



# RESEARCH SERVICES & LIBRARY

OFFICE OF TRANSPORTATION  
SYSTEM MANAGEMENT

## TECHNICAL SUMMARY

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### TOTAL PROJECT COST:

\$182,000

### MnDOT CONTRIBUTION:

\$100,000



The Twin Cities Metro Hybrid Simulation model was first used to model the impact of the new Green Line light rail on traffic.

# Creating a New, Dynamic Model of Twin Cities Traffic

## What Was the Need?

Before the June 2014 opening of the Green Line light rail, which connects downtown Minneapolis to downtown St. Paul, the Metropolitan Council wanted to forecast its impact on traffic levels and travel times along adjacent streets.

The Metropolitan Council already maintains the Regional Planning Model, a long-term, regional travel demand model for the Twin Cities. Like most such models, the RPM was developed to aid in making wise investment decisions, scheduling new transportation projects and measuring their effects on improving traffic flows in the region.

Macroscopic models such as the RPM are useful for characterizing a region's traffic as a whole, but they do not contain the detailed information needed to simulate how individual drivers will behave in response to new travel options. Information about traffic controls, geometric effects related to lane configurations, and the possibility that drivers will reroute to avoid congestion was needed to accurately predict the impact of the Green Line on traffic along its corridor and outlying areas.

Microscopic travel models, on the other hand, which can incorporate factors such as signal timing, road geometry and driving behaviors, have been developed for a variety of applications. Managing that level of detail, however, requires extensive computing power, which quickly becomes impractical if a large area is being simulated.

## What Was Our Goal?

The goal of this project, funded by MnDOT and the [Transitway Impacts Research Program](#), was to develop a travel simulation model that could incorporate the detail needed to accurately forecast the impact of the Green Line on traffic both within the Green Line corridor and in neighboring areas.

## What Did We Do?

Researchers built the Twin Cities Metro Hybrid Simulation model in the Aimsun modeling platform. This model combines a mesoscopic simulation of the core region immediately around the Green Line with a macroscopic model of the much larger surrounding region. This mesoscopic model provides an intermediate level of detail capable of incorporating dynamic traffic assignment, which allows drivers in the model to change their routes in response to traffic conditions the way real-world drivers will.

Researchers then used the new hybrid model to simulate travel times for the Green Line and traffic in the adjacent corridor.

## What Did We Learn?

While the model was completed too late to predict the impact of the Green Line, the results of the simulation closely matched the observed real-world impacts, suggesting that the hybrid model is valid as a simulation approach.

*The Twin Cities Metro Hybrid Simulation model developed in this project simulates Twin Cities traffic and driver behavior in more detail than the existing model. The new simulation tool closely matched actual effects of the Green Line and shows promise for use in a variety of other planning purposes.*

*“We went into this project in the dark and learned a lot about this type of model. Establishing a methodology and building a huge resource that can grow will provide lasting benefits.”*

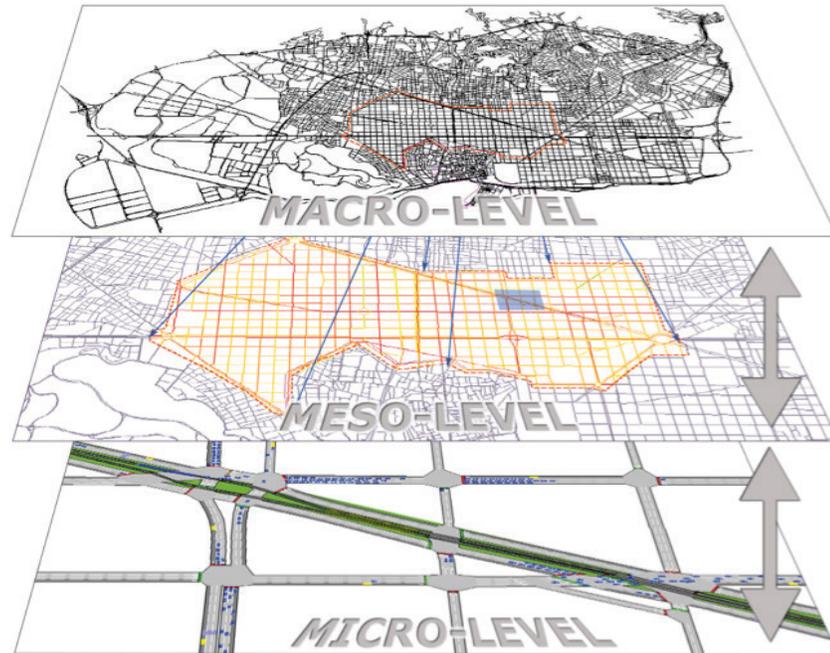
—John Hourdos,  
Director, Minnesota Traffic  
Observatory, University  
of Minnesota

*“This is an early attempt to develop a mesoscopic hybrid traffic simulation model. These models are very data-intensive and require significant resources to create and validate. However, they will become more cost-effective and easier to use over time, and will create tremendous value to decision-makers.”*

—Jim Henricksen,  
MnDOT Metro District  
Traffic Forecaster

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Macroscopic, mesoscopic and microscopic models are useful tools in traffic analysis. Macroscopic models characterize a region’s traffic as a whole while mesoscopic and microscopic models provide the level of detail needed to simulate individual vehicle behaviors.

The hybrid modeling approach is quite new: Only New York City has created a similar model on the scale of the Twin Cities Metro Hybrid Simulation model. A valuable result of this project is simply creating the model, which will be usable in other simulations.

Researchers learned several lessons about creating and operating a model of this size for future applications. Building, calibrating and running the model proved to require more human and computing resources than anticipated. The project also demonstrated the need to have information about road network geometry and traffic control devices in an accessible electronic format because manually entering such data is impractical.

### What’s Next?

This project serves as a stepping stone to broader implementation of hybrid modeling for planning and simulation. A follow-up project, Framework and Guidelines for the Development of a Twin Cities Meso-DTA Model, is aimed at creating guidelines and formalizing the methodology for expanding the modeling practice.

Another project recently completed, MnPASS Modeling and Pricing Algorithm Enhancement, has already extracted simulations of the relevant corridors from the Twin Cities-wide simulation built for this project. MnDOT is also looking at using a Dynamic Traffic Assignment model to evaluate the impacts of construction phasing and determine whether the overall inconvenience from construction can be better reduced by running multiple construction projects in a corridor simultaneously or sequentially.

Researchers recommend that the construction and maintenance of the travel simulation model be institutionalized and assigned to a dedicated group in the same way that a dedicated team at the Metropolitan Council maintains the RPM. This would allow the model to quickly incorporate the daily changes in the Twin Cities road network.

Adding microscopic-scale detail of new areas to the model so that other projects can effectively use the work of earlier models still needs to be perfected, although that is likely to become easier as hybrid models become more widely used.

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*This Technical Summary pertains to Report 2015-09, “Evaluating Twin Cities Transitways’ Performance and Their Interaction with Traffic on Neighboring Major Roads,” published March 2015. The full report can be accessed at <http://www.lrrb.org/PDF/201509.pdf>.*