VMT and Trip Reduction Calculation Packet

This packet contains example equations to assist in estimating the reduction in vehicle trips and vehicle miles traveled (VMT) associated with your project. Most of the equations are similar to those provided by CDOT, with modifications made by DRCOG, to assist in the annual reporting process on the effectiveness of programs funded with CMAQ dollars.

Separate equations are shown for each project type. These formulas are used to track the results of programs that have been implemented and account for only those who switched from driving alone to other mobility options, reducing trips/VMT as result of the program. These formulas may also be used to calculate the anticipated benefits of proposed programs. Below each equation is a list of variable definitions and default values. The default values are based on surveys and information gathered by or for DRCOG. If you recently performed your own surveys and obtained different values, please use those but provide documentation regarding your source. Only account for anticipated *new users* (those who are anticipated to transition from single occupancy vehicles as their primary commute mode) as a result of the project or program being proposed.

When describing your predicted trips/VMT reduced in your application, also provide the formula, input and assumptions used. The VMT is simply the number of trips reduced multiplied by the average one-way distance travelled.

Default values are not provided for all variables and some estimation and research on your part may be necessary. You may use an alternative equation or methodology, as long as it can be explained clearly. It must contain a logical set of steps, variables, and data inputs.

Please contact **Emily Lindsey (elindsey@drcog.org)** if you have any questions.

Bike Parking / Shelters Located at Transit Stations

The formula below is used to calculate the annual vehicle miles of travel reduced (AVMTR) from **new** bike parking/bike shelters located at transit stations:

$$AVMTR = [(D+d) \times S \times (C \times PCT \text{ Former SOV})] \times N_w$$

Where:

Variable	Description	Source of Data
D	Distance of auto trip (round trip) that is now a transit trip.	Survey*
d	Distance of bike trip (round trip) from transit stop to workplace/destination.	Survey*
C	Number of people/commuters/bikes the bike shelter could reasonably accommodate each day.	To be provided by applicant.
PCT Former SOV	Percent SOV before bike shelter constructed. **[.75]**	Survey*
S	Number of days per week of shift.	Survey*
N_w	Number of work weeks per year. **[48]**	Fixed at 48.

Note: Default values have been obtained from surveys performed by or for DRCOG. Please document your sources if your values differ.

*For predicting benefits, applicant may use research/other surveys conducted pertaining to bike parking/shelters.

Carpool Matching

The formula below is used to calculate the annual vehicle miles of travel reduced (AVMTR) from **new** participants in the carpool matching service:

$$\text{AVMTR} = N \times P \times \text{PCT Former SOV} \times ((S-1)/S) \times (F/W) \times N_t \times N_d \times D$$

Where:

Variable	Description and Suggested Default Values	Source of Data
N	Total new commuter registrants during the current year.	Carpool matching database (MyWaytoGo Commuter registrations for the year)
P	Carpool rate. The proportion (expressed as a decimal) of registrants who carpool. **[.16]**	Survey of registered users
PCT Former SOV	Percent SOV before registering. **[.74]**	Survey
S	Average carpool size (includes driver). **[2.74]**	Survey of registered participants who have set up trips
F	Average number of days per week that carpooling is used instead of driving alone. **[3.7]**	Survey of registered participants who have set up trips
W	Number of workdays in a week. **[5]**	Fixed
D	Average one-way trip distance (miles). **[19.5]**	Survey of registered participants who have set up trip
N_d	Number of benefit days per year. **[240]**	Fixed at 240 work days per year
N_t	Number of one-way trips per day. **[2]**	Fixed at 2 per day

Note: Default values have been obtained from surveys performed by or for DRCOG. Please document your sources if your values differ.

Schoolpool

The formula below is used to calculate the annual vehicle miles of travel reduced (AVMTR) from **new** participants in the schoolpool service:

$$AVMTR = N \times P \times ((S-1)/S) \times D \times W \times N_w \times (P_2 \times N_t) + ((1-P_2) \times N_f)$$

Where:

Variable	Description and Suggested Default Values	Source of Data
N	Number of new Schoolpool families in the database.	Schoolpool matching database.
P	The proportion (expressed as a decimal) of new families in the database that formed carpools.**[.24]**	Schoolpool survey
S	Average carpool size (average number of families, including driving family, in the carpool). **[2.6]**	Schoolpool survey
D	Average one-way trip distance (miles) from home to school. **[7.8]**	Schoolpool survey
W	Number of carpool days in a week. **[4.4]**	Schoolpool survey
N_w	Number of weeks in a school year. **[39]**	Fixed at 3
P_2	The proportion (expressed as a decimal) of two-way trip school carpools. A two-way trip school carpool is one where the driving parent would drop off the child(ren) at school on the way to work, and then pick up the child(ren) on the way home from work. The remainder of participants $(1-P_2)$ are assumed to be four-way trip school carpools, where the parent returns home after dropping off the child(ren) in the morning and drives back to school from home in the afternoon. If not for the need to transport children to school, these parents would not make any trips. **[.51]**	Schoolpool survey
N_t	Number of one-way trips per day for the two-way trip carpool. **[2]**	Fixed at 2
N_f	Number of one-way trips per day for the four-way trip carpool. **[4]**	Fixed at 4

Telework

The formula below is used to calculate the annual vehicle miles of travel reduced (AVMTR) from **new** teleworkers at firms participating in telework programs:

$$AVMTR = N \times \%SOV \times D \times N_t \times W \times N_w$$

Where:

Variable	Description	Source of Data
N	Total number of new teleworkers at companies that adopted a formal telework program during the year as a result of telework (or telework expansion) program.	Surveys at employment sites or estimated by participating employers.
%SOV	The percent of new teleworkers who drove to work alone when not teleworking. **[75%]**	Survey of teleworkers
D	Average one-way trip distance. **[17.2]**	Survey of teleworkers
N_t	Number of one-way trips per day. **[2]**	Fixed at 2.
W	Average days per week that employees telework instead of commuting. **[2.1]**	Survey of teleworkers
N_w	Number of work weeks per year. **[48]**	Fixed at 48.

Note: Default values have been obtained from surveys performed by or for DRCOG. Please document your sources if your values differ.

Transit Pass Programs

A) The formula below is proposed to calculate the annual vehicle miles of travel reduced (AVMTR) from **<u>new</u>** transit riders due to participation in pass programs. Transit Pass programs are only eligible during ozone season (28 weeks or 7 months). When predicting benefits, it can be assumed that 20% will continue using transit (as a result of the program) the remainder of the year if/when the subsidy is not in effect. This assumption may be factored into your calculation.

AVMTR = N x %SOV x Transit Days x N_w x N_t x D

Where:

Variable	Description	Source of Data
N	Number of new transit riders (boardings) due to pass program.	Survey of program participants or surveys at employment sites where programs are implemented.
%SOV	The percent of new transit riders who drive to work alone when not using transit. **[75%]**	Survey of program participants or surveys at employment sites where programs are implemented.
Transit Days	Number of transit commute days per week. Depends on pass program.	Survey of program participants or surveys at employment sites where programs are implemented.
N_w	Number of work weeks per year a transit pass may be utilized. **[28]**	Fixed at 28. Transit Pass projects are only eligible for 7 months during ozone season.
N_t	Number of one-way commute trips per day. **[2]**	Fixed at 2.
D	Average one-way trip distance (miles) from home to work. **[9.24]**	Survey of program participants or surveys at employment sites where programs are implemented. 9.24 miles is the regional avg. work trip distance (YR2015 (RTP-2016))

Transit Pass Programs (continued)

B) The formula below is proposed to calculate the annual vehicle miles of travel reduced (AVMTR) from **existing** transit riders who increase their ridership as a result of the implementation of a pass program.

$$\text{AVMTR} = N \times \%SOV \times \text{Increase in Transit Days} \times N_w \times N_t \times D$$

Where:

Variable	Description	Source of Data
N	Number of existing transit riders (boardings) where pass programs are implemented.	Survey of program participants or surveys at employment sites where programs are implemented.
$\%SOV$	The percent of existing transit riders who drive to work alone when not using transit. **[75%]**	Survey of program participants or surveys at employment sites where programs are implemented.
Increase in Transit Days	Increase in the number of transit commute days per week.	Survey of program participants or surveys at employment sites where programs are implemented.
N_w	Number of work weeks per year a transit pass may be utilized. **[28]**	Fixed at 28. Transit Pass projects are only eligible for 7 months during ozone season.
N_t	Number of one-way commute trips per day. **[2]**	Fixed at 2.
D	Average one-way trip distance (miles) from home to work. **[9.24]**	Survey of program participants or surveys at employment sites where programs are implemented. 9.24 miles is the regional avg. work trip distance (YR2015 (RTP-2016))

Vanpool

The formula below is used to calculate the annual vehicle miles of travel reduced (AVMTR) from **new** participants in the vanpool service:

$$AVMTR = N \times PCTSOV \times ((S - 1) / S) \times (F / W) \times N_t \times N_d \times D$$

Where:

Variable	Description and Suggested Default Values	Source of Data
N	New vanpoolers.	vRide monthly activity reports
PCTSOV	Percent that were SOV only. **[74%]**	DRCOG Vanpool Survey 2016
S	Average vanpool size (includes driver). **[5.4]**	vRide monthly activity reports
F	Average number of days per week that vanpooling is used instead of driving alone. **[4.23]**	DRCOG Vanpool Survey 2016
W	Number of workdays in a week. **[5]**	Fixed at 5.
N_t	Number of one-way trips per day. **[2]**	Fixed at 2.
N_d	Number of benefit days per year. **[240]**	Fixed at 240 work days per year.
D	Average one-way trip distance (miles). **[43.5]**	DRCOG Vanpool Survey 2016

Note: Default values have been obtained from surveys performed by or for DRCOG, vanpool database and vanpool odometer readings. Please document your sources if your values differ.

Marketing

A) If the objective of project/campaign is to exclusively target current SOV users to switch to an another mode:

	AVMTR = N x P x N_t x N_d x D	

Variable	Description	Source of Data and Assumptions	Examples
N	Total number of people (commuters, employees, households) targeted by campaign.	Census, employer data. Provide assumptions.	**N = 8000**
P	Percent who shift to an alternative mode as a result of the campaign	See assumptions. For post-project evaluations, this number (%) can be determined by a survey.	Project is an individualized marketing campaign **P = 5%**
N_t	Number of one-way trips per day.	Fixed at 2 per day.	**N_t = 2**
N_d	Number of <u>benefit</u> days per year.	Assume 240 work days or 48 work weeks per year.	Program will take place for 1 year and participants commit to using alt. transportation 2 times/week. [48 weeks x 2 days = 96 benefit days] **N_d = 96**
D	Average one-way trip distance (miles).	Regional average is 9.24 miles. Applicants may use local, recent data if available.	**D = 9.24**

Trips Reduced	*8000 x .05 x 2 x 96 = **76,800***
VMT Reduced	*76,800 x 9.24 = **729,600***

<u>**Assumptions**</u>
- Project exclusively targets current SOV users to switch to an alternative mode.
- Mass Marketing Campaign: It is estimated that 0.1-1% of people will switch to an alternative mode.
- Individualized Marketing Campaign: It is estimated that 3-8% of people will switch to an alternative mode**.**

B) If the objective is to promote a specific mode or various mobility options and targets all commuters (those who drive alone and/or use other modes of travel):

> *Note: You need to factor in those who are already not driving alone (no credit for switching from one clean mobility option to another). However, credit can be taken for those who increase their non-SOV mode usage as a result of the program (e.g., person uses an alternative mode 1 additional day per week as a result of campaign).*

AVMTR = N x P x PSOV x N_t x N_d x D

Variable	Description	Source of Data and Assumptions	Examples
N	Total number of people (commuters, employees, households) targeted by campaign.	Census, employer data. Provide assumptions.	N= 10,000
P	Percent who shift to an alternative mode as a result of the campaign.	See assumptions. For post-project evaluations, this number (%) can be determined by a survey.	Project is a mass marketing campaign. P = 0.5%
PSOV	Percent that formerly commuted by single occupant vehicle.	Census, recent surveys. Regional PSOV is 75%. Applicants may use local, recent data if available.	PSOV = 75%
N_t	Number of one-way trips per day.	Fixed at 2 per day.	N_t = 2
N_d	Number of <u>benefit</u> days per year.	Assume 240 work days or 48 work weeks per year.	Program will take place for 1 year and participants commit to using alt. transportation 3 times/ week. [48 weeks x 3 days = 144 benefit days] N_d = 144
D	Average one-way trip distance (miles).	Regional average is 9.24 miles. Applicants may use local, recent data if available.	D = 9.24

Trips Reduced   10,000 x .005 x .75 x 2 x 144 = **10,800**
VMT Reduced   10,800 x 9.24 = **102,600**

Assumptions
- Mass Marketing Campaign: It is estimated that 0.1-1% of people will switch to an alternative mode.
- Individualized Marketing Campaign: It is estimated that 3-8% of people will switch to an alternative mode.