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Travel Demand Modeling and Micro-simulation

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NC

Nothing Compares

NORTH CAROLINA

Agenda

- Travel Demand Models and Forecasts
- Micro-simulation Models
- Travel Demand and Micro-simulation interaction
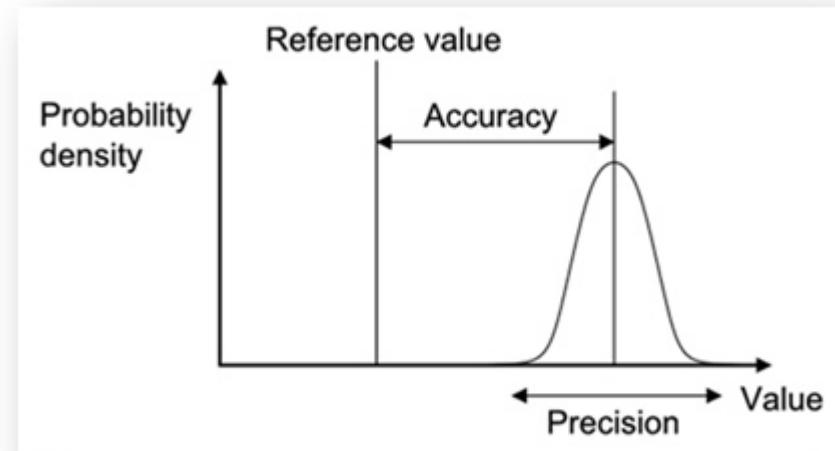
Travel Demand Models

Travel Demand Models and Forecasts: Precision vs. Accuracy

Must balance precision and accuracy.

Frequently a trade off between volumes and patterns.

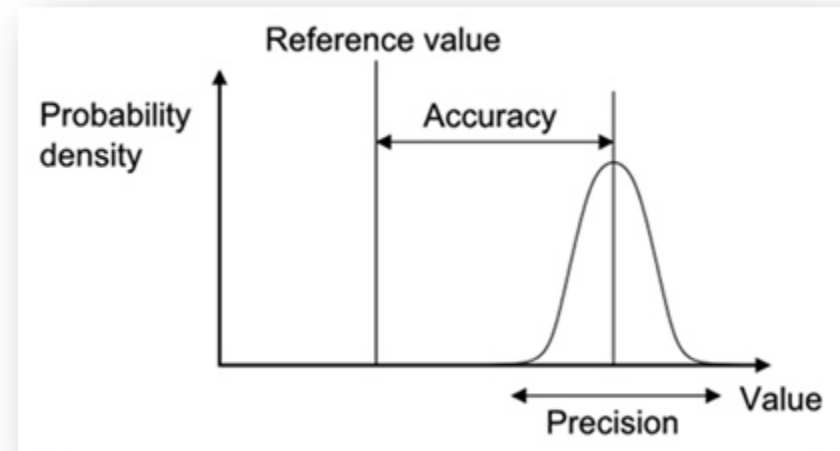Accurate patterns are as important as precise volumes.

Travel Demand Models and Forecasts: Precision vs. Accuracy

Forcing a model to produce precise volumes frequently has a negative impact on accurate patterns.

Inaccurate patterns means a model will not respond well to change.

Responding to change is the primary purpose of a travel demand model.

Travel Demand Models and Forecasts: General Limits of Travel Demand Models

All travel demand models have trade offs between accuracy and precision.

Forcing one can have a negative impact on the other.

Travel demand models do not have all facilities or take in to account all aspects of the road (e.g. exact driveways and locations).

As such, there are limits to accuracy and precision.

Travel Demand Models and Forecasts:
General Limits of Travel Demand Models

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Travel demand models do not have all facilities or take in to account all aspects of the road (e.g. exact driveways and locations).

As such, there are limits to accuracy and precision.

This is why a model is a tool and applied to field collected data/statistics.

Travel Demand Models and Forecasts: Specific Limits of Travel Demand Models

Some Travel Demand Model Limitations:

- Closely spaced signal interactions

- Network calibration vs corridor data

- Limitations to fineness

- Generalizations about congested travel time

- Toll acceptance

These limitations can impact forecasts negatively

Micro-simulation Models

Micro-Simulation Models:
Distance vs. Time

Micro-simulation Models move individual vehicles, people, and objects through a network.

Micro-simulation models require a lot of data:

- Signal Plans

- Exact roadway geometry

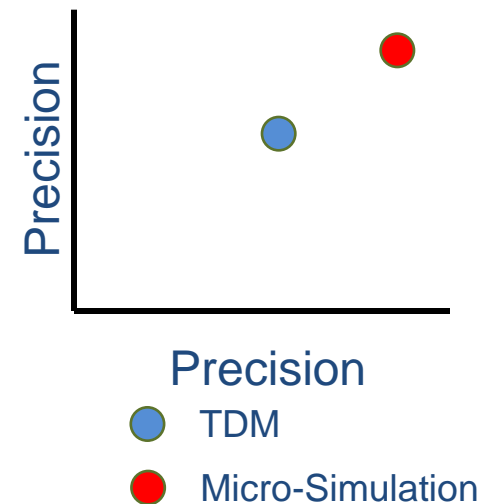- Vehicle specs

- Grades

- Observed Vehicle Speeds

- ETC

Micro-Simulation Models:
Distance vs. Time

Micro-simulation Models simulate actual conditions

Micro-simulation models aim to maximize accuracy and precision

For this reason micro-simulation models cover smaller areas

Micro-simulation models also provide more reliable travel time and LOS information

Precision

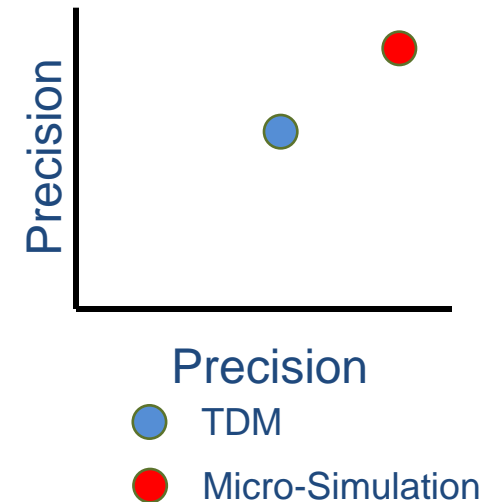Precision

● TDM

● Micro-Simulation

Micro-Simulation Models: Distance vs. Time

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Micro-simulation models also provide more reliable travel time and LOS information

Output can be used directly

Precision

TDM

Micro-Simulation

Micro-Simulation Models: Compared to Travel Demand Models

Micro-Simulation Models don't suffer the same limitations as Travel Demand Models.

- Closely spaced signals spillback in to each other

- Micro-simulation models and volumes are calibrated at the corridor level.

- Fineness of geometry can be as specific as necessary

- Travel time is derived from the network, not estimated

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How can we use micro-simulation models to inform and enhance travel demand models and forecasts?

Travel Demand and Mirco-Simulation Model Interaction

Travel Demand and Micro-simulation Models Interaction: Goals

Utilize the tools in the most appropriate way

Allow each tool to do what it does best

Do not hem in one tool with the other

She tasted the porridge in the little bowl.
"Mmm! This porridge is just right! It's not too hot and it's not too cold," said Goldilocks.
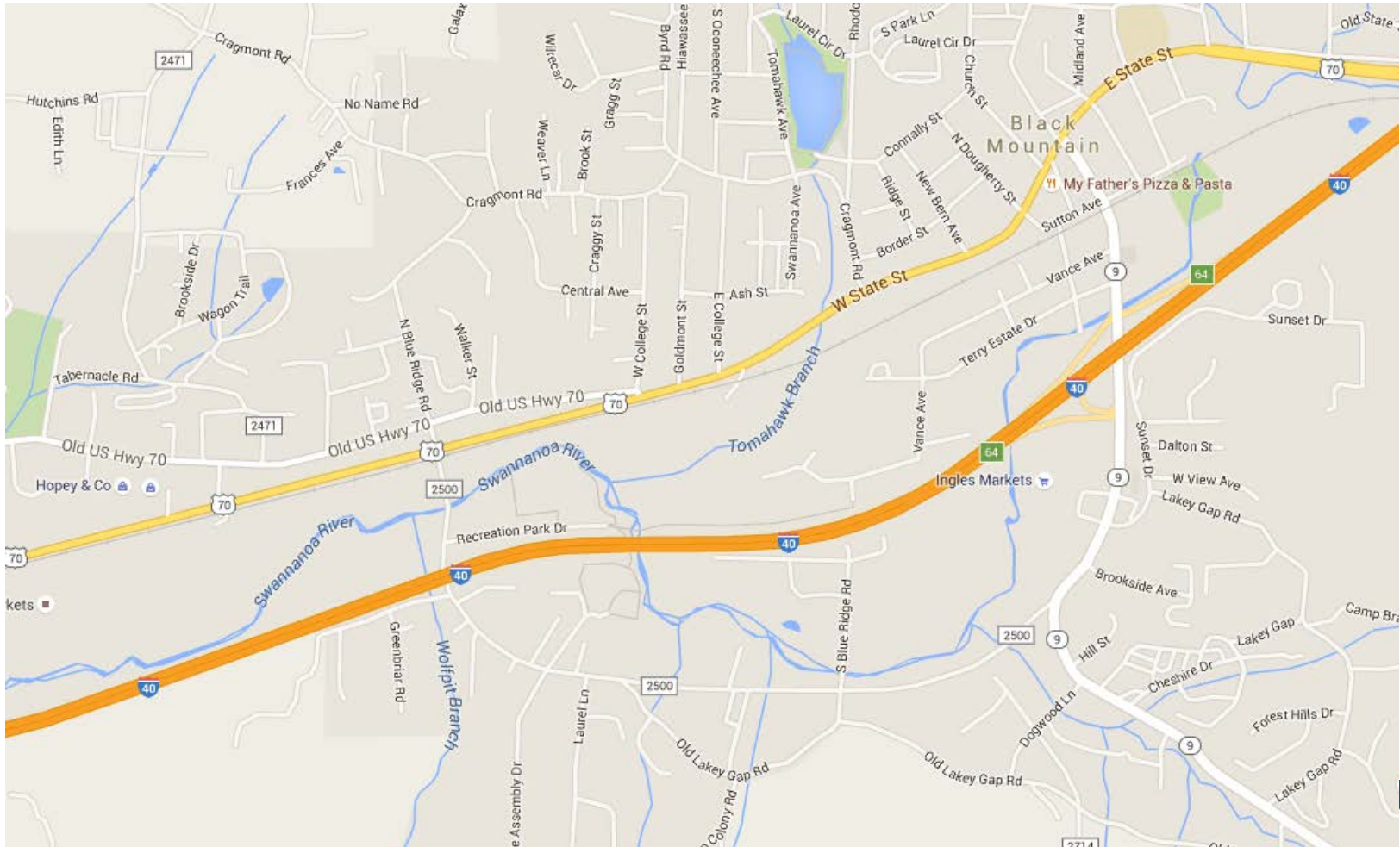
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Travel Demand and Micro-simulation Model Interaction
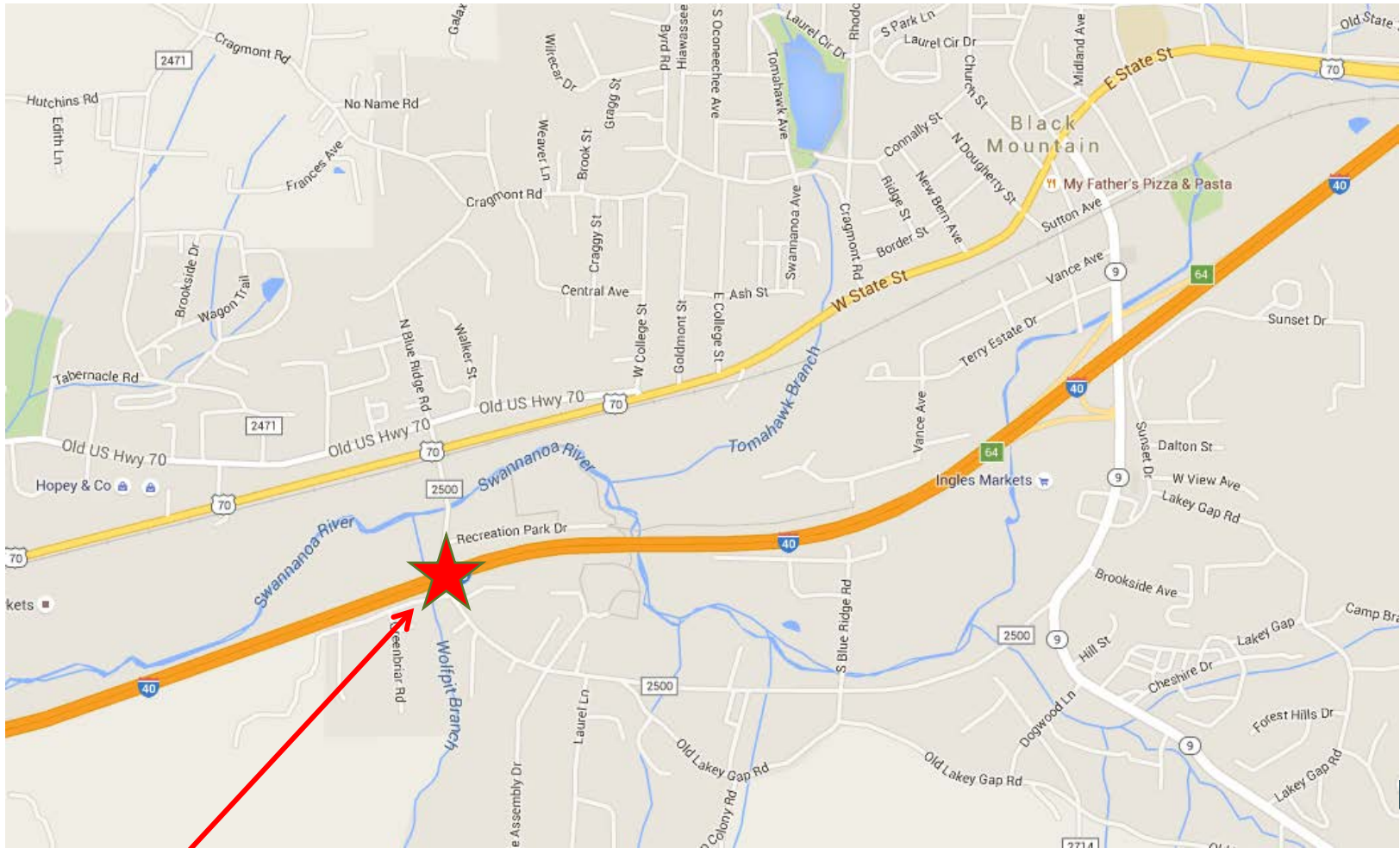
NCDOT is exploring three alternatives:

- Forecast/Estimate Hybrid

- Forecasts with Targeted Information

- Travel Demand Model and Micro-simulation iteration

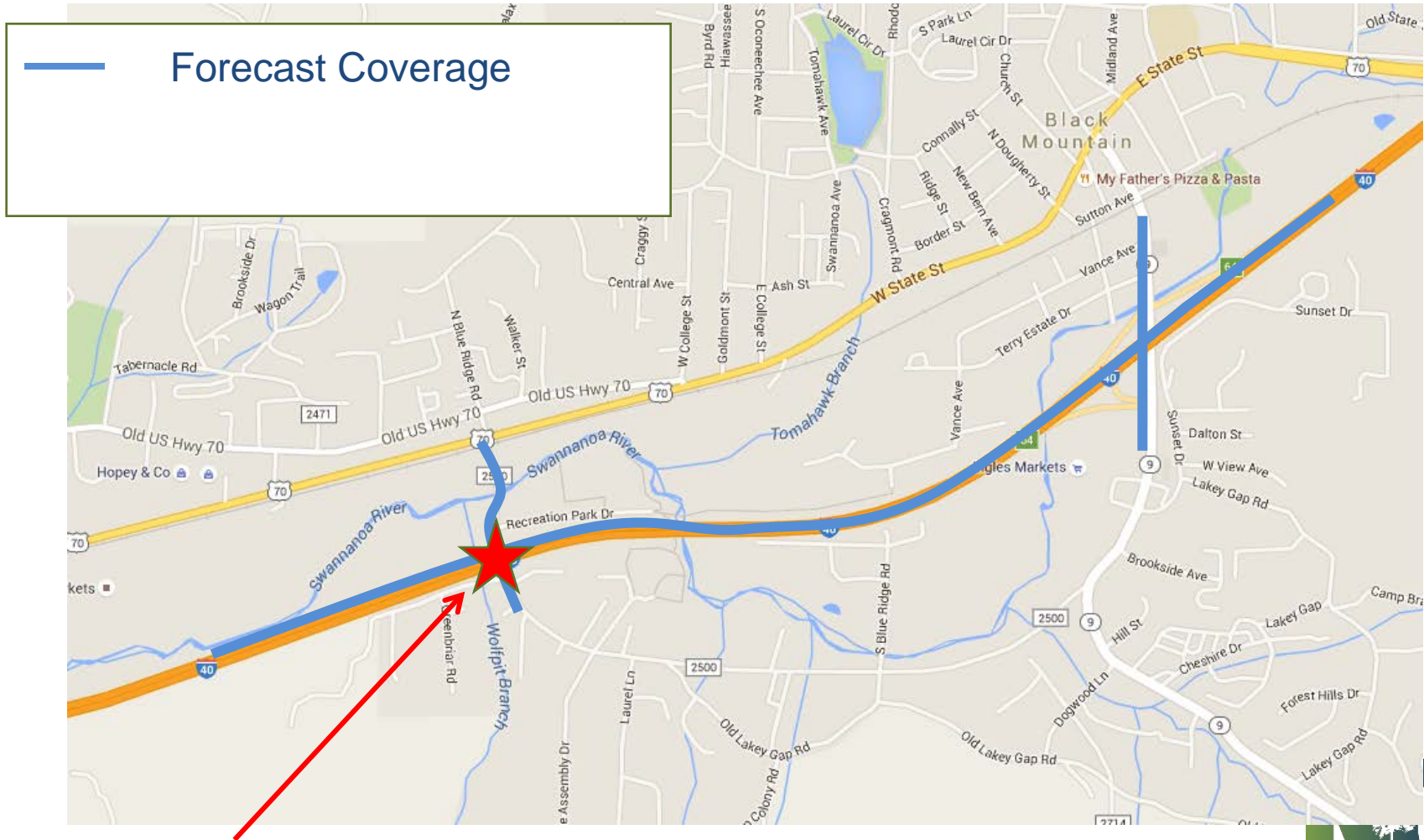# *Travel Demand and Micro-simulation Model: Forecast/Estimate Hybrid*

Travel Demand and Micro-simulation Model: Forecast/Estimate Hybrid

Proposed interchange with I-40

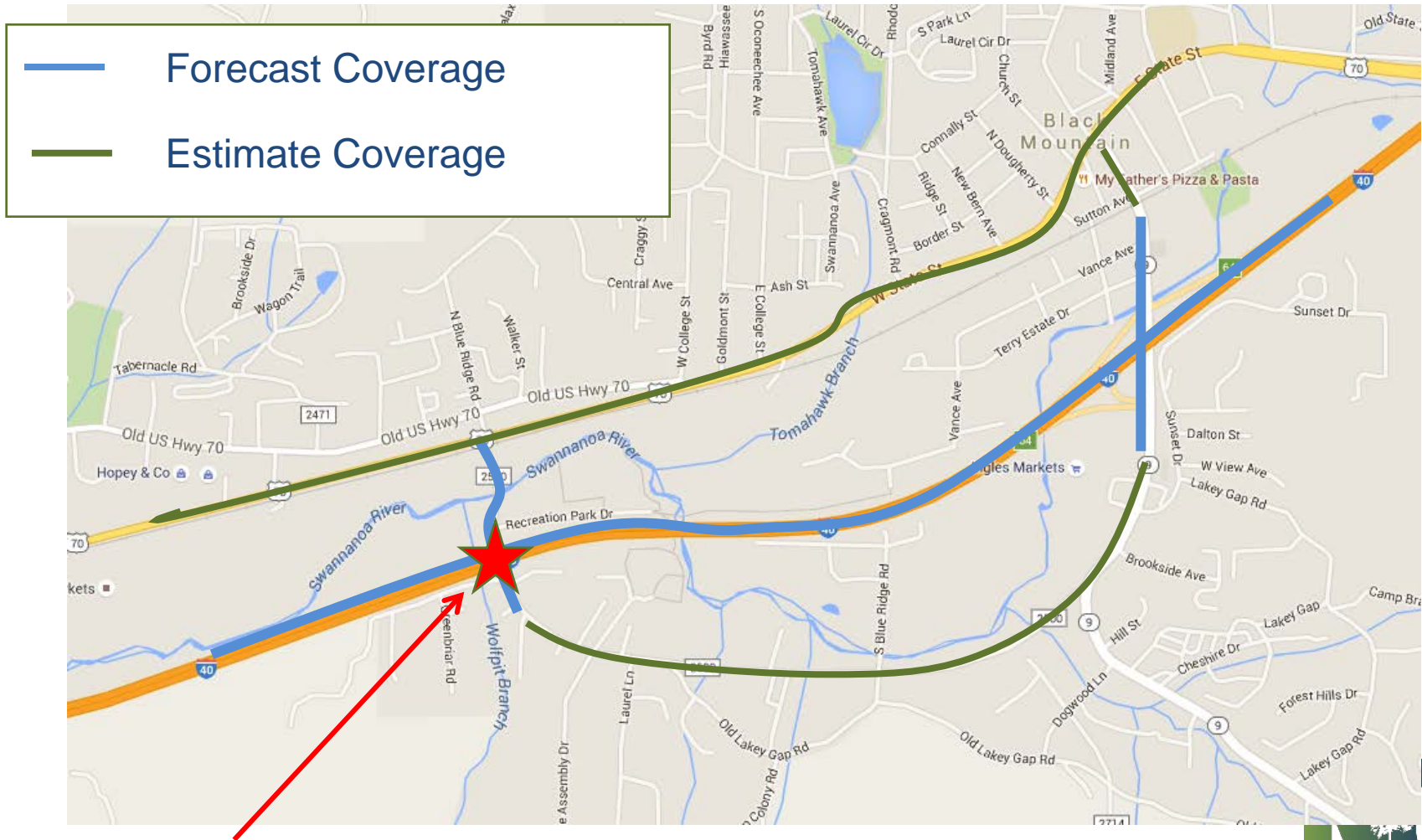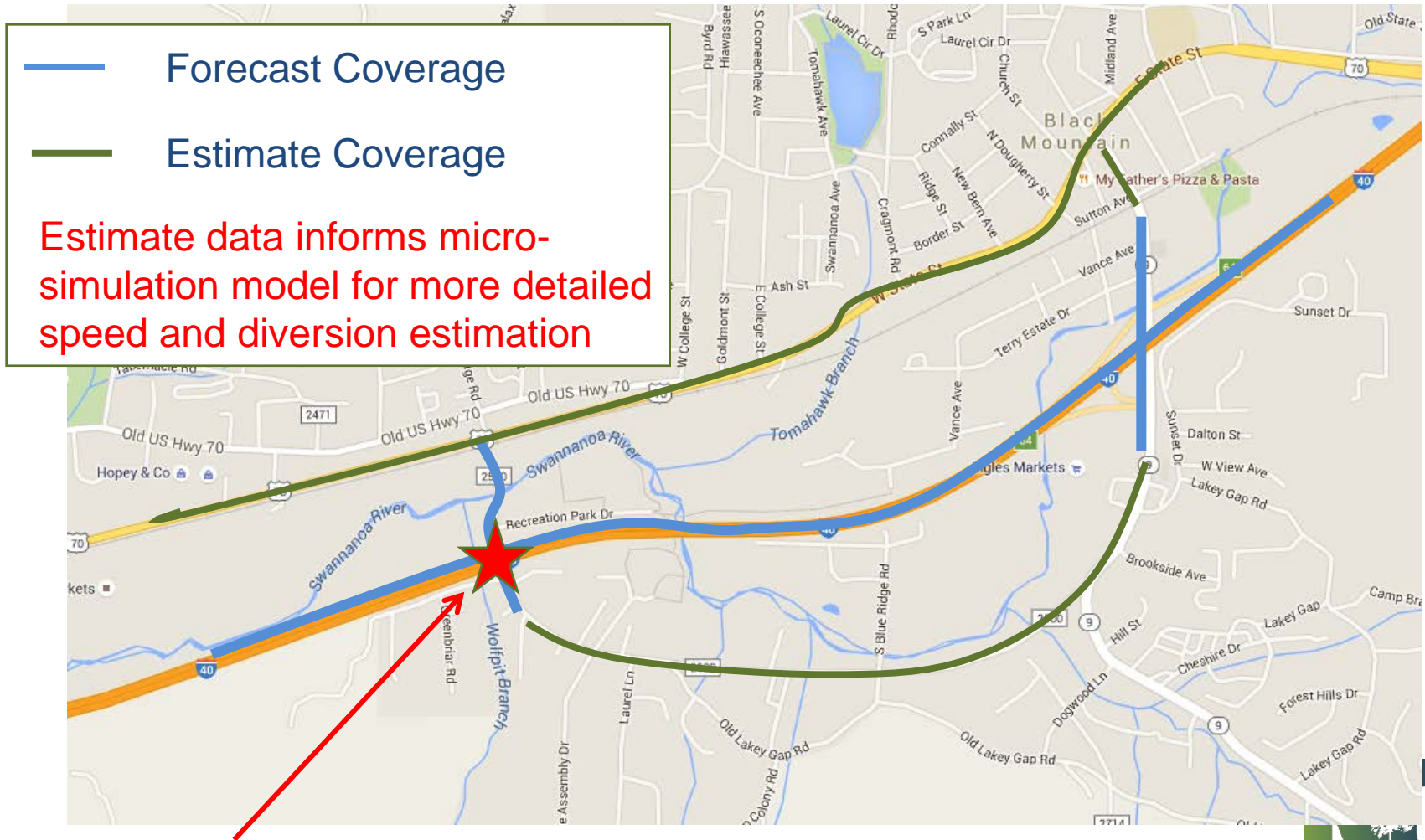# Travel Demand and Micro-simulation Model:
Forecast/Estimate Hybrid

Forecast Coverage

Proposed interchange with I-40

Travel Demand and Micro-simulation Model: Forecast/Estimate Hybrid

Forecast Coverage

Estimate Coverage

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Travel Demand and Micro-simulation Model: Forecast/Estimate Hybrid

Forecast Coverage

Estimate Coverage

Estimate data informs micro-simulation model for more detailed speed and diversion estimation
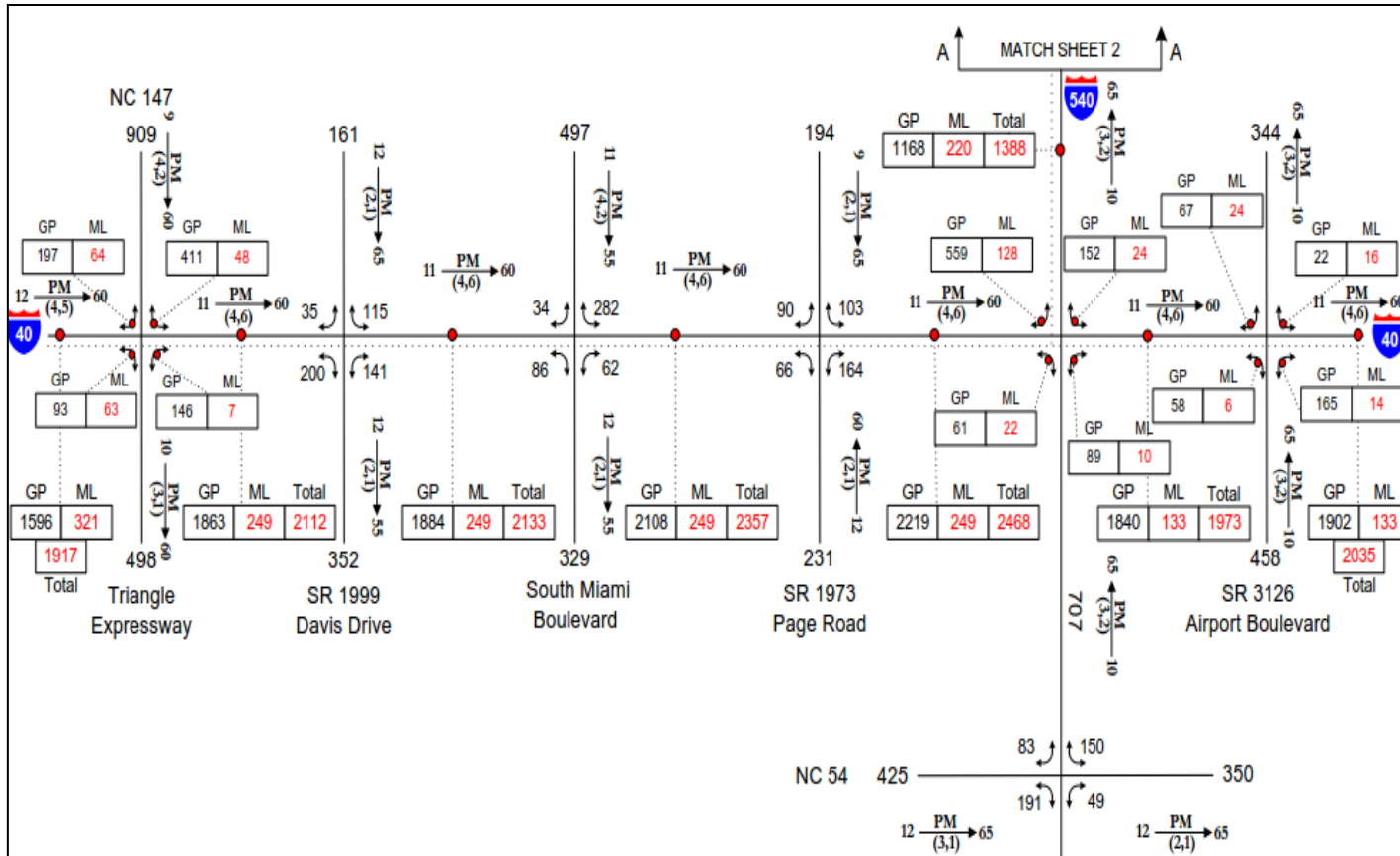
Proposed interchange with I-40

Travel Demand and Micro-simulation Model: Forecasts with Targeted Information

TIP I-5507 in the construction of express lanes on the I-485 Corridor

Transportation

Travel Demand and Micro-simulation Model: Forecasts with Targeted Information
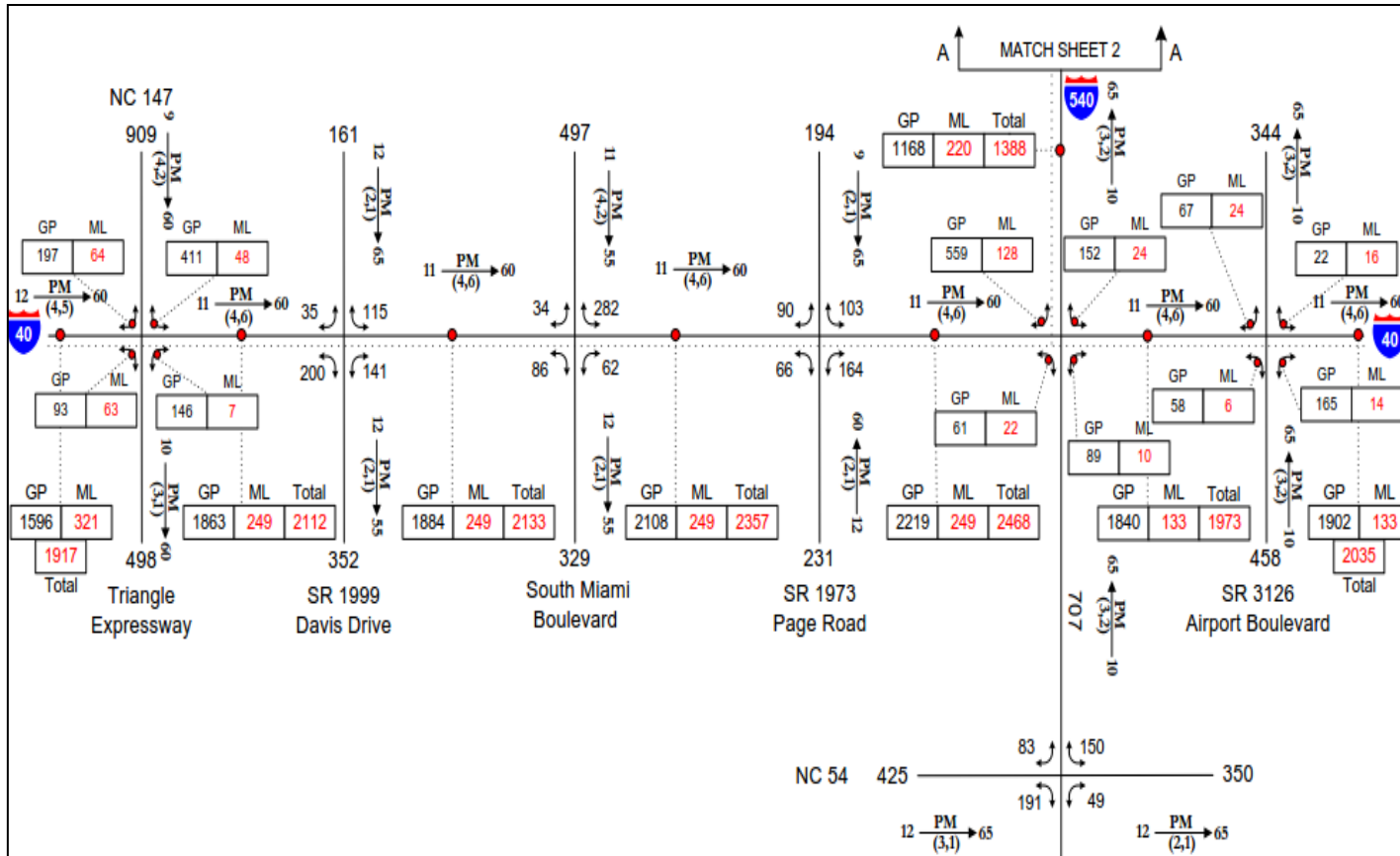

Previous express lane forecasts included both general purpose and express lane volumes

Travel Demand and Micro-simulation Model: Forecasts with Targeted Information

Previous express lane forecasts included both general purpose and express lane volumes

This limits the ability of the micro-simulation tool to help inform the toll facility volume as that gets set by the forecast.

Travel Demand and Micro-simulation Model: Forecasts with Targeted Information

Solution:

Show only corridor volumes on the forecast

- We are confident in the overall corridor volumes from TC

- Less confident in the split between GP and EL

Supplement the forecast with an additional item that provides guidance on likely EL volumes

- Shows percentages daily from TC and from TM

- Includes notes to help understand information

- Defines key terms to reduce confusion

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Travel Demand and Micro-simulation Model:
Travel Demand Model and Micro-Simulation Iteration

Third option: combine micro-simulation models and travel demand models.

Models run in an iterative manner with each feeding information to the other.

Micro data helps to inform macro level travel patterns

Helps address loading above capacity in travel demand models

Travel Demand and Micro-simulation Model:
Travel Demand Model and Micro-Simulation Iteration

Potential drawbacks

Potentially resource intensive:

- Additional iterations take time

- Simulation model development can be lengthy

Models at different levels:

- Some areas of the travel demand model have micro data, some don't

- Will there be a need to transform direct output before it can be used as input in the other model?

Yet to be tested

Travel Demand and Micro-simulation Model: Summary

Three potential options

All have positive and negative impacts

All are in some form of development

Full vetting not yet complete