

What is Travel Demand Modeling?

Travel analysis incorporates a wide spectrum of topics as part of regional transportation planning activities. In general, travel analysis is performed to assist decision makers in making informed transportation planning decisions. The strength of modern travel demand forecasting is the ability to ask critical “what if” questions about proposed plans and policies.

To do this, we use a travel demand forecasting model - a computer model used to estimate travel behavior and travel demand for a specific future time frame, based on a number of assumptions.

How does a travel demand model work?

Traditionally, an approach known as the “four-step process” has been used for regional transportation planning analysis. As its name implies, this process has four basic phases:

1. **Trip generation** (the number of trips to be made);
2. **Trip distribution** (where those trips go);
3. **Mode choice** (how the trips will be divided among the available modes of travel); and
4. **Trip assignment** (predicting the route trips will take).

By looking at these four areas, we can answer the following questions:

How many trips will people make?

Looking at land use characteristics (i.e. how we use land in our region) is the main way to figure out **trip generation** rates. This is because factors like the number and size of households, automobile ownership, types of activities (residential, commercial industrial, etc.), and density of development all drive how much travel flows from or to a specific area within the region.

For simplicity, a geographic unit called a transportation analysis zone (TAZ) is used to create trip generation rates for the region. Specifically, a number of existing or projected characteristics within the TAZ are used for this. In Virginia, the number of TAZs can vary widely depending on the size of the model region from about 200 for some of the small model regions to over 2,000 for the Washington, DC regional model .

Where will jobs and people locate?

Once the model generates a certain number of trips from each TAZ, it needs to determine to which zone each trip goes. This is called **trip distribution** and the analysis involves a sophisticated process for weighting the “attractiveness” of each TAZ based on the number of attractions it has and the travel time from other TAZs. This step leads to a picture of origin and destination points within the region and how many trips are going between each pair of TAZs. For large model regions this can be an extremely large origin-destination matrix, e.g., over 2,000 x 2,000 for Washington, DC, a total of over 4,000,000 matrix cells!

How will people travel?

Mode choice shows which mode people use to travel between their origins and destinations. That is, whether people take transit, their own car, or a carpool to and from work or another destination.

A complex sub-model has been created for determining the modal choice, and is based both on certain assumptions about transit capacity, schedules, and fare levels and on real-world observations of how, when, and where people use transit.

What routes will people take?

Trip assignment determines the routes people will take from start (origin) to finish (destination). Generally, the computer assumes everyone will take the quickest route to their destination. To compute route selection requires all kinds of information regarding actual or predicted congestion levels, road conditions, transit schedules and fares, traffic signal systems, etc.

How do we know the model predicts reasonable trips?

Once the four steps are completed, the model provides planners with a picture of existing travel patterns. The results are then given a reality check. Modelers check with planning staff to make sure the numbers make sense, and cross-check how well the model predicts current “observed” data, such as park-and-ride utilization and highway vehicle traffic counts. This “checking” is called a validation. Model validations are generally done at least once a decade.

What can the model tell us?

Travel demand model results can assist decision makers in making informed transportation planning decisions. The results from the model vary depending on the ideas and information used and the sophistication of the particular model. Small models generally provide users with forecasted highway volumes for roadways with functional classes of minor arterial and above. Large model regions generally provide users with everything included in small models and transit forecasts. Some more sophisticated models also provide users with information on truck forecasts, college/university travel, HOV travel, and the effects of toll strategies on travel behavior. Because of their aggregate nature and regional scope, travel demand models are not designed to forecast bicycle or pedestrian trips.

What resources are available to update Virginia Travel Demand Models?

The latest updates to model development programs are being fostered by the federal government’s [Travel Model Improvement Program](#). This is a cooperative effort by which travel demand model professionals and users are attempting to bring more accuracy and robustness to regional models. The Virginia Department of Transportation (VDOT), Virginia Planning District Commissions, and Virginia MPOs are also working cooperatively through the Virginia Transportation Modeling (VTM) user’s group to ensure that census, household travel survey, land use, and other necessary data is provided for modeling efforts given available resources.