

Chattanooga-Hamilton County Regional Planning Agency

Spring 2011 TN CMAQ Project Competition

Chattanooga Green Trips Program Proposal

May 26, 2011

Section 1. Project Description

This CMAQ proposal is being submitted to develop and operate, through Chattanooga-Hamilton County Regional Planning Agency staff and/or a consultant contract, a three year pilot web-based green trips education, incentives, and encouragement program targeted at reducing vehicle miles traveled (VMT), reducing air quality emissions, and documenting emissions reductions for reported trips in the Chattanooga region that improve air quality. This program would be called "Chattanooga Green Trips" with the main concept being an incentive-based program to encourage more efficient use of the existing transportation system through reduction in single-occupancy vehicle travel.

The Green Trips program would be a key tool in the Chattanooga region in providing and encouraging alternatives to single occupancy vehicle commutes and serve to reduce VMT and congestion. The U.S. Department of Transportation reported that Americans take 1.1 billion trips per day and that 78% of these trips were single occupancy trips. This web-based program would offer incentives/rewards when someone walks, bikes, takes transit, telecommutes, carpools, vanpools, or works a compressed work week instead of driving alone in a vehicle. The incentives or rewards are geared toward local businesses and would include discounts for local restaurants, retailers and tickets to shows.

This type of program is generally geared towards commuters but the incentives would also apply towards any type of trip because home-to-work trips account for only 25-33%¹ of all trips made in most urban areas. Employers do however play a critical role in many of these transportation control measures related programs because of their influence over employee travel behavior, work schedule, and parking; therefore a key component of the green trips program consultant's outreach and focus will be towards large employment generators in Chattanooga's urban core. RPA's Green Trips program would also encourage/offer incentives for compressed work weeks and/or telecommuting as both of these concepts can reduce VMT greatly and are often overlooked in these types of alternative transportation programs.

The Green Trips program would be able to calculate reduced VMT for each completed trip and reduced NO_x, VOC, and CO₂. Another benefit of a web-based green trips program is the ability to calculate the reduced vehicle trips for each completed trip based on if the person has a car and did not drive it.

¹ Statistic provided in EPA's Transportation Air Quality Technical Overview on Transportation Control Measures publication dated July 1998.

The Chattanooga-Hamilton County/North Georgia Transportation Planning Organization's (TPO) Multimodal Travel Time Pilot Study results show that bicycling is generally the fastest transportation mode in the downtown urban corridor. The education component of the green trips program will be extremely helpful and beneficial when relaying these study results and other general information about green modes of transportation out to the public. Not only will the Green Trips program be a conduit to reach the public about alternative transportation but also will reward them for using that alternative mode.

One of the Long Range Transportation Plan (LRTP) 2035's goals is to "provide sustainable travel options that improve the quality of life and the environment" with the objective being to "encourage alternative modes of transport that reduce SOV VMT and air pollutant emissions," which is exactly the purpose of the Chattanooga Green Trips program.

The RPA desires this project to be a three-year pilot program since this type of program is new to the TPO region. The project is estimated to cost a total of \$600,000 over a 3-year period with an annual average cost of \$200,000/year. Please see "Section 2. Project Budget" and "Section 9. Project Schedule, Project Milestones, Description of Major Tasks and Project Management" for more information on requested funding for each federal fiscal year and what will be accomplished in each year. It is RPA's intention that this program become self sustaining though this may take time. As shown on the Budget Worksheet (Attachment to Section 2), RPA expects to significantly reduce the federal funds needed in the fourth year by garnishing support from major employers and local philanthropic organizations. Also, as the growth of these supporters increases, it is RPA's hope that the annual average cost of the program, \$200,000, will drop as additional adjacent communities outside of the TPO region become joint partners in the web-base platform. The idea being, that the more participating communities in the program, the lower the operating and maintenance costs.

Section 2. Project Budget

As summarized in the "Project Description Section", the RPA desires this project to be a three-year pilot program since. The project is estimated to cost a total of \$600,000 over a three-year period. These cost figures include a Program Coordinator which may be accommodated through a consulting contract, a hired employee of the RPA, or a combination of the two not to exceed the line item amount per year shown in the attached CMAQ Project Budget Worksheet. The costs also include, as more specifically identified in the Budget Worksheet, funds to pay for operations, program materials such as education publications, marketing and partner recruitment, incentives, data analysis/forecasting expertise, and the development of a internet web-based multimodal alternative trips membership program available to addresses within the entire TPO region. As reflected in the Budget Worksheet, it is expected that there will be more operational, marketing, and technical related expenditures such as educational tools/materials, website development, and outreach to potential participants in the first year and thus the first year proposed costs are more than the remaining two years. It is also expected that once the data and emissions analysis reporting and future projections calculations have been established there will be no future need for this service and thus was removed from the program budget for the 3rd year and future years. It is important to note that the incentives being utilized as a match for successful program results increases over the program timeline while the CMAQ and the RPA matching funds decrease. Additionally, we expect to see additional matching funds from contributing

employers and/or interested agencies/organizations which will hopefully eliminate needed contributions from RPA and significantly reduce the need for continued federal assistance. In hopes of receiving funds, RPA staff is preparing the proper Transportation Improvement Plan amendment documents with specified matching funds as indicated in the guidelines though this amendment request would not be processed until official notification of the award has been received.

Section 3. Air Quality Analysis and Emission Reduction Estimates

RPA's Chattanooga Green Trips Program is a combination of education, encouragement through incentives, and over time a behavioral shift that provides for immediate and accumulative air quality emissions benefits indefinitely. RPA has calculated, as shown on the attached "Chattanooga Green Trips Air Quality Emissions Reduction Estimates and Cost Effectiveness" table the emissions for Carbon Monoxide (CO), Volatile Organic Compounds (VOCs), Nitrogen Oxides (NO_x), and Particulate Matter at the 2.5 micron in size (PM_{2.5}). Also included, though understood to not affect this application process, are the calculation of Carbon Dioxide (CO₂) and Sulfur Dioxide (SO₂) in an effort to standardize the calculation process for all potential pollutants and prepare for the future possibility of additional EPA emission reduction requirements.

RPA was fortunate to have the assistance of the Chattanooga-Hamilton County Air Pollution Control Bureau (APCB) in developing these emission reduction estimates. The APCB provided the RPA with a Microsoft Excel calculation table and methodology addendum for the assumptions their agency made in the creation of the formulas for two tables: one associated with intersection improvements and one for alternative trips. For the Green Trips emission reduction estimates, RPA only used and included the table for alternative trips. For this reason, the addendum "Methods for Calculating Emission Reductions" is an adjusted excerpt of their original summary as traffic flow does not apply to the Green Trips program of eliminating the gasoline vehicular miles. Therefore, VMT was used for the initial calculation to generate daily fuel saving and ultimately the reduction in emissions of the specified pollutants.

RPA structured the targeted VMT reductions around a reasonable expectation of reduced VMT resulting from individual participation in the program. Obviously, a new program will generate less participation in the first year than the second and so on due to lack of familiarity/awareness. Thus RPA provided the emission reductions by program year associated with reasonably expected increases in participation that result in a percent yield of VMT reduction. RPA conducted peer research on other similar alternative/smart trip programs across the U.S. and within Tennessee. It was apparent from these programs that a 1-3% VMT reduction could be expected in the programs first year. Understanding that this type of program would be new to the Chattanooga region, RPA targeted the lower end at 1.5% reduction for the first year, a 3% reduction by the second year, and 5% for the third year. The chosen VMT reduction targets were applied to the TPO's 2007 Highway Performance Monitoring System (HPMS)² Adjusted Base Year VMT obtained from the TPO's travel demand model for the 2035 Long Range Transportation Plan. This VMT was reduced by 1.9% due to the through traffic VMT included in the model which would not be affected by this program. Fuel savings

² HPMS adjustments were at the direction of EPA and other members of the Chattanooga Interagency Consultation Committee for Air Quality.

were calculated using the reduced VMT. The emission reductions were then calculated for each pollutant from those anticipated savings. Freight related emissions were removed since these would also not be affected by this program. For additional details on the specific pollutant emissions calculation, please refer to the APCB “Methods for Calculating Emissions Reductions” addendum.

The resulting savings for the first year, FY 2012, is calculated to be a total of 1,785 kilograms/day of combined pollution from CO, VOCs, and NO_x and 2 kilograms/day of PM_{2.5}. As the program participation increases and the expected VMT decreases, these savings continue to increase. By the third year, FY 2014, the accumulative savings would be 11,308 kilograms/day of the combined pollutants and 11 kilograms/day of PM_{2.5} (a total of 11,319 kilograms of pollution). Additionally, the RPA believes the Green Trips program will foster a behavioral shift in a portion of the TPO area population from single occupancy vehicle travel to alternative transportation choices such as walking, biking, and/or transit. This behavioral shift is expected to result from the likelihood that the participants of the program will continue to use alternate/green modes for a variety of reasons due to their exposure and/or the offering of incentives to utilize these options. These reasons, common among other similar programs, include, but are not limited to cost effectiveness, health, convenience, environmental protection and social interaction. Given that behavioral changes can last the bulk of an individual’s lifetime, it is reasonable to assume that at the end of this three-year program, a continued daily reduction of 11,319 kilograms air pollution could be achieved in the Chattanooga region well into the future. That would mean a reduction of 41,314,350 kilograms by year 2025 and 144,600,225 kilograms by 2050.

In terms of documenting and evaluating the actual emissions reductions resulting from the Green Trips Program, the web-based application will generate immediate reductions for each trip for each of the pollutants described above. The results will also include actual VMT reduction. An example of these results is provided below.

<u>Trips & Reductions</u>	All trips	Trips with <5
All trips	198,951	184,442
Avg trip distance (miles)	28.3	26.9
Avg vehicle occupancy	2.8	2.5
Reduced car trips	264,798	218,530
Reduced miles (VMT)	7,540,579	5,869,626
Reduced car starts (VT)	104,179	92,372
Gallons of gas saved	385,442	301,183
Reduced NOx (tons)	4.95	3.85
Reduced VOC (tons)	4.88	3.80
Reduced CO2 (tons)	3,777.34	2,951.60
Total reduced emissions	3,787.16	2,959.25

Section 4. Cost-Effectiveness of Project Emission Reductions

Using the emissions estimates and the proposed yearly costs (FY 2012 at \$225,000, 2013 at \$200,000, and 2014 at \$175,000) and the total three-year program budget (\$600,000), RPA calculated the cost effectiveness for each budgeted year and the program as a whole. As noted earlier, the program’s first year would cost more and certain costs would taper off over the three-year period. Given this expectation, the cost-effectiveness of the first year, FY 2012, is less desirable than the second, and the second less desirable than the

third. More specifically, the FY 2012 cost-effectiveness for combined CO, VOCs, and NO_x is estimated at \$0.35 and \$340.69 for PM2.5 per kilogram of savings. However, the total three-year cost-effectiveness at the end of FY 2014 for the combined pollutants is estimated to be \$0.05 and \$47.82 per kilogram of savings. For calculation details refer to the attached “Chattanooga Green Trips Air Quality Emissions Reduction Estimates and Cost Effectiveness” table. The Microsoft Excel workbook used to calculate these estimates and the estimates in Section 3 was included via email to verify formulas.

Section 5. Project Relevance to CMAQ Priorities as Defined by Congress

This Green Trips project addresses the CMAQ SAFETEA-LU priority of funding cost-effective emission reduction activities and cost-effective congestion mitigation activities that provide air quality benefits, and reductions in fuel consumption.

Section 6. Project Innovations and/or Impacts on Evolving Transportation Issues

RPA’s Green Trips transportation program is following on the heels of the successful bicycling efforts in Chattanooga which utilized advocacy, education, choice, and incentives to garnish support and participation for bicycling as a legitimate form of transportation in the region. The Green Trips program will work with local retailers, restaurants, and employers to advocate, educate, and incentivize accessible green transportation choices offered in the TPO area. Green Trips will provide the opportunity to better educate the public and business sector on the importance of reducing air pollution associated with transportation choices in a positive rewarding way. The program is a web-based members program that will reward individuals for choosing any form of transportation that offsets/reduces pollutant emissions associated with personal automobiles. More specifically, any trip that is not single occupancy vehicle travel will be rewarded. Other rideshare/ride matching programs that are paired with incentives only reward the participants that take advantage of the match (i.e. a biking partner, walking partner, carpool partner etc.). RPA’s Green Trips program will immediately reward members and automatically calculate emissions reductions for any SOV replacement trip including multimodal trips (you decide to take the bus then take your car, see Figure below).

Record a trip

1 Is this a new or saved trip?

New
 Saved

2 Specify the mode

 Carpool or vanpool
  Bus
  Rail (e.g. train, subway, light rail, etc.)
  Telecommute / telework
  Walk
  Bike
  Ferry
  Compressed work week
  Multi-mode (e.g. bus+subway, etc.) - coming soon!

Lastly, the RPA and TPO recognize the emerging trends in travel demand management such as telecommuting and the need to quantify pollutant emissions associated with Climate Change (the Greenhouse Gases (GHGs)). Although telecommuting is not growing in the southern states as rapidly as elsewhere in the U.S. and the GHG estimates are not required as part of Metropolitan Transportation Planning or Air Quality Conformity, RPA's Green Trips program will offer rewards to telecommuters in the region and calculate actual reduction for CO₂ the major GHG pollutant for each trip (see example results depicted in Section 3). These additional efforts will support the Chattanooga Mayor's recent Climate Change Agreement for targeted GHG reductions and the region's desire to be a model sustainable community.

Section 7. Project Impact on Diversity and Comprehensiveness of Regional Initiatives

Planning for and building alternative transportation facilities such as sidewalks and bike lanes and investing in public transit are well known in the transportation planning academia to be socially and financially equitable as they provide a level of independence for all socioeconomic sectors and provide fiscally conscience choices for sustainable transportation infrastructure. The Chattanooga Green Trips program provides the opportunity to reward and educate the community on these principals. The program is also a suggested transportation demand management strategy in the TPO's Congestion Management Process and the determined to be one of the most cost effective and likely strategies to gain traction in the TPO region as documented in the TPO's Transportation Demand Management Report produced for the TPO's 2035 Long Range Transportation Plan. As mentioned earlier, the program will complement the Climate Action Plan initiatives and create a solid foundation for documenting, calculating, and projecting air pollution emission reductions for the region. In addition, Green Trips will be partnering with the Chattanooga Bike Share program, a 30 station bike rental program currently being implemented, to increase the likelihood that participants will choose to bike as both a healthy and environmentally conscience transportation choice. Other expected benefits for existing programs include the TPO's existing partnership with the Health Department on their Robert Wood Johnson Foundation grant "Healthy Kids Healthy Communities" which targets various improvements including transportation in disadvantages areas of Chattanooga. Lastly, the University of Tennessee at Chattanooga is actively involved in ongoing evaluation of active transportation in terms of impacts on public health, environment, policy, and priority infrastructure improvements in which this program would provide useful data inputs.

Section 8. Project Benefits for Multimodal Infrastructure

This Green Trips program is designed to increase the use of transportation alternatives like walking, biking, using transit and ridesharing. According to the Chattanooga Area Regional Bicycle and Pedestrian Plan there are currently 170 miles of sidewalk accommodations on arterial and collector roadways within our region and currently over 90 miles of bike lanes, bike routes and greenways in the Chattanooga TPO area. The proposed program will encourage the use of these existing facilities. Our Green Trips program would also encourage the use of the CMAQ funded Bike Share underway in the Central Business District of Chattanooga's urban core. These incentives will work to create a mutually supporting structure for continued expansion of the bike share into adjoining neighborhoods. This project will specifically capture additional information on origin and destination of multi-modal trips which will complement existing data collection efforts for the development and prioritization of infrastructure improvements. Green Trips will also create a database of active

transportation users which can be queried both internally and in partnership with other researchers to identify specific infrastructure needs such as end-of-trip bicycle parking.

Section 9. Project Schedule, Project Milestones, Description of Major Tasks and Project Management

The Chattanooga Green Trips program schedule has been detailed in the attached "Chattanooga Green Trips Task Timeline". Noteworthy tasks include the hiring/contracting of a program coordinator which as noted may be a RPA employee, consultant, or combination of the two, preparation of education and marketing materials, development of the web-based platform, progress reporting/tracking which is critical to ensure timely project completion, program evaluation tasks and air quality analysis. The program will be directly managed through the RPA's Strategic Long Range Planning Division headed by Melissa Taylor, the TPO's Director for the last few years. This division is also responsible for the TPO's Transportation Plan and Air Quality Conformity thus providing suitable staff resources and expertise. Although RPA has not been the recipient of any past CMAQ funds, the staff is familiar with project tracking from responsibilities associated with the TPO's TIP process and 2009 ARRA expedited project implementation. The TPO has received accolades in recent years for their success in obligating a significant portion of their local Surface Transportation Program (STP) allocation in large part due to the substantial involvement of the RPA staff with project sponsors. RPA expects to continue this track record if afforded the opportunity to manage the Chattanooga Green Trips program.

Attachment A
2011 Project Budget Worksheet

- *Complete budget worksheet for each project proposed for CMAQ funding. **Complete all blanks.**
- *Show the amount and sources of all match funding committed to this project. Add columns if needed and adjust formulas for Total Project Cost and Total CMAQ Funds Requested, as necessary.
- *Indicate if this will be a public-private partnership. PPPs will require a minimum 20% nonfederal match.
- *Provide estimated project costs for each of the major tasks and activities described in Section 9 of the Proposal Format. Show all years of funding requested.

Applicant/Project Sponsor: Melissa Taylor/Betsy Evans, Chattanooga-Hamilton County Regional Planning Agency

Name of Project: Chattanooga Green Trips

Type of Project: Alternative Transportation Education, Outreach, and Incentives Program to Reduce VMT

List All Funding Sources: Federal, Project Sponsor, and other Local

For public-private partnership, list partners:

List Major Tasks/Activities and show funding proposed for this project by activity and funding source	Federal Fiscal Year: 2012					Federal Fiscal Year: 2013					Federal Fiscal Year: 2014					Federal Fiscal Year: 2015+ (Proposed Program)					
	Provide source(s) and amount of all funds					Provide source(s) and amount of all funds					Provide source(s) and amount of all funds					Provide source(s) and amount of all funds ¹ (Not included in Total Project Cost Due to Uncertainties)					
	CMAQ Funds Requested	RPA (10% match)	Retailer Incentives (\$ value for a minimum 10% match)			CMAQ Funds Requested	RPA (10% match)	Retailer Incentives (\$ value for a minimum 10% match)			CMAQ Funds Requested	RPA (10% match)	Retailer Incentives (\$ value for a minimum 10% match)			CMAQ Funds Requested	Major Employers	Other Interested Organizations	Retailer Incentives		
Program Coordinator	20,250	2,250				18,000	2,000				13,500	1,500				10,500	3,000	1,500			
Operations/Logistics/Materials	18,000	2,000				9,000	1,000				4,500	500				3,500	1,000	500			
Branding/Marketing/Employer Recruitment	22,500	2,500				13,500	1,500				9,000	1,000				7,000	2,000	1,000			
Incentives			22,500					25,000					25,000						50,000		
Website Development, Progress Tracking, & Technical Maintenance (potential consulting)	108,000	12,000				108,000	12,000				108,000	12,000				84,000	24,000	12,000			
Data and Emissions Set-up Expertise (potential consulting and/or in-house)	13,500	1,500				9,000	1,000														
Totals	182,250	20,250	22,500	0	0	157,500	17,500	25,000	0	0	135,000	15,000	25,000	0	0	105,000	30,000	15,000	50,000	0	
Total Project Cost	600,000																				
Total CMAQ Funds Requested	474,750																				

¹These would be potential future funding sources thought no solicitation has occurred and no commitments have been offered. RPA intends to explore these opportunities in addition to conversations with interested foundations.

Chattanooga Green Trips Air Quality Analysis, Emissions Reduction Estimates, and Cost Effectiveness

Chattanooga Green Trips VMT Reduction Targets by Year	2035 LRTP HPMS Adjusted 2007 Average Annual Daily Travel VMT	Minus Estimated Pass Through Traffic VMT @ 1.9% ¹	Green Trips Targeted Reduction in Daily VMT ²	Green Trips Targeted Reduction in Annual Vehicle ³	Daily Fuel Savings (gal/day)	Annual Fuel Savings (gal/yr)	Reduced GHG Emissions (CO ₂) (tons/yr)	Reduced CO Emissions (tons/yr) ¹	Reduced VOC Emissions (tons/yr) ¹	Reduced NO _x Emissions (tons/yr) ¹	Reduced PM _{2.5} Emissions (tons/yr) ¹	Reduced SO ₂ Emissions (tons/yr)	CO, VOCs, NO _x Total Emissions Reduction Tons/Year ⁴	CO, VOCs, No _x Total Emissions Reduction Kilograms/day ⁴	PM _{2.5} Emissions Reduction Kilograms/day ⁴	Program unit cost (dollars/day) @ Yearly Budget Estimates from Budget Wksht	Per Year Program Cost Effectiveness for CO, VOCs, NO _x (\$/kilogram)	Per Year Program Cost Effectiveness for PM _{2.5} (\$/kilogram)	Program unit cost (dollars/day) @ \$600,000 Total Program Budget	Cumulative 3 Year Program Cost Effectiveness for CO, VOCs, and No _x (\$/kilogram)	Cummulative Total 3 Year Program Cost Effectiveness for PM _{2.5} (\$/kilogram)	Cumulative Total 3 Year Program Cost Effectiveness All Highlighted Criteria Pollutants (\$/kilogram)
First Year (FY 2012) is estimated to be @ 1.5% Targeted Participation (1:1 offset of SOV for carpooling, Transit, Walking, Biking, Etc.)	12,981,036	12,956,372	194,716	71,071,172	11,454	2,863,464	27,721	536.96	77.70	37.02	0.66	0.28	652	1785	2	\$616	\$0.35	\$340.69				
Second Year (FY 2013) is estimated to double yielding a 3% Targeted Participation (1:1 offset of SOV for carpooling, Transit, Walking, Biking, Etc.)	12,981,036	12,956,372	389,431	142,142,344	22,908	5,726,928	55,441	1,073.92	155.41	74.04	1.32	0.56	1,303	3571	4	\$548	\$0.15	\$151.42				
Third Year (FY 2014) is estimated to more than triple first year participation, targeted @ 5% (1:1 offset of SOV for carpooling, Transit, Walking, Biking, Etc.)	12,981,036	12,956,372	649,052	236,903,907	38,180	9,544,879	92,402	1,789.86	259.02	123.40	2.20	0.94	2,172	5951	6	\$479	\$0.08	\$79.49	\$548	\$0.05	\$47.82	\$0.05
3 Year Totals	38,943,108	38,869,116	1,233,198	450,117,423	72,541	18,135,271	175,564	3,401	492	234	4	2	4,127	11,308	11	N/A	N/A	N/A				

¹This estimated percentage of through traffic was removed from the 2035 HPMS Adjusted 2007 Average Annual Daily Travel VMT due to recognizing that the percentage represents a sizable portion of the VMT in the TPO region that can not be considered as part of the % reduction targets. The estimate was generated by the TPO's Travel Demand Modeling Consultants. In addition freight emissions were removed from the final emissions reductions since these programs are not expected to impact freight traffic.

²The targeted vehicle miles traveled (VMT) daily reduction numbers used the TPO's 2035 Long Range Transportation Plan (LRTP) Highway Performance Monitoring System (HPMS) adjusted 2007 base year figures as shown on pages 16-23 of the TPO's Conformity Determination Report. These numbers represent the entire TPO area and are shown in the second column of the table.

³Based on 365 days/year as this program expects to target individuals' personal trips and work trips.

⁴The TN CMAQ criteria pollutants used to calculate the cost effectiveness of this proposal are CO, VOCs, NO_x, and PM_{2.5}

GHG = greenhouse gases (consisting entirely of carbon dioxide [CO₂] in these cases)

CO = carbon monoxide (a criteria air pollutant)

VOC = volatile organic compounds (a contributor to the formation of ozone, a criteria air pollutant)

NO_x = nitrogen oxides (a criteria air pollutant and a contributor to the formation of ozone)

PM_{2.5} = fine particulate matter (particulate matter with an aerodynamic

SO₂ = sulfur dioxide (a criteria air pollutant)

SOV = single occupancy vehicle

Methodologies & Sources: This calculation table was provided by the Chattanooga-Hamilton County Air Pollution Control Bureau (APCB). A methodology addendum which includes assumption source citations has been attached for reference though the information contained in the addendum has additional information on calculations for intersection improvement projects which were not needed for the Green Trips emissions estimates. Adjustments to the APCB methodologies have been provided as footnotes to the table above. Also included as an attachment is documentation of the excluded truck and through traffic percentages from the RPA's consultant.

METHOD FOR CALCULATING EMISSION REDUCTIONS

(APBP, Provided by Alan Frazier and adjusted by Melissa Taylor, RPA and Cambridge Systematics)

An Excerpt Relevant to Calculations for the Chattanooga Green Trips Program

For each gallon of fuel saved there is a 100% offset to the expected reduction in the amounts of carbon dioxide (CO₂), nitrogen oxides (NO_x), fine particulate matter (PM_{2.5}), sulfur dioxide (SO₂), carbon monoxide (CO), and volatile organic compounds (VOC) emitted into the air as alternative vehicle miles (i.e. walking, biking, transit) completely removes a gasoline vehicle from travel. Thus VMT is used as the reduction variable and the fuel savings is calculated from the estimated VMT reduction.

The carbon contents (in units of g/gal) for gasoline that are used in the equation for CO₂ emissions reduction are from Title 40 *Code of Federal Regulations* Part 600.113-78(d) & (e).

- CO₂ emissions reduction =
(gallons total fuel saved) * (0.9 gal gasoline/gal total fuel * 2,421 g carbon/gal gasoline)
* 0.99 moles CO₂/mole carbon * (44.0095 g CO₂/mole CO₂ / 12.0107 g carbon/mole carbon) / (453.59237 g/lb * 2,000 lb/ton)

To estimate the emission levels for NO_x, PM_{2.5}, and SO₂, the MOBILE 6 air quality model for the Chattanooga area was used.

- For local streets, the MOBILE 6 emissions table projects that 1.314 grams of NO_x are emitted for each mile traveled when vehicles travel between 10 and 45 miles per hour.
- For local streets, the MOBILE 6 emissions table projects that 0.0281 grams of PM_{2.5} are emitted for each mile traveled when vehicles travel between 10 and 45 miles per hour.
- For local streets, the MOBILE 6 emissions table projects that 0.0112 grams of SO₂ are emitted for each mile traveled when vehicles travel between 10 and 45 miles per hour.

The formulas used to calculate these emissions reductions are as follows:

- NO_x emissions reduction =
(gallons total fuel saved) * 1.314 g NO_x/mile * 17 miles/gal / (453.59237 g/lb * 2,000 lb/ton)
- PM_{2.5} emissions reduction =
(gallons total fuel saved) * 0.0281 g PM_{2.5}/mile * 17 miles/gal / (453.59237 g/lb * 2,000 lb/ton)
- SO₂ emissions reduction =
(gallons total fuel saved) * 0.0112 g SO₂/mile * 17 miles/gal / (453.59237 g/lb * 2,000 lb/ton)

The MOBILE 6 air quality model was not available on short notice to determine the CO and VOC emissions reductions. Therefore, these reductions were approximated as proportions of the respective NO_x emissions reductions. These proportions were arrived at by using data from the planned 5th edition of “AP-42 Volume II: Mobile Sources” that is available at www.epa.gov/oms/ap42.htm. The relative emissions reductions for light-duty gasoline powered vehicles were calculated to be 23.022 g CO/mile, 3.404 g VOC/mile, and 1.492 g NO_x/mile using data from Tables 1.4A, 1.11A.1, 1.11B.1, and 1.11C.1. The relative emissions reductions for heavy-duty diesel powered vehicles were similarly calculated to be 11.516 g CO/mile, 2.005 g VOC/mile, and 7.316 g NO_x/mile using data from Tables 7.4, 7.11A.1, 7.11B.1, and 7.11C.1. Tables 1.4A and 7.4 provide fractional distributions of vehicles of each model year on the road for the twenty-five most recent model years as of January 1 of any year. Tables 1.11B.1 and 7.11B.1 provide projected CO emissions, in units of g/mile, as of January 1, 2010, for vehicles of each model year from 1986-2010. Tables 1.11A.1 and 7.11A.1 provide projected VOC emissions, in units of g/mile, as of January 1, 2010, for vehicles of each model year from 1986-2010. Similarly, Tables 1.11C.1 and 7.11C.1 provide projected NO_x emissions, in units of g/mile, as of January 1, 2010, for vehicles of each model year from 1986-2010. Each of the six relative emissions reductions stated above were calculated by adding together the products of the appropriate fractional distribution times the emissions for each of the twenty-five model years.

- CO emissions reduction =
 $(\text{g NO}_x \text{ emissions reductions}) * (0.9 \text{ gasoline vehicle mile/total vehicle mile} * 23.022 \text{ g CO/gasoline vehicle mile}) / (0.9 \text{ gasoline vehicle mile/total vehicle mile} * 1.492 \text{ g NO}_x/\text{gasoline vehicle mile}) =$
 $(\text{tons NO}_x \text{ emissions reductions}) * 10.543 \text{ tons CO/ton NO}_x$
- VOC emissions reduction =
 $(\text{g NO}_x \text{ emissions reductions}) * (0.9 \text{ gasoline vehicle mile/total vehicle mile} * 3.404 \text{ g VOC/gasoline vehicle mile}) / (0.9 \text{ gasoline vehicle mile/total vehicle mile} * 1.492 \text{ g NO}_x/\text{gasoline vehicle mile}) =$
 $(\text{tons NO}_x \text{ emissions reductions}) * 1.574 \text{ tons VOC/ton NO}_x$

Since the regional VMT and subsequent VMT reduction estimates included truck traffic, an adjustment must be made to the final emissions reductions since the VMT reduction program will not affect freight trucks. The following factors¹ that represent the percent of emissions from non-freight traffic were applied to the emission reductions described above.

Table 1. Percent of Total Emissions from Non-freight Traffic

CO	94%
VOC	92%
NO _x	50%
PM2.5	30%
SO ₂	32%

¹ Cambridge Systematics analysis of Georgia EPD 2005 CERR Data.

Chattanooga Green Trips Task Timeline

			Quarterly Task Timeline by Federal Fiscal Year											
			FY 2012				FY 2013				FY 2014			
			Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept
Project Milestone	Description of Tasks for Milestone	Due Date												
TDOT Announces Awards	Notification is sent to TPO from TDOT announcing the recipients of the July 2011 CMAQ application process	09/02/11												
RPA-TDOT Contract	RPA begins contract process with TDOT	09/12/11												
RPA Issues RFP and/or Job Position	RPA works with Purchasing to begin the RFP and/or employment process for hiring a consultant and/or coordinator to manage and/or maintain the program. This could be one or the other or a combination of both	09/26/11												
Project/Funding Incorporated into TPO's TIP/STIP	RPA works with TPO to review TIP amendment at the TCC meeting on September 6th and approve it by Board resolution at the October 18th meeting	10/18/11												
TDOT Contract Finalized	RPA-TDOT provide final signatures on contract with TDOT	10/31/11												
FHWA Obligates Funds	RPA submits all necessary materials to TDOT and TDOT submits request for obligation then FHWA obligates funds	11/30/11												
Consultant Contract Finalized and/or Coordinator Hired	Coordinator and/or Consultant has entered into employment and/or contract with RPA for Start of Work on 1/1/2012	12/31/11												
1st Quarterly Report 2012	RPA prepares the first project report	12/31/11												
Coordinator/Consultant Starts Work	RPA has hired Coordinator and/or Consultant and they begin work	01/01/12												
Program Team Kickoff Mtg	RPA conducts a Green Trips Team meeting and explains the intended outcomes of the program, tracking responsibilities, and program management including quarterly meetings	01/05/12												
Development of Program Needs, Expectations of Applications, and Partners	RPA staff works internally on expected needs, secures partners, and considers applications of the program including website technicalities	2/1/2012												
CMAQ Continuation Application	If necessary, the RPA will submit for a continuation of the Green Trips Program	3/31/2012												
2nd Quarterly Rpt 2012	RPA and Team work collaborately to prepare the 2nd progress report	03/31/12												

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			Quarterly Task Timeline by Federal Fiscal Year											
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			Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept
Project Milestone	Description of Tasks for Milestone	Due Date												
Creation of Education/Marketing Campaign	RPA staff works with consultant and/or coordinator to prepare and complete the necessary marketing and education tools/materials for the program	4/1/2012	█	█										
Development of the Program Website	RPA in conjunction with the Program Coordinator and/or consultant work on various aspects of creating the Green Trips program website for test rollout on April 1, 2012	04/08/12		█	█									
Official Program Rollout for Earth Day w/ Press Conference	RPA-TPO Press Conference to announce program and officially take the website live or participant enrollment	04/22/12			█									
On-going documentation of progress, emissions results, and public education/support	Team continues to track program progress, emissions, and support inquiries from public about program				█	█	█	█	█	█	█	█	█	█
3rd Quarterly Rpt 2012	RPA and Team work collaborately to prepare the 2nd progress report utilizing information collected weekly from the website including first set of emissions data	06/30/11			█									
90 Day Program Evaluation for Technical Issues	RPA works with Coordinator and/or consultant on resolving membership issues or technical difficulties.	07/31/12			█	█								
4th Quarterly Rpt 2012	RPA and Team prepare the 4th progress report with set of emissions data and integrates Bike Share data	09/30/12				█								
Program Demonstrates Active Members w/ Reoccurring Activity	Program successfully active with participation	12/31/12			█	█	█							
1st Quarterly Rpt 2013	Team prepares the 1st progress report of 2013	12/31/12					█							
Education and Marketing Splash	RPA and Coordinator/consultant conduct education/marketing splash to kick off the 2nd year of the program	02/28/13					█	█						
CMAQ Continuation Application	If necessary, the RPA will submit for a continuation of the Green Trips Program	03/31/13					█	█						
2nd Quarterly Rpt 2013	Team prepares the 2nd progress report of 2013	03/31/13						█						
Begin 6 month Employer Recruitment	RPA staff uses demonstration activity and emissions data to recruit employers to the program and garnish matching funds to sustain the program	06/30/13						█	█					
3rd Quarterly Rpt 2013	Team prepares the 3rd progress report of 2013	06/30/13							█					

Chattanooga Green Trips Task Timeline

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			Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept	Oct-Dec	Jan-Mar	Apr-Jun	July-Sept
Project Milestone	Description of Tasks for Milestone	Due Date												
Begins Data Analysis & Projections	Team works collaboratively with the Air Pollution Control Bureau (APCB) to prepare and analyze the first set of data collected including preliminary projections for future reductions													
4th Quarterly Rpt 2013	Team prepares the 4th progress report of 2013	09/30/13												
1st Quarterly Rpt 2014	Team prepares the 1st progress report of 2014	12/31/13												
Education and Marketing Splash	RPA and Coordinator/consultant conduct education/marketing splash to kick off the 3rd year of the program	02/28/14												
CMAQ Continuation Application	If necessary, the RPA will submit for a continuation of the Green Trips Program	03/31/14												
2nd Quarterly Rpt 2014	Team prepares the 2nd progress report of 2014	03/31/14												
Earth Day Media Release 1 Year Results	RPA prepares and issues media release on the first year of progress, participation, and emissions results	04/21/14												
3rd Quarterly Rpt 2014	Team prepares the 3rd progress report of 2014	06/30/14												
Final CMAQ Emissions Analysis Report	RPA works with the APCB to prepare and complete final CMAQ emissions analysis required by TDOT	8/31/2014												
Consultant Contract and/or Employee Coordinator Evaluation	RPA evaluates revenues and determines whether to extend consultant and/or RPA employee	9/1/2014												
Final Quarterly Rpt 2014	Team prepares the 4th/final progress report of the pilot	09/30/14												