle trips do your employees reduce from the road?  
Current daily vehicle trips to and from your location: 272  
Commuter daily vehicle trips to and from your location: 308  
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  
Commuter Vehicle Miles Traveled (VMT) Reduced  
Current daily commute miles driven by your employees: 4936  
Commuter daily commute miles driven by your employees: 5184  
Percent daily commute miles driven by your employees: 6%  
Daily commute miles reduced by your employees: 248  
Greenhouse Gas 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%  
CO<sub>2</sub> equivalent emissions (includes CO<sub>2</sub> and other greenhouse gases) reduced: 307.4  
Percent CO<sub>2</sub> equivalent emissions (includes CO<sub>2</sub> and other greenhouse gases) reduced: 6%

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# Theoretical Analysis



# Theoretical Analysis

- Used E<sup>3</sup>Calc to determine the impact that TDM strategies have on reducing GHG emissions in the DATA service area.
- Used local commuter and employment data.
- Analyzed TDM impacts on approximately 16,000 businesses in DATA service area that employ almost 300,000 employees (comprising over 34% of No. Va. jobs).



# Theoretical Analysis Findings

TDM strategies and alternative SOV use in DATA's Service area:

- Remove 390,000 tons of GHG emission annually;
- Reduce DAILY Vehicle Miles Traveled (VMT) by 2.85 million miles;
- Remove 180,000 vehicle trips, a DAY; and
- Take more than 89,000 cars off of Northern Virginia roads, DAILY, or over 23.3 million vehicles annually.

# Theoretical Analysis Findings

The collective impact that TDM strategies have in DATA's service area is equivalent to:

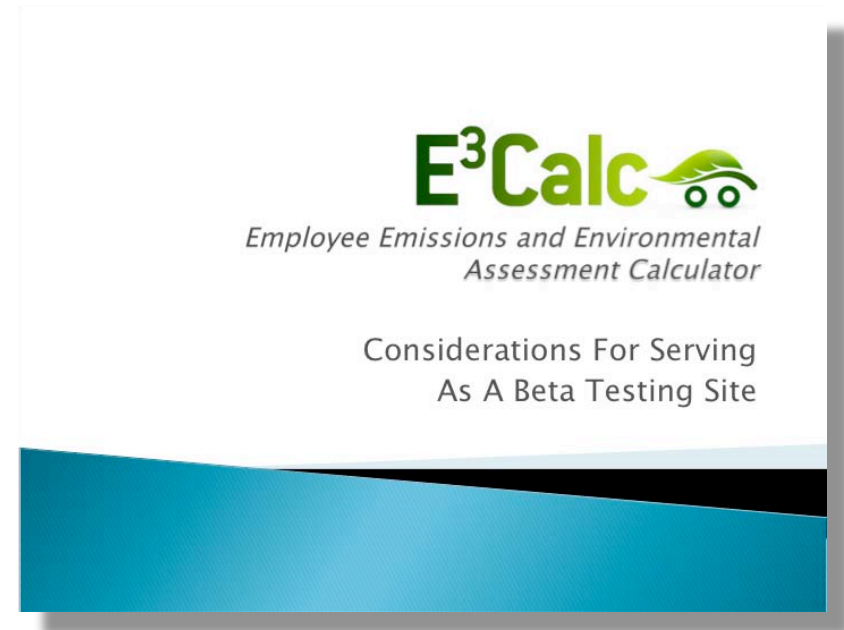
- Removing the emissions from the daily use of almost 69,000 passenger cars;
- Removing the number of cars that would fill all four lanes of the Beltway (56 miles) EVERY DAY;
- Annually filling a four lane highway with vehicles that stretches around the earth's equator one and a half times; or
- Removing the CO<sub>2</sub> emissions generated by the electricity used in more than 43,000 homes.

# Conclusion

- TDM related strategies seem to be a very effective means of reducing the region's GHG emissions.
- E<sup>3</sup>Calc is a tool that demonstrates the effectiveness of TDM strategies in reducing GHG emissions.
- As the E<sup>3</sup>Calc is introduced as another tool in the TDM toolbox, businesses will be able to benchmark, monitor and manage their carbon footprint as it pertains to employee commutes and travel.
- E<sup>3</sup>Calc will be an important tool for TDM professionals in demonstrating the effectiveness of these strategies and their overall importance to a business' operational viability.

# Beta Testing

- DATA is currently beta testing at three sites
- Will be soliciting new participants this fall
- Plan a wider distribution this winter and next spring



# Thank You!

## Contact Information

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