Triangle Regional Model *Generation 2*

Introduction

The Triangle Regional Model Generation 2 (TRMG2) is a **new travel forecasting model** that supports regional transportation planning.

What is the Triangle Regional Model?

The TRM is a mathematical computer model used by transportation planning agencies in the region to develop and evaluate strategies that support mobility, access, economic health and quality of life.

Area Covered by TRM

3,533 square miles

- Includes **40 jurisdictions**
- **2,965 analysis zones** include:

1,057,590 jobs

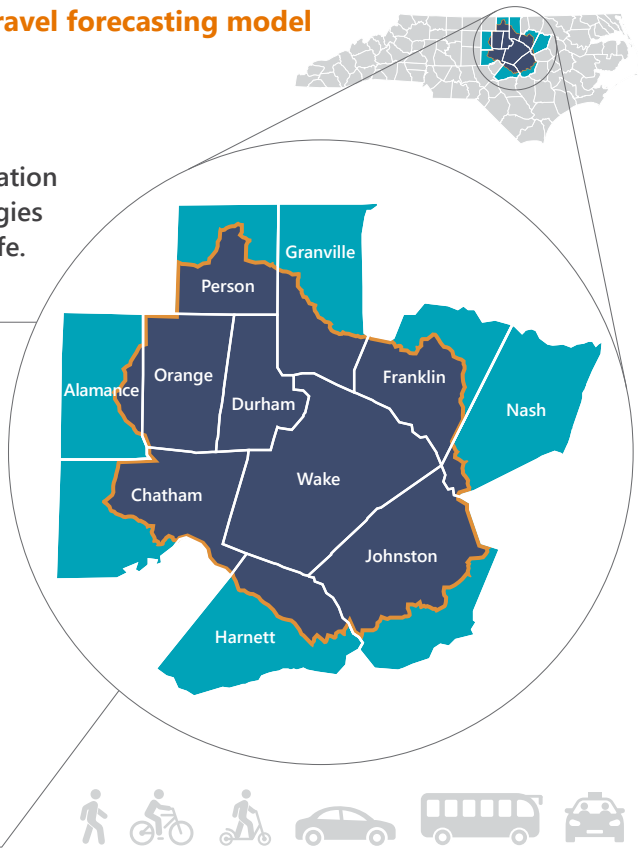
2,001,649 people

16,368 miles of roadway

121 transit routes

79,228 university students

10 transit agencies



What makes this a best practice model?

The design **better captures individual, household, and neighborhood characteristics** that influence travel choices and the way people make trips, including by car, bus, rail, bike or walk. These advances lead to improved decision making for regional transportation investments which ensures a more efficient and well-connected future.

The new model considers...

Family Characteristics
Children, workers, and seniors

Neighborhood Characteristics
Walkability, mix of land uses

Trip Connectivity
Trips are modeled not as individual segments, but as connections to anchor activities such as work.

The Triangle Region Characteristics
The Triangle region is complex with many large and small city centers.

Cost and Availability of Parking

Mobility Services

...to better represent:

Auto Ownership
The number of autos owned by a family influences their choice of mode and number of trips they make.

Walk and Bike Trips
An important planning factor for Triangle communities

How People Travel

36% work tour trips

64% non-work tour trips

People tend to favor destinations within their own community.

People's Choices
Parking constraints influence people's choice of mode and destination. The model also forecasts mobility services such as Uber and Lyft.

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Advanced Components

Explainable Artificial Intelligence (XAI)

The **number of trips** made by residents in the region is estimated using explainable artificial intelligence (XAI) that fully utilizes Triangle Travel Survey data and allows for a greater number of variables such as age, access, income, worker status, vehicle ownership and household composition.

Nested Destination Choice Model

The destinations that residents **travel to** is estimated using a nested destination choice model that is first informed by the activities available to them in their own community/city, and then to the broad array of activities available throughout the region.

The Influence of Parking Cost and Availability

The **choice of mode** for travel in the Triangle is influenced by parking cost and availability and includes the option of traveling by Uber or Lyft in addition to the traditional auto and transit modes.

Mode and Destination Consistency

Resident trips that start and end at locations other than home are informed by the destination of the original home-based trip and the travel mode used to reach that destination.

Synthetic Population

A synthetic population of over 1.8 million people is generated in roughly two minutes. Household level data includes household size, number of workers and income. Person level data includes age groups for children, adults and seniors.

Accessibility

Zonal socioeconomic data and network travel times are used together to calculate several accessibility variables for roadway, transit and non-motorized modes. These accessibilities are used to capture sensitivity to behavioral responses to development patterns, area type, and proximity of attractions nearby.

Time of Day

Individual level home-based trips are apportioned to four time-of-day periods (AM: 7:00 AM – 9:00 AM, MD: 9:00 AM – 3:30 PM, PM: 3:30 PM – 6:15 PM, NT: 6:15 PM – 7:00 AM) based on fixed factors from the survey for each trip type. The choice of trip mode and destination use these same time periods providing better representation of the travel choices people actually experience over the course of a day.

Run Time

The 2020 model takes **2.5 hours** to run.*

The 2050 model takes **10 hours** to run.*

** Using recommended computer specs*

NC STATE UNIVERSITY ITRE Institute for Transportation Research and Education

DCHC Metropolitan Planning Organization Planning Tomorrow Today

CAMPO NC Capital Area Metropolitan Planning Organization

GO Triangle

Caliper Mapping & Transportation Software Solutions

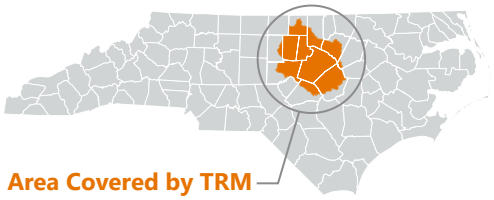
The model was developed by Caliper Corporation and is maintained by ITRE@NCSU and four stakeholders: NC Department of Transportation, Durham-Chapel Hill-Carrboro Metropolitan Planning Organization, Capital Area Metropolitan Planning Organization, and GoTriangle.

A Summary of the TRM Planners Guidebook

Copies of the complete Planners Guidebook is available by request from one of the TRM member agencies or at the following link: *https://itre.ncsu.edu/wp-content/uploads/2022/06/TRMG2_PlannersGuidebook.pdf*

What is the Triangle Regional Model?

The Triangle Regional Model (TRM) is a state of the practice regional travel demand model. It uses algorithms to represent the **transportation system** and the daily multi-modal **travel choices** that people make. The TRM is the principal analytical tool used by transportation agencies in our region to develop and evaluate transportation strategies that support the **mobility, accessibility, economic health** and **quality of life** for the Triangle region.



All major roads in the region and all transit services provided by local and regional providers are included. The TRM covers all of Wake, Durham and Orange counties, and portions of Alamance, Chatham, Franklin, Granville, Harnett, Johnston, Nash, and Person counties.

Resulting travel demand captures choices related to the number and types of **trips** people make, the **mode** they use to travel, the choice of **destination**, and the **paths** used to reach that destination.

What should the TRM be used for?

- ✓ To develop and evaluate transportation strategies at the:
  - ✓ **Regional level:** whole metro
  - ✓ **Subarea level:** county, town, city or predefined district
  - ✓ **Corridor level:** collector, arterial, highway, interstate or transit-only facility
- ✓ To evaluate transportation system project additions (e.g. ridership on new transit service), modifications (e.g. new travel lanes on a roadway) or removal
- ✓ To help answer important transportation and land use questions (e.g. toll, parking, or land use density studies)

What should the TRM *not* be used for?

- ✗ To evaluate operational level analysis such as:
  - × on-street parking
  - × auxiliary lanes
  - × ramp metering
  - × intersection traffic signal timing
  - × intersection level delay
  - × transit management and operations

Expectations for Application

- Travel demand models can and should be used to inform **decision making**, spark **conversation** and provide **insight.** One of the biggest strengths of travel models is for scenario planning/analysis and to support **storytelling with data.**
- Model output is only as good as the model input. The model is sensitive to input **demographic data** such as population, households, income, workers, children and jobs, but if that data does not well reflect future **planned changes,** model sensitivity will be limited.

Planning Topics Covered in the Guidebook

Equity

*How can we **improve transportation equity** through different land use policies?*

Evaluate changes in accessibility and mobility that result from land use changes specifically designed to support underserved communities.

Community Health Metrics

*How does non-motorized travel change under **different land use scenarios**?*

Evaluate changes in non-motorized travel resulting from increasing the zonal mix of land uses and/or zonal density for specific clusters of zones.

Quality of Life

*How do different land use patterns, investments in transit, or toll pricing influence **travel choices**, commute times, and time spent traveling in congestion?*

Conduct various scenario analyses that consider increased density, increased investments in transit, and various toll policies. Evaluate not just highway and transit assignment metrics, but also investigate changes in accessibility metrics, the spatial distribution of non-motorized trips, the spatial distribution of trips, changes in travel times, changes in mode shift for specific communities, etc.

Economic Development

*What are the benefits of **serving high employment areas** with improved transit service?*

Identify TAZs with high employment (specifically low-wage jobs) and low existing transit ridership/service. Investigate the spatial distribution of trips to these high employment areas. Evaluate changes in ridership resulting from new investments connecting these areas.

Safety

*Are there travel model performance metrics that can inform **patterns of high crash locations**?*

Use GIS to spatially investigate patterns between highway performance measures such as delay or congestion and high-frequency crash locations. Use this information as a surrogate for identifying possible future concerns in order to inform safety planning.

Freight

*What is the effect of **clustering freight efficient land uses** on travel demand for commercial vehicle (CV) and trucks?*

How do these changes influence highway performance measures? Create a land use scenario that clusters freight efficient land uses and evaluate changes in the spatial patterns of CV and truck trips, changes in link level CV and truck demand, and changes in key highway performance measures.

Land Use

*What is the sensitivity of travel choice to **future year growth and land use policies** forecast by local governments that show no change in demographics versus intentionally changing demographics to reflect expected changes?*

Evaluate various model performance measures, in particular changes in the spatial distribution of trip productions by trip purpose, non-motorized travel, and modal shifts that result in changing key demographic inputs such as income, percent workers, and percent seniors.

Non-motorized Modes

*How does **removing barriers to access** improve non-motorized trips?*

Identify barriers between TAZs with complimentary land uses, e.g. lack of connectivity between retail and residential development, and provide off-road connectors to evaluate changes in non-motorized trips. Or, use forecast link travel demand to identify roadways with low modeled volumes that can act as connectors for cyclists.

Accessibility

*How can **access to jobs** be improved through multimodal transportation investments?*

Calculate the difference in number of people or jobs within different travel bands by different modes of travel.

Mobility

*How do different land use policies and/or transportation investments support **increased mobility**? What does this look like for **Communities of Concern**?*

Perform analysis using different land use and transportation investment scenarios. Evaluate not just highway and transit assignment metrics, but also investigate changes in accessibility metrics, the spatial distribution of non-motorized trips, the spatial distribution of trips, changes in mode shift for specific communities, etc.

Glossary

- A Glossary of modeling terms is included in the Guidebook.

CAMPO NC Capital Area Metropolitan Planning Organization · DCHC Metropolitan Planning Organization Planning Tomorrow Today · State of North Carolina Department of Transportation · GO Triangle · ITRE Institute for Transportation Research and Education