Bringing Travel Modeling to Small and Medium Sized Areas with Big Data

2025 Modeling Mobility Conference

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Agenda

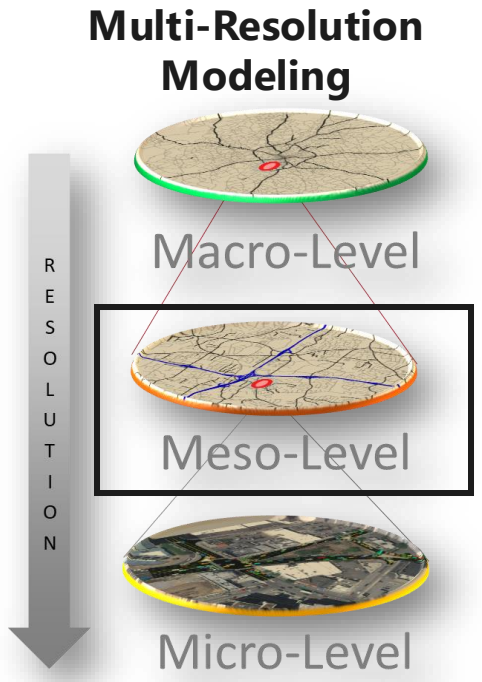
- Purpose
- Motivation
- Sherburne County DTA model
- Takeaways

Purpose

- Bring travel modeling to small and medium sized areas
- Leverage “big data” to develop meaningful planning tool
- Demonstrate a “cost-effective” approach to develop a data-driven model that can be used for sustainable future transportation planning

Motivation

- A need for a data-driven planning tool for small and medium size areas
  - Comprehensive/holistic analysis
    - Mobility
    - GHG emission analysis
    - Traffic impact analysis
    - Infrastructure investment
  - Sensitive to roadway projects (type and scope)
  - Sensitive to demographic, employment and land-use assumptions
- Mesoscopic simulation model is the right tool
  - Supplements regional macroscopic (i.e. travel demand) modeling with dynamic assignment approach using higher resolution network details
  - Performs wider-area network analysis not feasible for microscopic simulation models
  - Big data makes development more accessible than ever before



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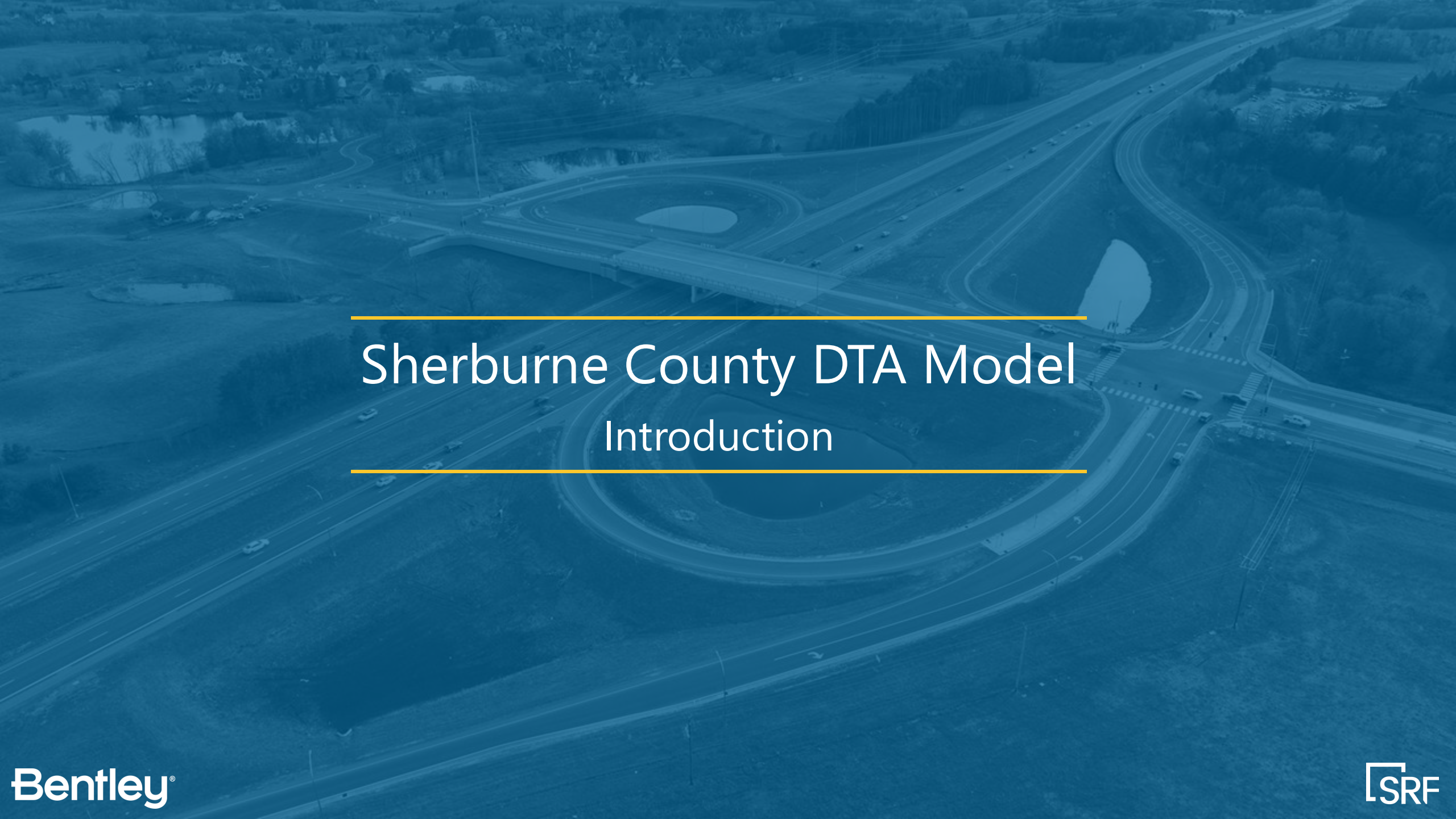

Sherburne County DTA Model

Introduction

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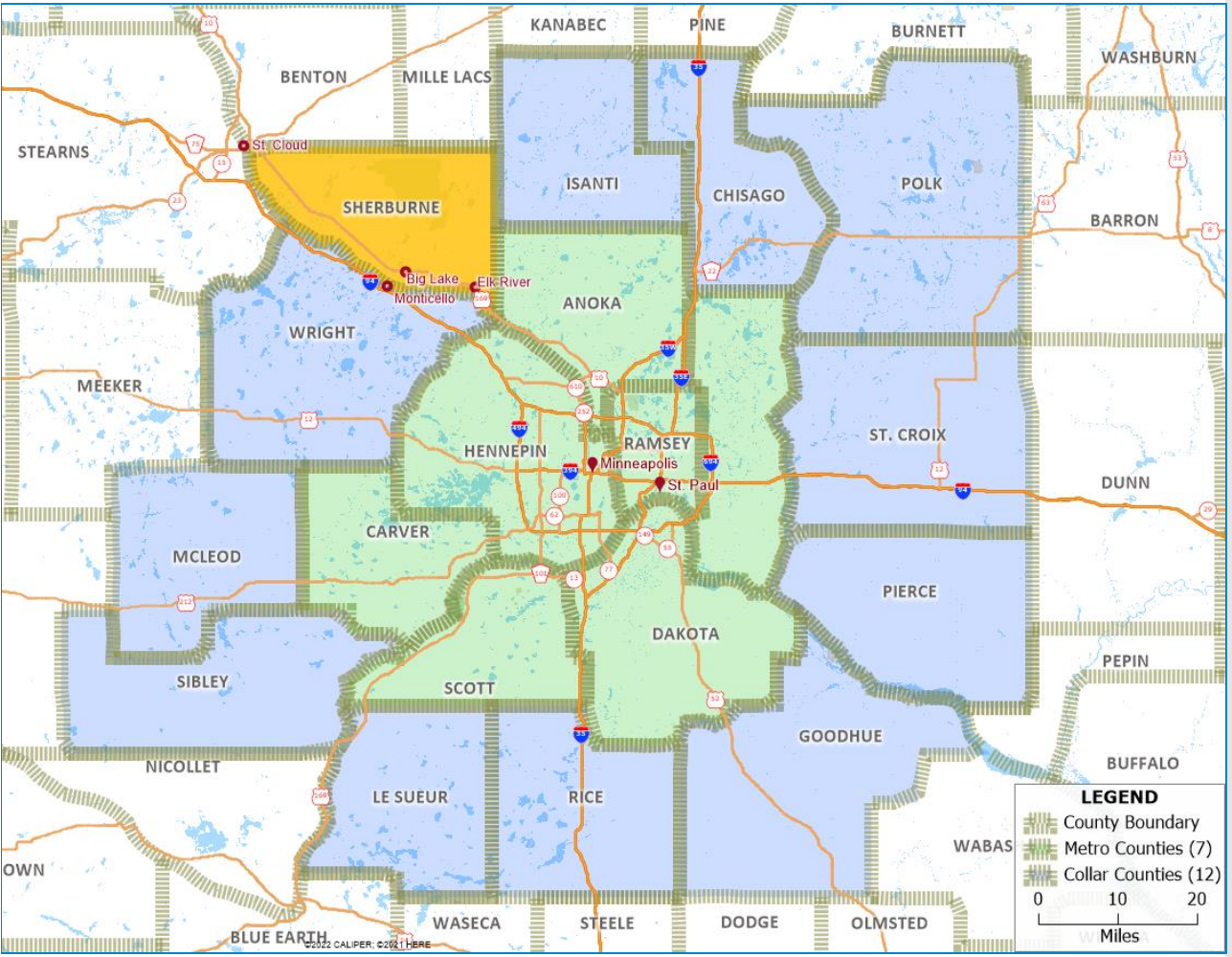


Sherburne County

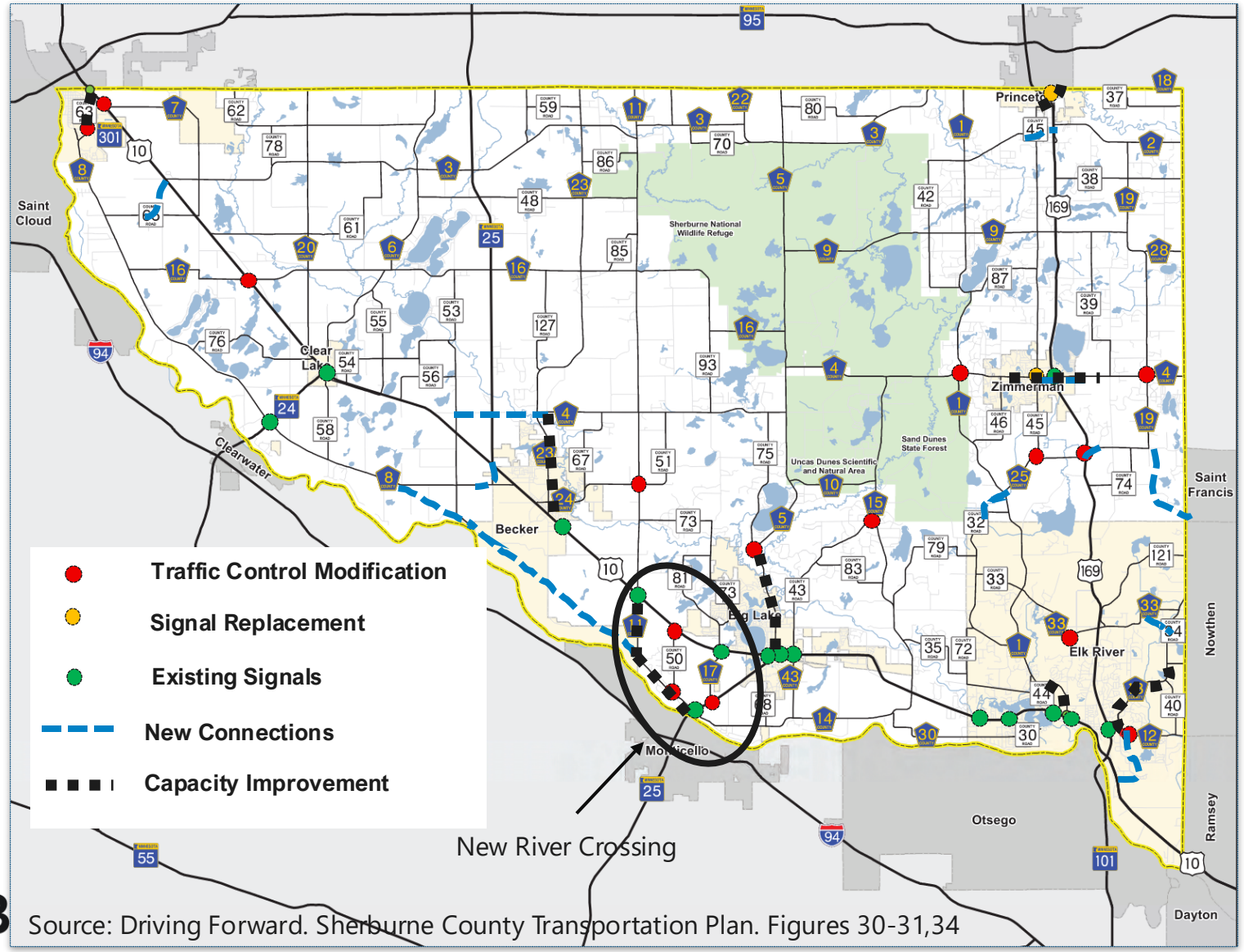
- One of the fastest growing counties in MN
- A "collar" county of the Met Council Activity-Based travel demand model (ABM)

Long Range Transportation Plan

- Adopted on November 7, 2019
- Potential project types –
  - Traffic control modification
  - Capacity improvement
  - New connection
- Off-model growth factors were assumed to project 2040 traffic forecasts

https://www.co.sherburne.mn.us/1117/Transportation-Plan

Potential Projects

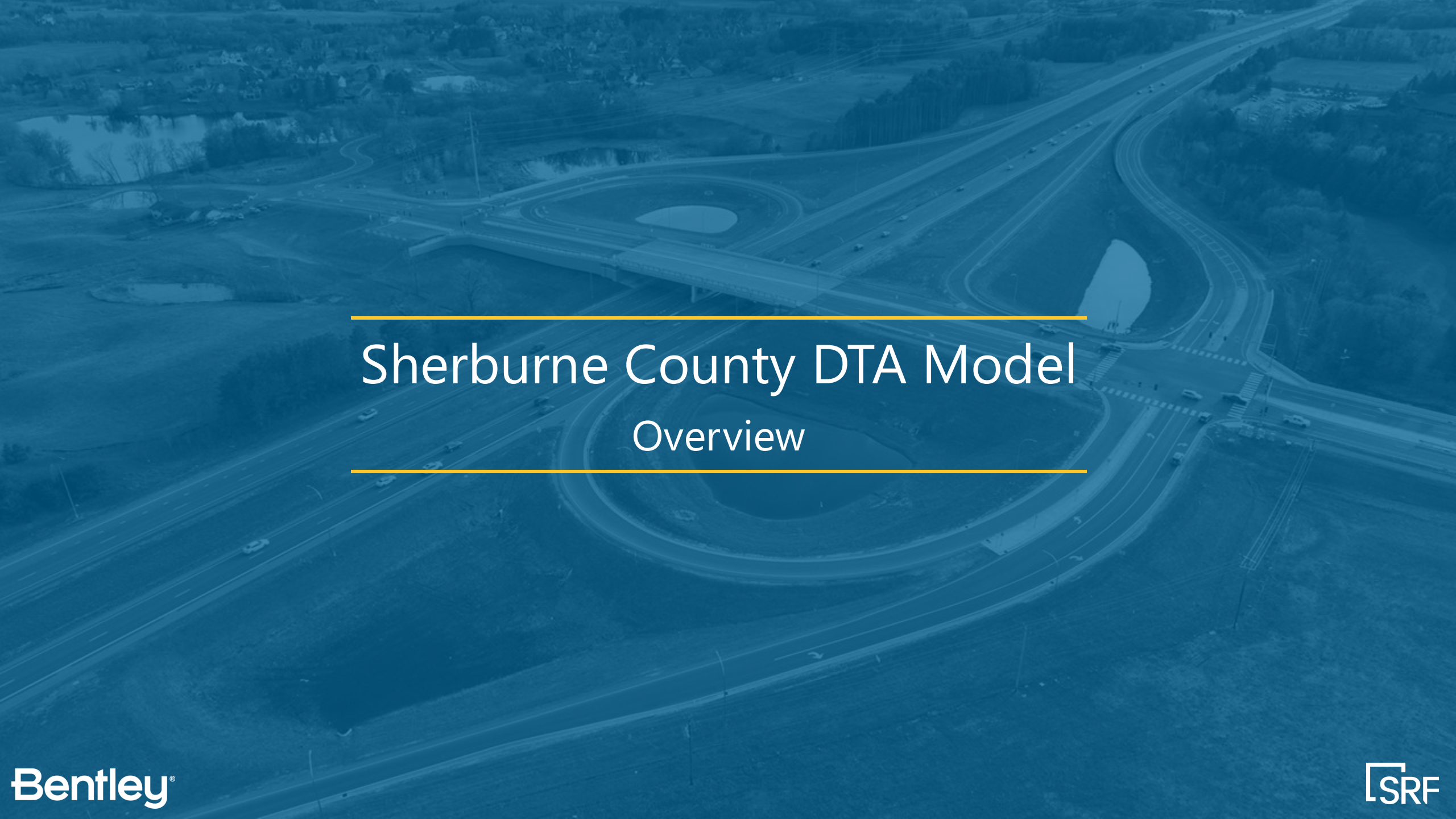


Source: Driving Forward. Sherburne County Transportation Plan. Figures 30-31,34

- Potential impacts
  - Shift travel routes
    - new localize hot spots
  - Improve mobility
  - Attract new developments
  - Change VMT/VHT and GHG emissions - Minnesota legislature requires emissions impact assessment and offset for new capacity expansion projects
- No intersection modeling with the regional model
  - Cannot evaluate traffic control modification projects

Challenges of Existing Approach

- Regional travel demand model
  - Network – lower facility-type roads are typically excluded
  - Zones – too coarse – 47 TAZs in Sherburne County
  - Intersection delay is not considered
- Off-model traffic growth factors
  - Based on historical data, 2040 ABM results, and local knowledge
  - A static approach – traffic operation is dynamic
  - Traffic forecasts is for the future
- Needs of analysis tools
  - Trip diversions
  - Test what-if scenarios
  - Identify bottlenecks and local hot spots
  - Evaluate and strategize mitigation plans



Sherburne County DTA Model

Overview

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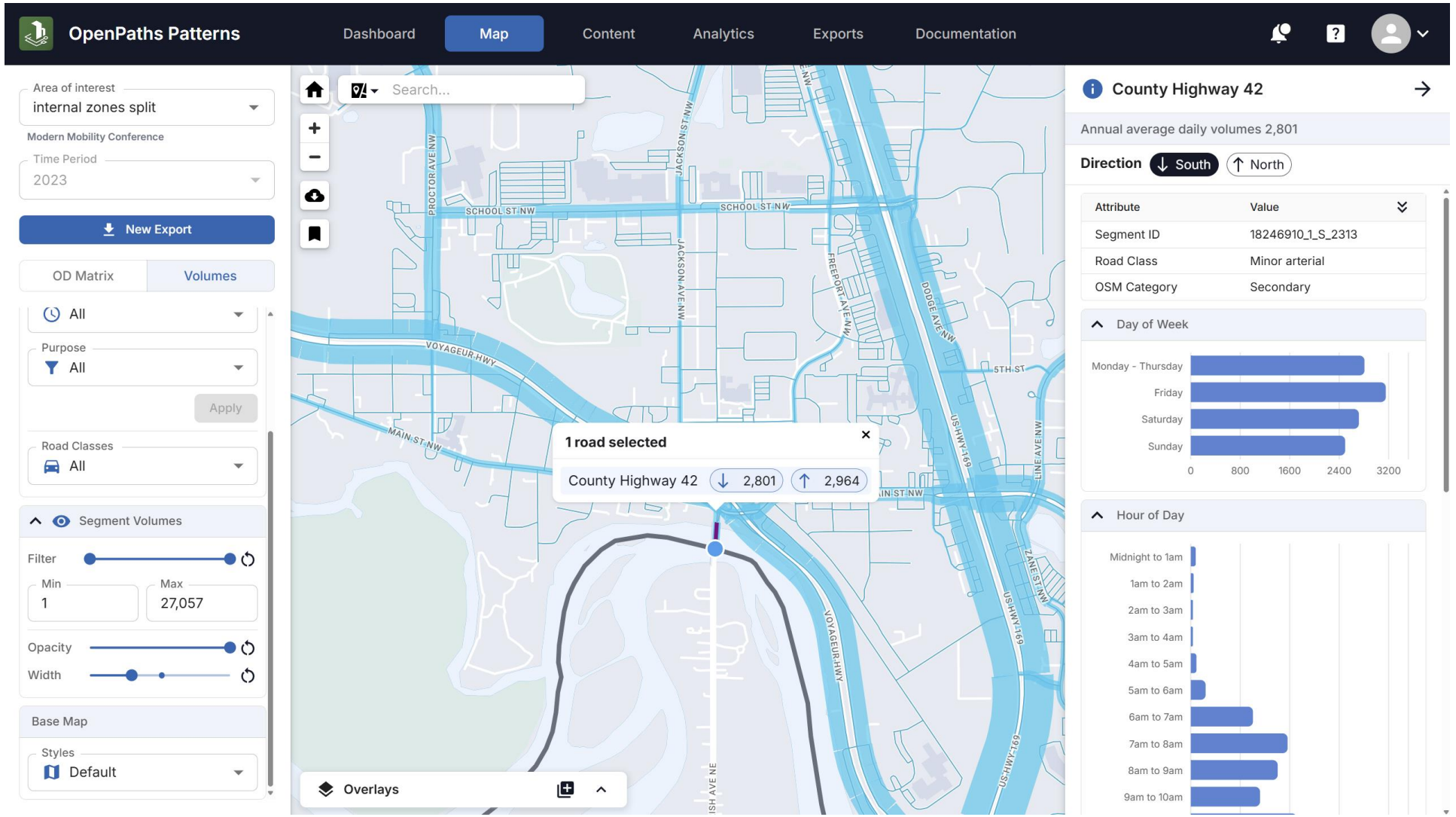
Model Data

- DTA is data heavy
- Network
  - OpenPaths Patterns derived from Open Street Map (OSM)
  - Intersection geometry – referencing Google Map, Google Earth and Bing Map images
- Time series demand trip data – 16 15-minutes OD trip tables
  - Sourced from OpenPaths Patterns (Big Data)
  - Customized zone boundary
- Time series traffic count data
- Travel time data
  - Iteris ClearGuide travel time data on selected highway segments

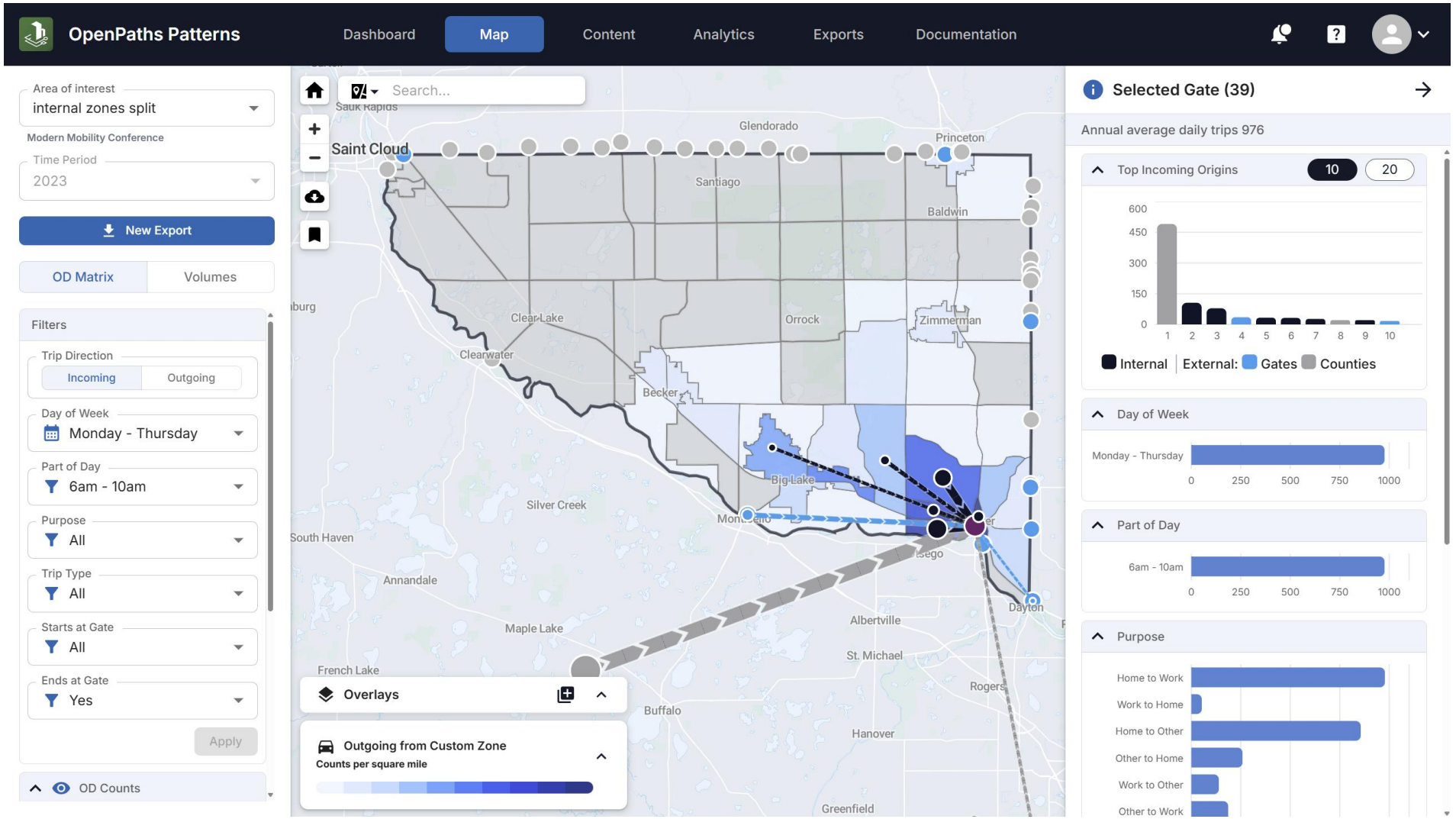
Road Volumes and Network

OpenPaths Patterns

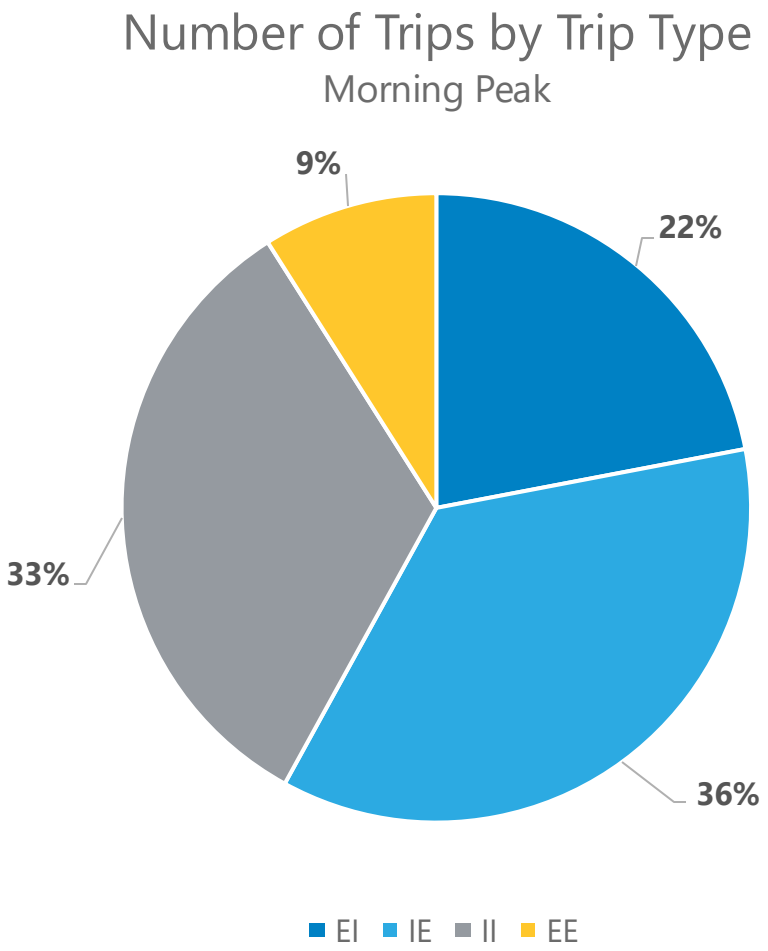


Origin-Destination Data

OpenPaths Patterns

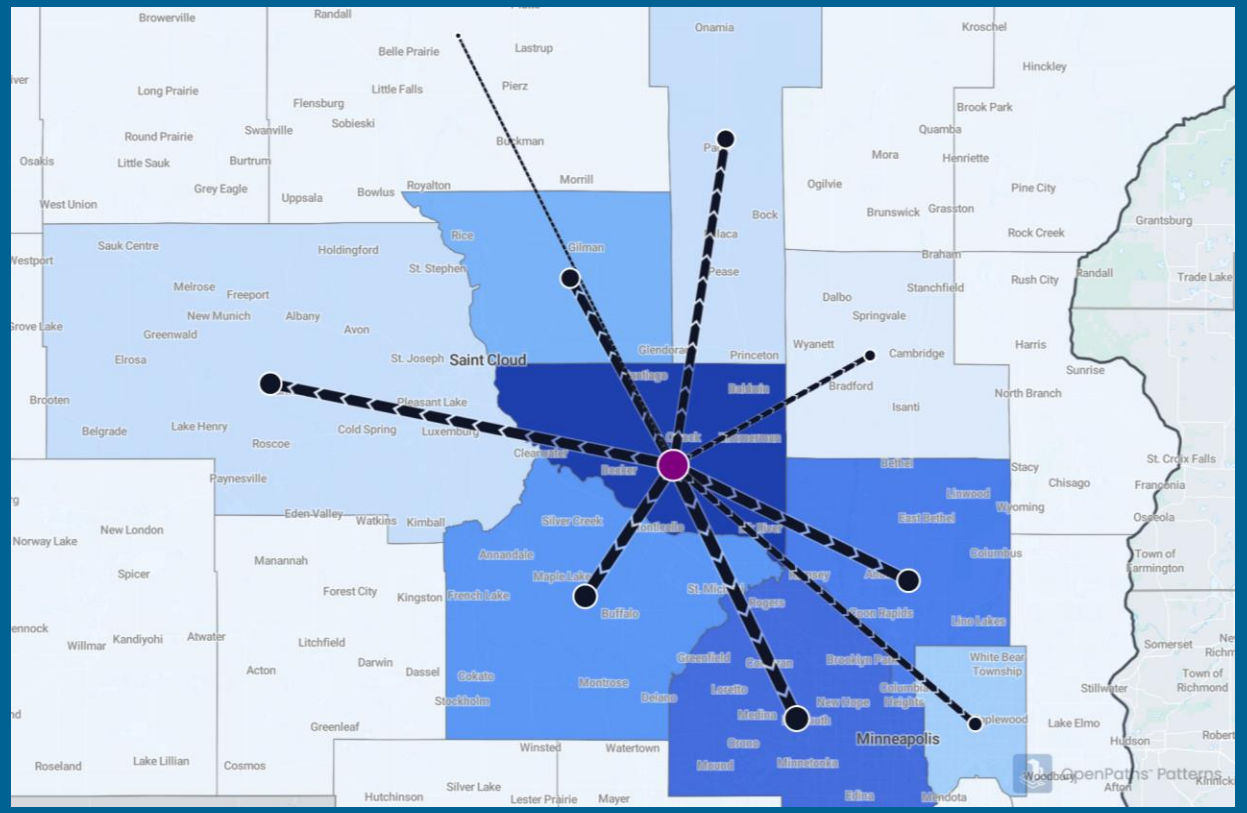


Travel Patterns



Source: OpenPaths Patterns

- 58% of trips travel in and out of the county
- 33% of trips stay inside of the county



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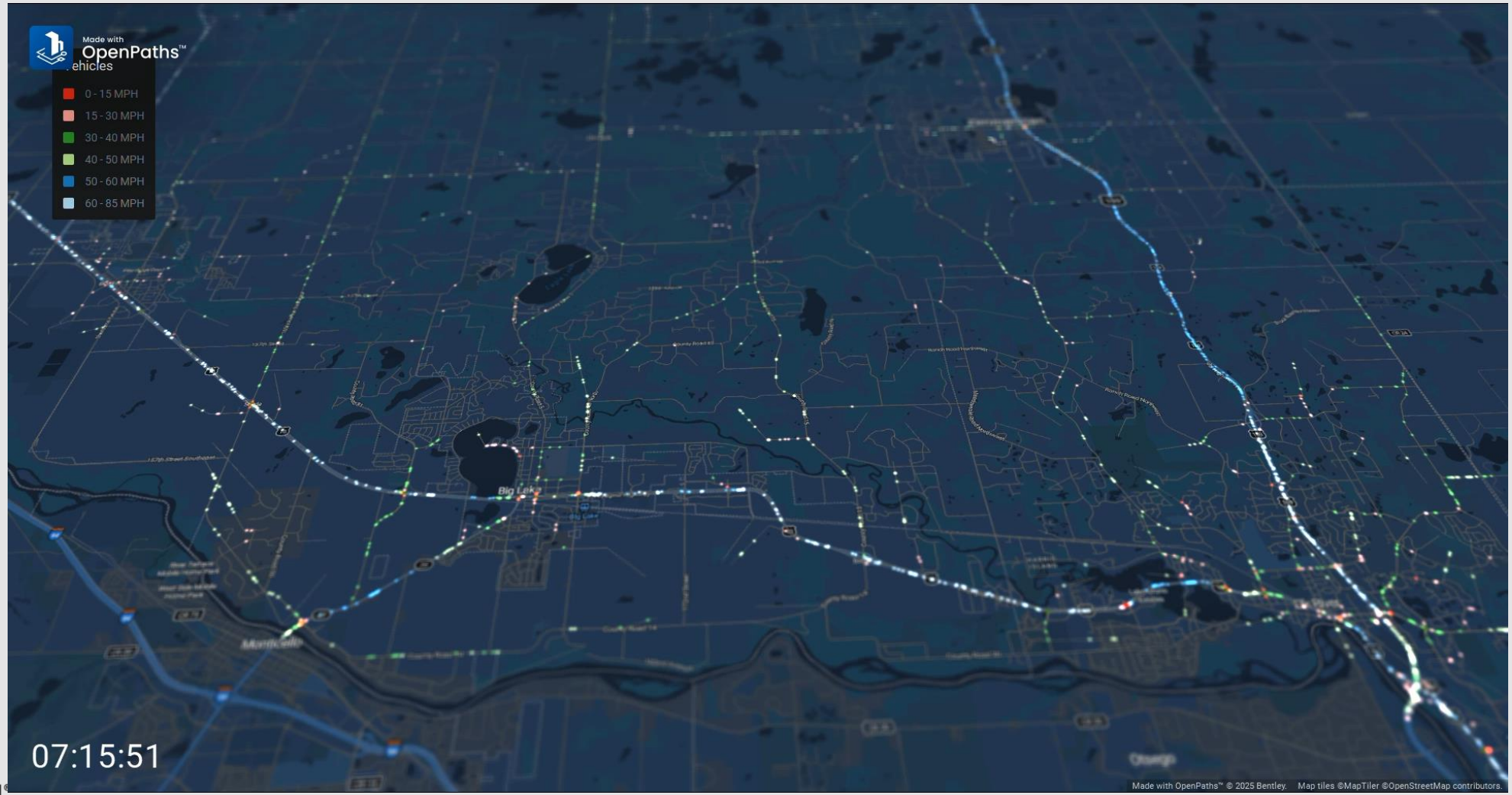
Sherburne County Model

OpenPaths DYNAMEQ

Traffic simulation and dynamic traffic assignment (DTA) package with features typically associated with conventional microscopic models, such as:

- Car-following models
- Gap-acceptance models
- Explicit signal timings



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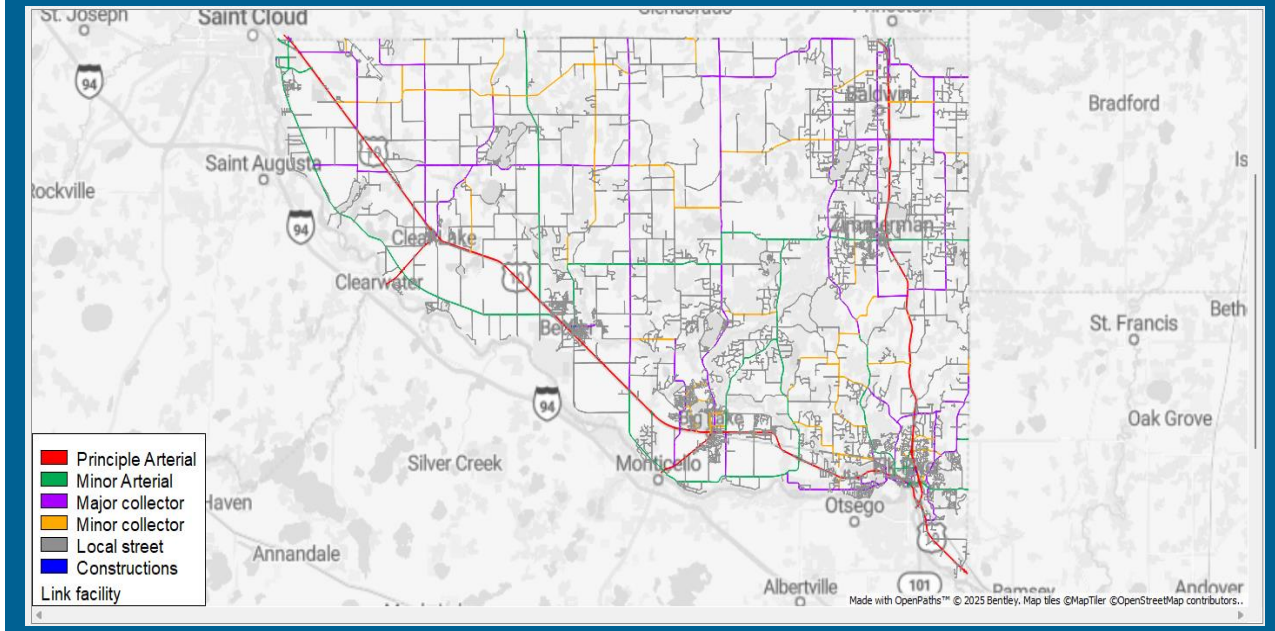
Model Overview

- **Time:** Morning period (6:00 AM to 10:00 AM)
- **Software:** OpenPaths DYNAMEQ
  - Mesoscopic traffic simulation modeling software platform
  - In Bentley's OpenPaths transportation planning software suite, along with OpenPaths CUBE (used in Met Council's regional model)
- **Coverage:** Sherburne County



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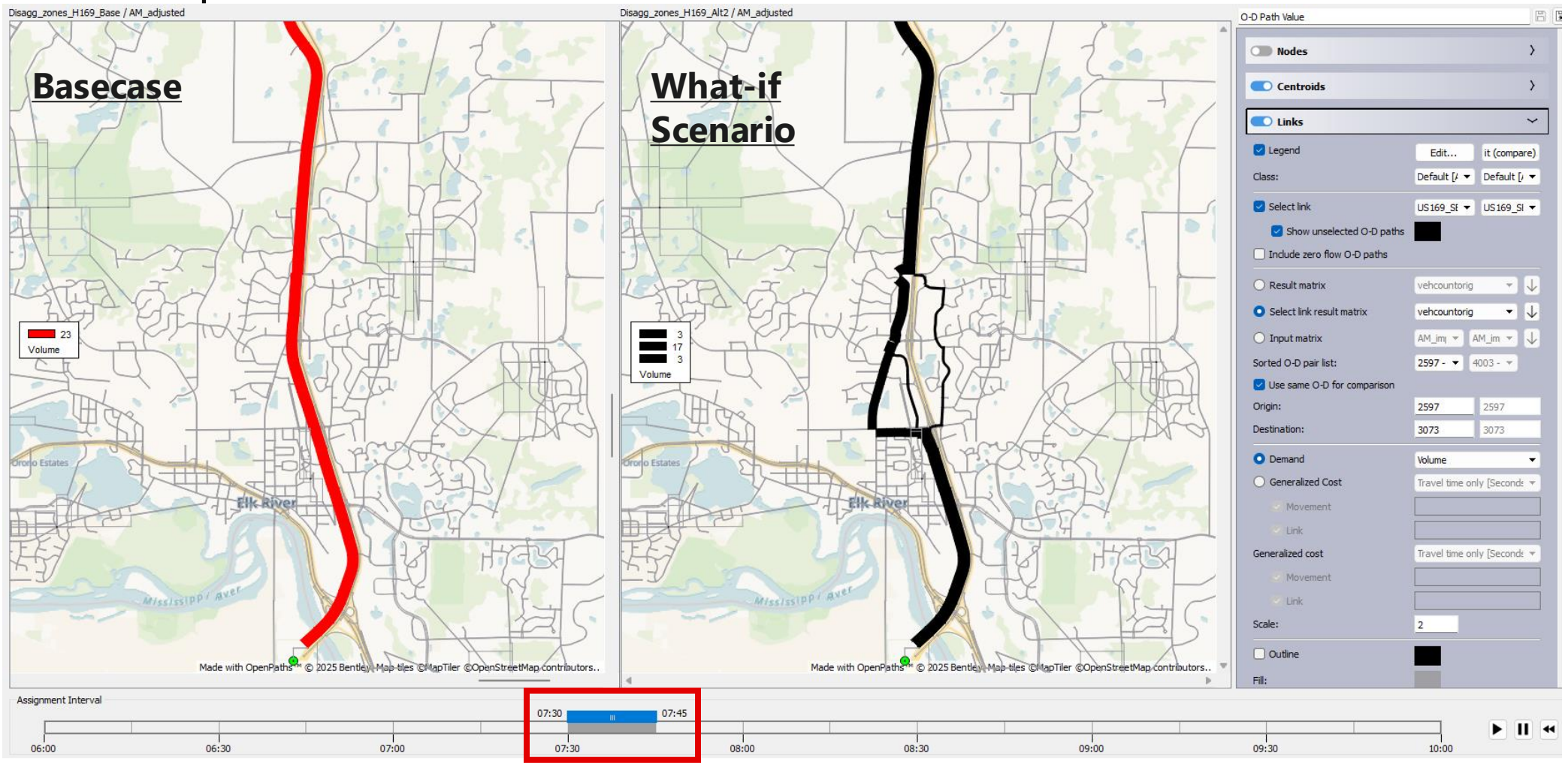
Model Development

- Network calibration
- Demand OD calibration
  - Adjusted OD trip tables - simulation-based dynamic matrix adjustment - an automated procedure for adjusting the demand matrices of a DTA to improve the similarity between simulated volumes and traffic counts

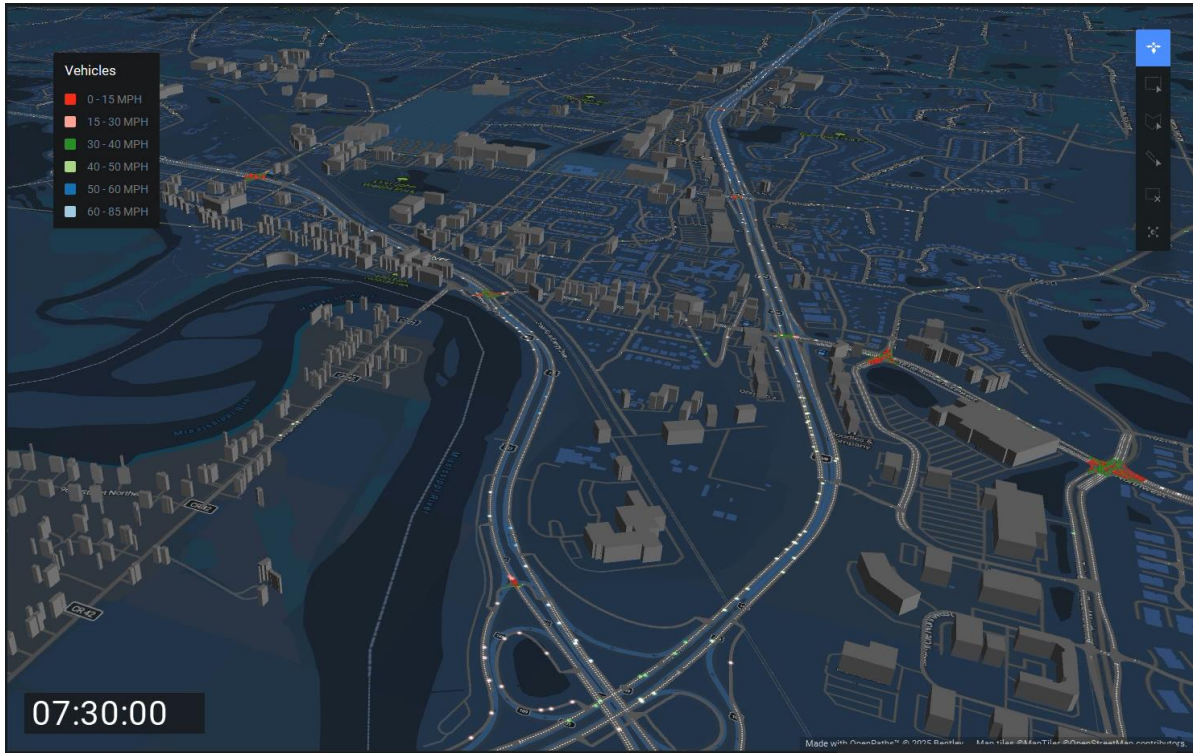
Example of DTA Results – Trip Diversion

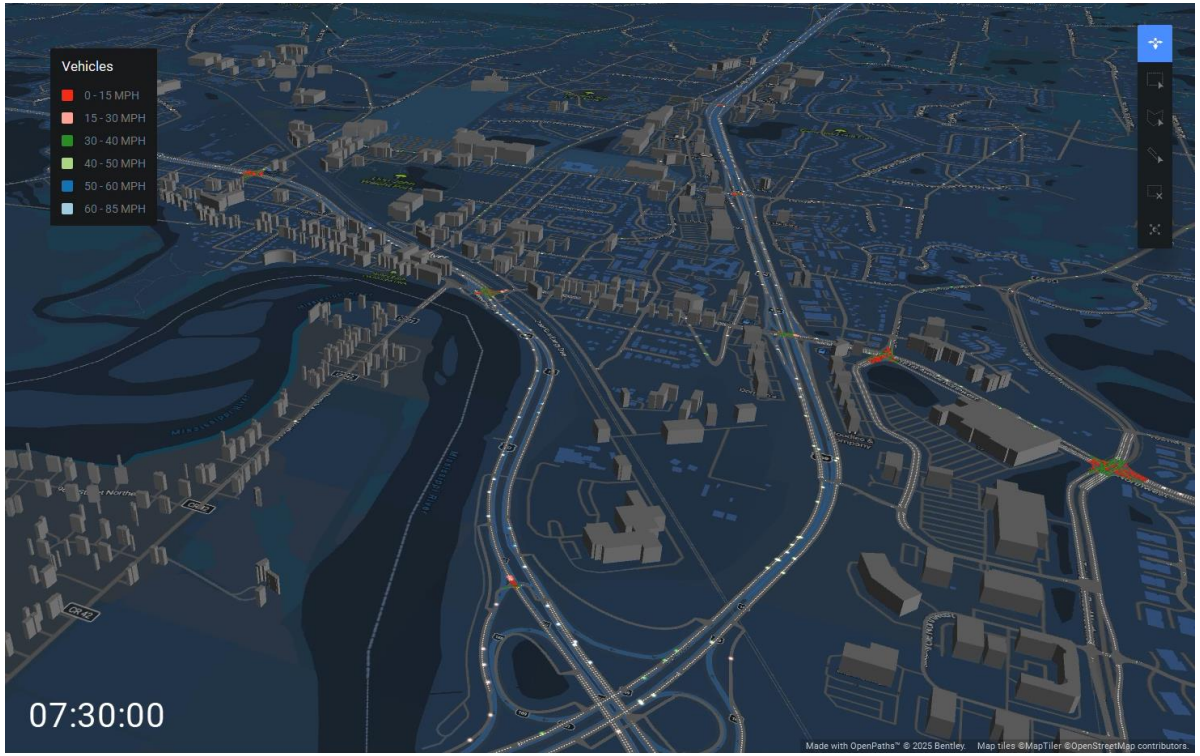
- Comparison of link volumes – AM periods and by time interval
- Selected OD pair



Advantage of DTA Model - Visualization

- View simulation results
- Help identify problems
- Communication tool for stake holder meetings and public engagements





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Takeaways

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Takeaways

- Filling in modeling gaps left by existing tools for areas with robust growth forecasted
- Tool was assembled quickly to get answers “cost-effectively”
  - Compare to alternative approaches
    - Validate existing model and post-process model results
    - Off model traffic forecasts
  - Quick turn-around time to evaluate what-if scenarios
  - Communication tool
- Future forecasts – must consider prior to developing a DTA model
  - Benefits from regional travel demand models – forecasts of SED and external trips
  - Refined zone structure allows more accurate traffic forecasts
    - Known and planned developments
    - Future adopted land use plans
    - Local growth management plan

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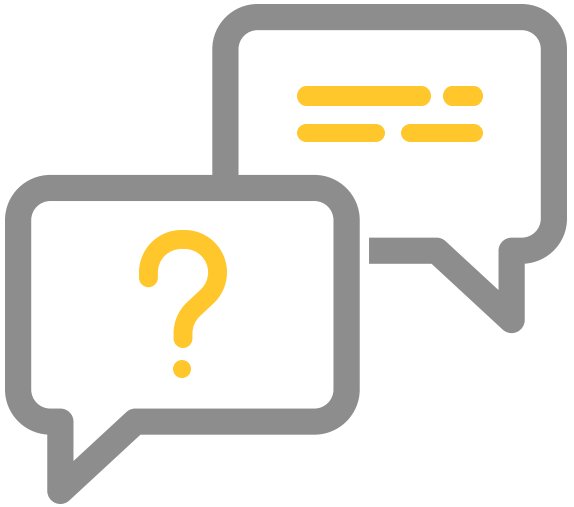
Thank You



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