Triangle TDM FY19 Annual Impact Report

Full Methodology

The method that LDA Consulting developed to calculate travel and air quality impacts in the Triangle Region consists of a series of calculations, the original bases of which are the populations of interest for individual services. A series of multipliers (derived from surveys of users of the services or similar services) is then applied to account for various real-world complexities. Each service has a unique set of multipliers that depend on the characteristics of the users and the service, but the basic calculation method is the same for all services. A brief description of the calculation process follows here.

The approach defined in these nine steps was used to calculate the FY19 impacts for the Triangle TDM program. The results of the calculation are presented in Section 3.

1. Define the commuter population "base" for each service

A TDM service is designed to influence or encourage a targeted set of travelers to shift to non-drive alone "alternative" modes. These targeted travelers represent the population base or population of interest for that service. Depending on the service, this could be (for example) all commuters, students, employers, or another targeted group. Population base counts for this evaluation were provided by Triangle TDM Local Service Providers.

The FY18 evaluation assessed benefits accruing from TDM services during Fiscal Year 2019 (July 1, 2018 through June 30, 2019) based on commuters who received or accessed services during this 12-month period. It also includes additional credit to account for continued or "retained" use of alternative modes by commuters who started using a new alternative mode in FY18 after using the service and continued using the new mode in FY19. Specifically, for services in which these continued FY18 service users would not be duplicative of commuters in the FY19 participation base, a percentage of the FY18 participation was counted toward the FY19 participation base.

2. Calculate "placement rate."

Placement rate refers to the percentage of commuters in the population base who are "placed" into an alternative mode after receiving a service. Placement rates are calculated using data from surveying a sample of the population and vary from one service to another since they depend on the characteristics of the service and user population. To collect placement rate data, commuters are asked several questions:

- How do you travel to work now? What modes do you use and how often do you use them?
- Did you make any mode use changes in your travel to work since you received "X" service?
- How did you travel before you made these changes?
- Did the service encourage or assist you to make this change? (to derive an estimate of the influence of the service)

Respondents who made a travel change that was influenced by the service are considered "placements." Two rates are calculated and are distinguished by the length of time the commuter uses the alternative mode after shifting. The "continued rate" represents commuters who made a shift to a new alternative mode and continued using the new mode. The "temporary rate" represents commuters who tried a new alternative mode but shifted back to original mode within the evaluation period. In some cases, the temporary rate can be used to estimate impacts for a program, such as a trial program that was in effect for only a portion of the year. Delineation between temporary and continued change is necessary because temporary changes provide credits to the program only for the duration of time respondents used the new mode.

3. Estimate the number of new alternative mode placements.

Step 3 estimates the number of new commuter placements in alternative modes. This is the expected number of commuters who started or increased use of alternative modes as a result of the service. It is calculated as:

Total Population base (from Step 1) x Placement rate (from Step 2)

4. Calculate the vehicle trip reduction (VTR) factor for new placements.

Using the same survey data used to calculate placement rate, the VTR factor is calculated as the average daily vehicle trips reduced per placement, taking into account three types of changes:

1) Shifts to an alternative mode, either from driving alone or from another alternative mode

2) Increased use of alternative modes (e.g., riding the bus more days per week)

3) Increase in the number of riders in an existing carpool or vanpool

The VTR factor is calculated by summing the individual weekly vehicle trip change for each commuter placement to obtain a count of the total change in vehicle trips for all placements together, then dividing by the number of commuter placements to estimate the average change in vehicle trips per placement. Note that the calculation can include alternative mode shifts that increase vehicle trips, such as a change from transit to carpool, but commuters who shift from alternative modes to driving alone are not included, since these changes most often result from changes in personal travel needs, such as changing jobs, and are not the intended result of TDM services. In short, the calculation accounts for vehicle trip increases resulting from successful placement of an alternative mode user into a lower-occupancy alternative mode (e.g., bus rider shifts to carpooling), but does not penalize the program if it is unable to keep an existing alternative mode user in an alternative mode.

5. Estimate vehicle trips reduced.

The number of daily vehicle trips reduced for the service is estimated by multiplying the number of commuter placements by the VTR factor:

Total placements (from Step 3) x VTR factor (from Step 4)

6. Estimate vehicle miles traveled (VMT) reduced.

The daily VMT reduced is calculated by multiplying the number of daily vehicle trips reduced (Step 5) by the average commute distance for commuters who made a travel change. The average distance is calculated from the same survey data used to calculate the placement rate and VTR factor or from other service-specific data obtained from Local Service Providers.

Total vehicle trips reduced (from Step 5) x one-way travel distance

7. Adjust vehicle trips and VMT for access mode and trips.

Emissions reductions were calculated by multiplying vehicle trips reduced and VMT reduced by emissions factors; but because commuters who drive alone to meet a carpool, vanpool, or bus create a "cold start," the air quality analysis subtracts these access trips and the VMT driven to the meeting point from the vehicle trip reductions and the VMT reductions. These "adjusted" vehicle trips reduced and VMT reduced, rather than the initial totals, are used as the base for calculation of emissions reduced.

The adjusted VMT reduced is also reported as the total VMT reduction for the program. But because vehicle access trips are typically very short relative to the total commute distance and the vehicle trip is physically removed from the road network for the vast majority of the commute trip, the adjusted vehicle trip count is used only for the emission portion of the analysis; the total vehicle trip reduction is reported as the travel impact of the program.

8. Estimate emissions reduced.

Daily emissions reduced are estimated by multiplying regional emissions factors by the number of VMT reduced to determine the pollutants reduced as result of the program. The emissions factors in the FY19 evaluation were derived from emission data obtained in 2010 from NCDOT-Transportation Planning Branch's CMAQ Project website (see specific factors in the notes under the table in Appendix 7). The emissions factors account for emissions created from a "cold start" when a vehicle is first started, a "hot soak" that occurs when the vehicle is later turned off, and the emissions generated per mile of travel by an average warmed-up vehicle.

Adjusted VMT reduced (from Step 7) x Running emission factor for individual pollutants

9. Estimate the energy savings.

Energy savings is reported as gallons of gasoline saved and is estimated by multiplying the adjusted VMT reduced by an average fuel consumption factor for the regional mix of light-duty vehicles.

Impact Multiplier Factors

The impact calculation method applied a series of service-specific multiplier factors to more accurately estimate impacts, which are applied during several of the steps described above. Surveys and estimates have helped determine key factors (placement rates, VTR factors, travel distances, and drive-alone access percentage) for the services included in the calculation. For example, for the Share The Ride NC ridematch database, the long-term placement rate for participants into alternative modes is 36%, and the long-term vehicle trip reduction factor is 0.6 trips per day. These figures were derived from a survey of rideshare database registrants.

Whenever possible, the calculation methodology derives multiplier factors from data collected by TJCOG or the Regional or a Local Service Provider. Many Service Providers conducted some follow-up contacts with service users, during which data were collected on service use and mode changes; data from commuter surveys was also used. If original local data were not available to derive a factor directly, the evaluation team sought a proxy or assumed value from another Triangle TDM service that was expected to have similar characteristics and for which a multiplier value was known. If this was not possible, the evaluation team used multiplier values derived for similar programs in other U.S. locations that have conducted program evaluations.

Many of the program's services are used in conjunction with other services. For example, someone might use the GoTriangle website as well as the Share The Ride NC database. To correct for the overlap and avoid double or triple counting participating commuters, the evaluation team derived discount factors to estimate the share of each service impact that was independent of other services. These discount factors were multiplied by the trip, VMT, and emission impacts calculated for each service individually to reduce individual service impacts appropriately.

The final step in the calculation was to add all the discounted impacts for each program together, to produce the total aggregate impacts for all services combined. These impacts are presented in Table 1 (daily) and Table 2 (annual).

Table 1 – FY19 Triangle TDM Program Daily Impacts

Impact Indicator	**All Changes**	**Directly Influenced Changes**	**Average of All & Directly Influenced Changes (Best Estimate)**
Placements (new alternative mode users)	81,747	38,840	60,294
Daily vehicle trips reduced	33,616	18,040	25,828
Daily VMT reduced	368,156	194,294	281,225
Emissions reduced (daily kilograms)			
– Nitrogen oxides (NOx)	175	92	134
– Volatile organic compounds (VOC)	231	122	177
– Carbon dioxide (greenhouse gas)	136,899	72,248	104,574
Energy savings – daily gallons of gasoline saved	15,404	8,129	11,767

Table 2 – FY19 Triangle TDM Program Total Annual Impacts

Impact Indicator	All Changes	Directly Influenced Changes	Average of All & Directly Influenced Changes (Best Estimate)
Placements (new alternative mode users)	81,747	38,840	60,294
Annual vehicle trips reduced	8,404,015	4,509,892	6,456,954
Annual VMT reduced	92,038,964	48,573,563	70,306,263
Emissions reduced (annual kilograms)			
– Nitrogen oxides (NOx)	43,811	23,121	33,466
– Volatile organic compounds (VOC)	57,800	30,504	44,152
– Carbon dioxide (greenhouse gas)	34,224,689	18,062,079	26,143,384
Energy savings – annual gallons of gasoline saved	3,851,003	2,032,367	2,941,685