Freight Model Improvement Project for ECWRPC

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16. Abstract In early 2009 WisDOT, HNTB and ECWRPC completed the first phase of the Northeast Region Travel Demand Model. While the model includes a truck trip generation based on the quick response freight manual, the model lacks enough truck classification counts and other data to accurately calibrate the model to existing conditions, as well as for future freight demand conditions. Therefore, sufficient data needs to be collected in order to accurately calibrate a model for use in calibrating freight use. This project will calibrate the model through data collection and field verification efforts. This study will provide data to evaluate and improve a model for the truck/freight mode split component of the travel model. Current freight information that could be used to verify and calibrate the model is minimal; therefore, this project will collect the needed data to do so using aerial photography, GIS data, mapping projects, and other data obtained by East Central Wisconsin Regional Planning Commission (ECWRPC). The project will complete a land use inventory specific to the freight industry, with documentation and mapping. The research team will also provide staff training and technical assistance.			
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EXECUTIVE SUMMARY

Project Summary

In early 2009, the Wisconsin Department of Transportation (WisDOT), HNTB and East Central Wisconsin Regional Planning Council (ECWRPC) completed the first phase of the Northeast Region Travel Demand Model (hereafter referred to as the NE Regional Model). While the model includes a truck trip generation based on the quick response freight manual, the model lacks enough truck classification counts and other data to accurately calibrate the model to existing conditions, as well as for future freight demand conditions. Through this project, necessary data are collected for use in calibrating the freight model component.

Background

The NE Regional Model is a travel demand forecast model developed for the northeast region of Wisconsin, including counties of Brown, Calumet, Dodge, Door, Fond du Lac, Kewaunee, Manitowoc, Oconto, Outagamie, Shawano, Sheboygan, Washington, Waupaca, and Winnebago. The study area is comprised of 2585 internal traffic analysis zones (TAZ) indexed from 1 to 2774, where the zones in each county are indexed in a continuous range. Outside the study area, there are 64 external zones indexed from 2801 to 2864, which are defined as locations at the periphery of the study area that carry traffic in and out of the study area. The model includes a conventional four-step model component for passenger travel and a three-step truck model component for freight transportation.

Process

This study provides data to evaluate and improve a model for the truck/freight component of the NE Regional Model. As current freight information that could be used to verify and calibrate the model is minimal, this project collects the needed data to do so using aerial photography, GIS data, mapping projects, and other data obtained by ECWRPC. Specifically, the project entails the following components:

1. Establish a Highway 41 Freight Advisory Council.
2. Review/develop trip generation variables.
3. Issue and manage subcontracts for the following tasks:
    - Complete a land use inventory.
    - Compile relevant data, edit, and update the NE Regional Model.
    - Provide staff training and technical assistance.
    - Prepare illustrative mapping.
    - Work with various stakeholders to improve modeling capabilities statewide.
    - Prepare final report and document model development.

Findings and Conclusions

The data collection and model evaluation effort undertaken as part of this project suggest that the NE Regional Model is capable of illustrating the roadways with the greatest anticipated travel demand. As such, the model can assist in forming policies and prioritizing transportation investments. The model can be a powerful tool for recognizing critical corridors and connections for the efficient movement of goods and services throughout the region.

INTRODUCTION

In early 2009, the Wisconsin Department of Transportation (WisDOT), HNTB and East Central Wisconsin Regional Planning Council (ECWRPC) completed the first phase of the Northeast Region Travel Demand Model (hereafter referred to as the NE Regional Model), which was a travel demand forecast model developed for the northeast region of Wisconsin. The NE Regional Model covers counties of Brown, Calumet, Dodge, Door, Fond du Lac, Kewaunee, Manitowoc, Oconto, Outagamie, Shawano, Sheboygan, Washington, Waupaca, and Winnebago. The study area is comprised of 2585 internal traffic analysis zones (TAZ) indexed from 1 to 2774, where the zones in each county are indexed in a continuous range. Outside the study area, there are 64 external zones indexed from 2801 to 2864, which are defined as locations at the periphery of the study area that carry traffic in and out of the study area. The model includes a conventional four-step model component for passenger travel and a 3-step truck model component for freight transportation.

While the NE Regional Model includes a truck trip generation based on the quick response freight manual, the model lacks enough truck classification counts and other data to accurately calibrate the model to existing conditions, as well as for future freight demand conditions. This project calibrates the model through data collection and field verification efforts.

This study provides data to evaluate and improve a model for the truck/freight mode split component of the NE Regional Model. As current freight information that could be used to verify and calibrate the model is minimal, this project collects the needed data to do so using aerial photography, GIS data, mapping projects, and other data obtained by ECWRPC. The project entails the following components:

1. Establish a Highway 41 Freight Advisory Council.
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    - Prepare illustrative mapping.
    - Work with various stakeholders to improve modeling capabilities statewide.
    - Prepare final report and document model development.

This report briefly summarizes the study effort and findings. Chapter 2 describes the establishment of the Freight Advisory Council. Chapter 3 documents the truck trip generation component of the NE Regional Model. Chapter 4 presents the results of evaluating the NE Regional Model against various data sources.

OUTREACH TO STAKEHOLDERS

In 2010, ECWRPC, Prime Focus LLC, and UW researchers worked together to set up the ECWRPC Freight Advisory Council (FAC). The purpose of the FAC is to facilitate strategic information exchange between Wisconsin freight stake-holders regarding freight mobility needs and potential solutions. The role of the FAC is to:

- Serve as a forum for discussions about freight movement to, from and within the state.
- Assist in the prioritization of regional transportation projects
- Provide State DOT with improved access to freight data and data sources which impact planning and improve cost benefit calculations.

The FAC is envisioned to assist ECWRPC in identifying and delivering freight transportation regional planning solutions that will meet the growing needs of the East North Central Wisconsin community and economy.

The research team developed brochures and recruited stakeholders through multiple venues, including regional tradeshows and local chambers of commerce (see Appendix A for the brochure describing the FAC). The research team also prepared invitations, map displays, and discussion materials for the FAC's kickoff meeting held on May 27, 2010. The kickoff meeting was attended by representatives from WisDOT central and district offices, regional ports, local business associations, rail operators, carriers, manufactures and businesses. After the kickoff meeting, the ECWRPC will continue to expand and engage the FAC to discuss specific freight goals, objectives, and policies in the current long range transportation plan (LRTP).

NORTHEAST REGIONAL TRAVEL DEMAND MODEL

As part of this project, the NE Regional Model was updated and, in particular, the trip generation component of the truck model was reviewed. This chapter briefly describes the modeling effort.

NE Regional Model Update

The NE Regional Model was developed to provide a decision-making tool for the Wisconsin Department of Transportation's (WisDOT) Northeast Region. The development of the NE Regional Model is a collaborative effort with WisDOT, Brown County Planning, and the East Central and Bay-Lake Regional Planning Commissions. The model builds on the existing Fox Valley model and covers counties of Brown, Calumet, Dodge, Door, Fond du Lac, Kewaunee, Manitowoc, Oconto, Outagamie, Shawano, Sheboygan, Washington, Waupaca, and Winnebago, as shown in Figure 1. The NE Regional Model now includes the five metropolitan planning areas of Green Bay, the Fox Cities (Appleton-Neenah), Oshkosh, Fond du Lac, and Sheboygan. It includes the entire US-41 corridor and most of northeast Wisconsin. The study area is comprised of 2585 internal traffic analysis zones (TAZ) indexed from 1 to 2774, where the zones in each county are indexed in a continuous range. Outside the study area, there are 64 external zones indexed from 2801 to 2864, which are defined as locations at the periphery of the study area that carry traffic in and out of the study area. The model includes a conventional four-step model component for passenger travel and a three-step truck model component for freight transportation. The model has been calibrated for base year 2005 and forecasts daily auto and truck traffic for the future years (2020, 2035).

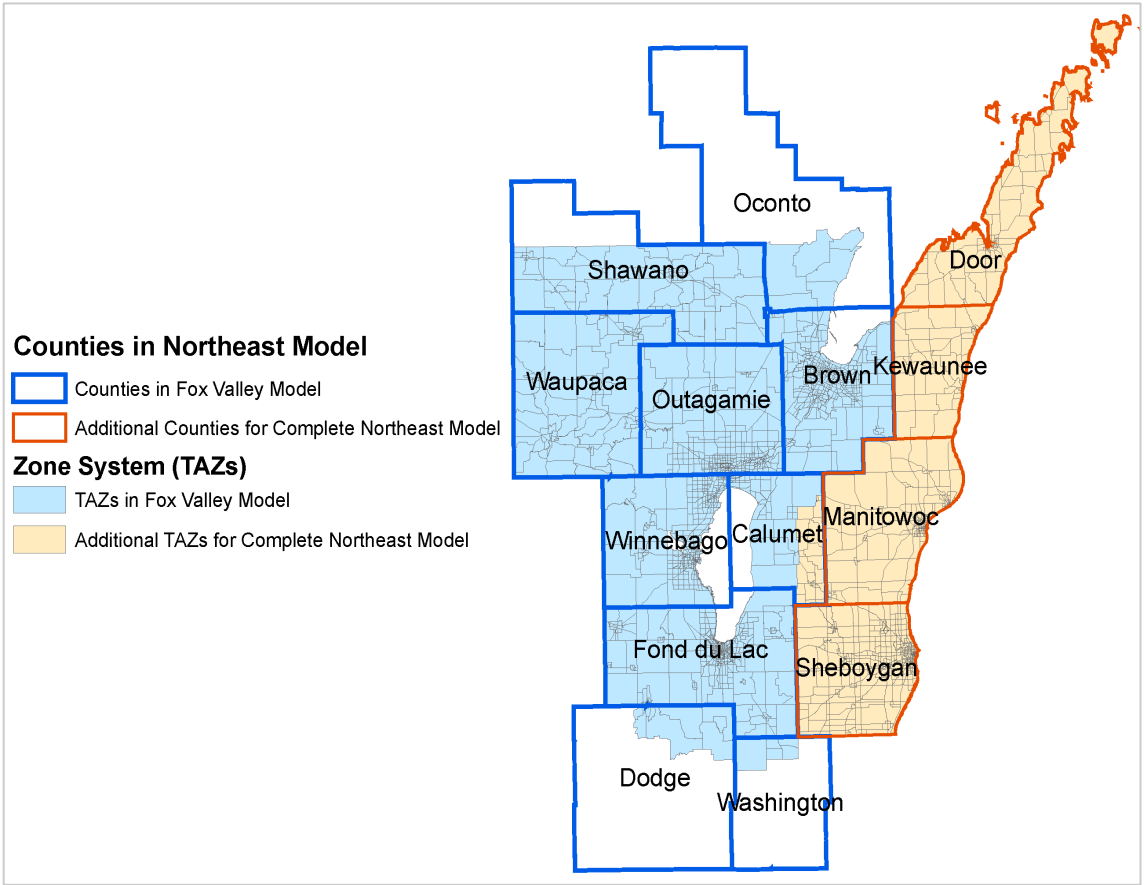

Figure 1. Geographic scope of the NE Regional Model

Trip Generation Model Component

Internal Trip Generation

The truck trip generation component of the NE Regional Model estimates the number of daily truck trips produced from and attracted to each TAZ within the study region. Based on the zonal socio-economic data of each scenario (2005/2020/2035), the number of truck trips produced is estimated separately for single unit trucks and combination trucks using the following linear models:

Number of Truck Trips Produced$_{Single}$ =

Number of Households × Household Rate$_{Single}$ +

Number of Retail Employment ×Retail Employment RateSingle +

Number of Non-retail Employment × Non-retail Employment RateSingle

Number of Truck Trips Produced$_{Comb}$ =

Number of Households × Household Rate$_{Comb}$ +

Number of Retail Employment × Retail Employment Rate$_{Comb}$ +

Number of Non-retail Employment × Non-retail Employment Rate$_{Comb}$

In the current model, generic trip production rates are applied to the entire study area. These trip rates are summarized in the table below.

Table 1. Trip production rates by truck type

	Single-Unit Truck Trips	Combination Truck Trips
Households Rate	0.099	0.038
Retail Employment Rate	0.253	0.065
Other Employment Rate	0.143	0.055

After the number of zonal truck trips produced for each zone is determined, truck trip attraction is simply assumed to be equal to truck trip production. That is:

Number of Truck Trips Attracted$_{Single}$ = Number of Truck Trips Produced$_{Single}$

Number of Truck Trips Attracted$_{Comb}$ = Number of Truck Trips Produced$_{Comb}$

External Trip Generation

For the base year, trip production and attraction for the external zones have been previously estimated using data from the Wisconsin Statewide Multimodal Travel Demand Model. As part of this project, the data set was updated with actual vehicular data counts in order to increase the NE Regional Model's accuracy at these locations. SRF, in conjunction with JT Engineering, Inc. collected additional traffic counts for 17 external sites, which were selected according to traffic volume, highway functional class, and whether the sites are on designated truck routes. The traffic counts at these external sites give the number of daily truck trips produced and attracted.

For the future year 2035, the NE Regional Model uses the same forecasts that were used in the Fox Valley model for 58 external zones. The forecasts for the remaining external zones are determined based on the Wisconsin Statewide model, WisDOT's TAFIS (Traffic Analysis Forecasting Information System), and count data with a constant 1.5 percent annual growth. Once the 2035 forecasts are determined, the 2020 external forecast are interpolated using the 2005 and 2035 traffic volumes.

MODEL EVALUATION

As part of this project, freight-related land use and activities related to higher volume truck traffic are reviewed. Freight information and truck classification counts collected as part of various studies within the region are then compared with outputs generated by the NE Regional Model. This chapter highlights some of the model evaluation findings.

Truck Trip Generation

As illustrated in Figure 2 through Figure 4, the model can be used to quickly identify the zones that produce the largest number of truck trips onto the street and highway network. These key generators appear to be consistent with major shippers, industrial parks, and intermodal terminals.

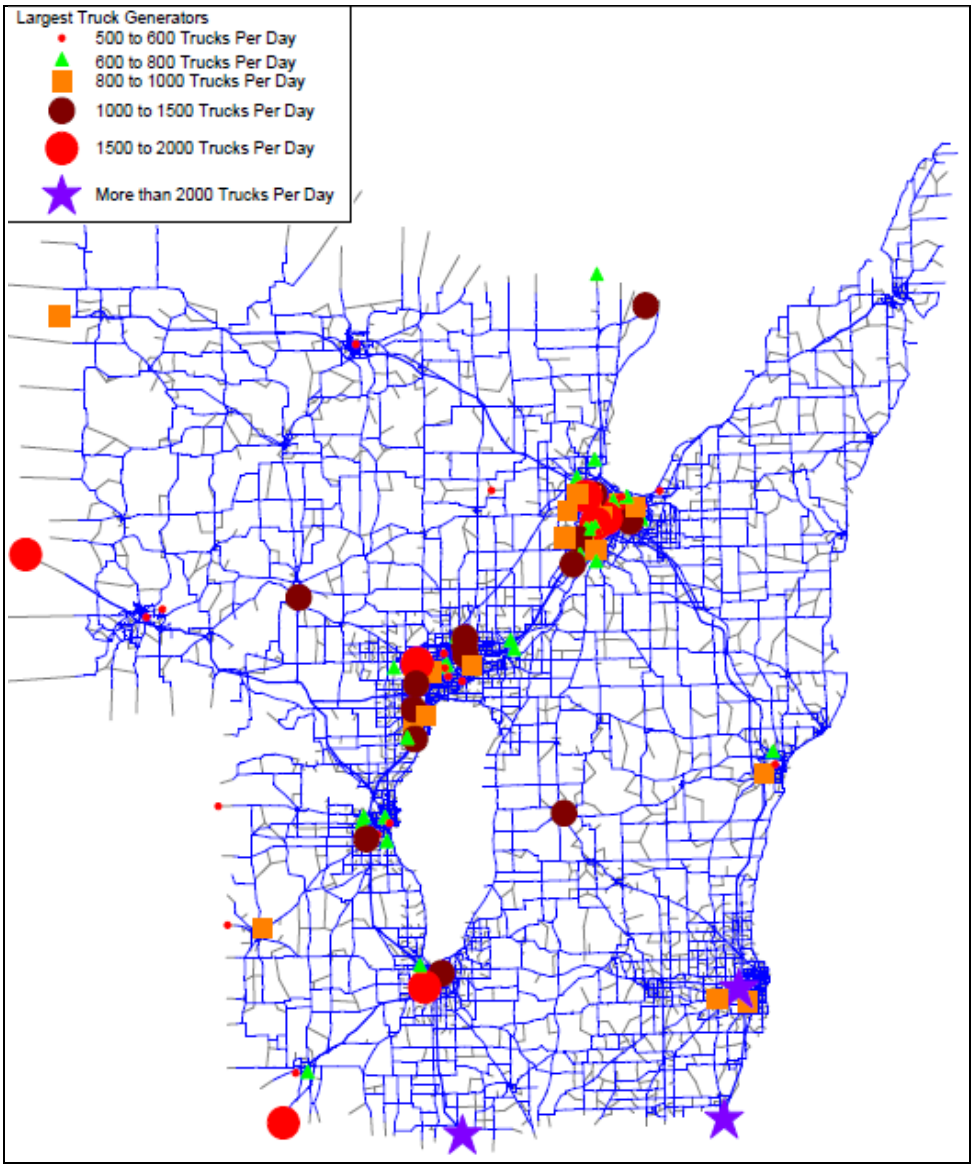

Figure 2. Zones generating more than 500 truck trips a day

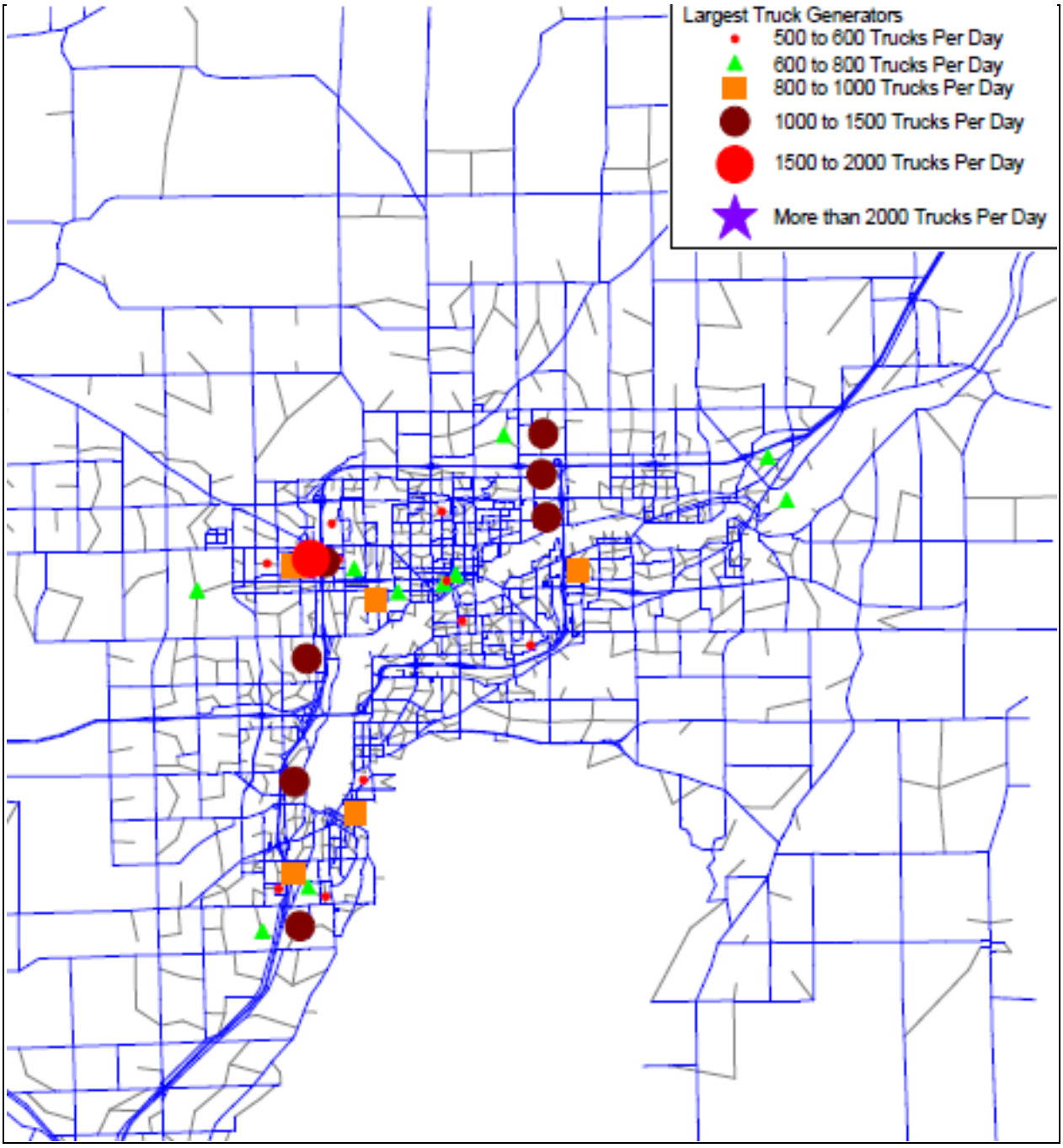

Figure 3. Zones in the Fox Cities area that generate over 500 truck trips per day.

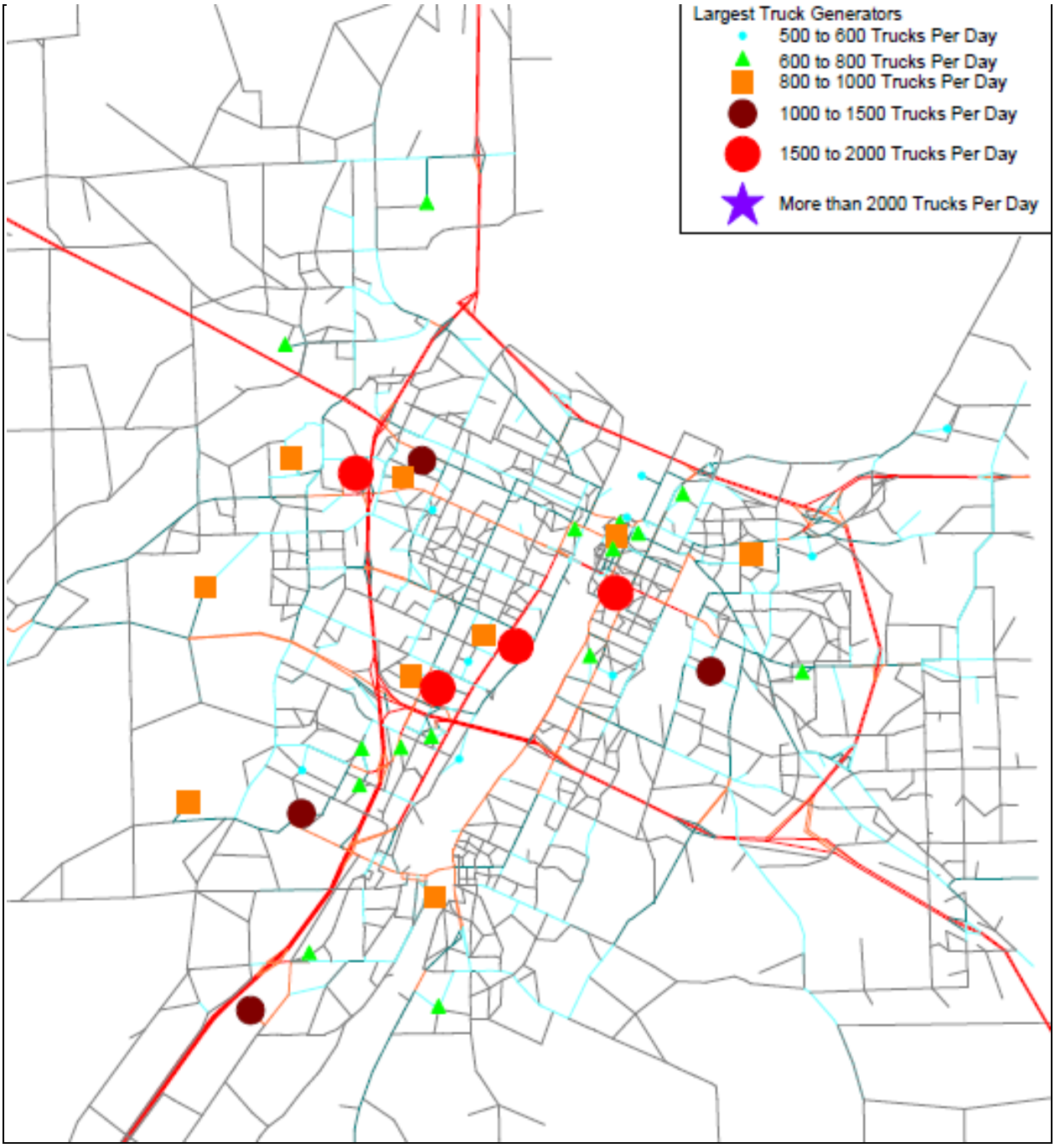

Figure 4. Zones in the Green Bay area that generate over 500 truck trips per day.

Truck Trip Distribution

As illustrated by the model and shown in Figure 5 and Figure 6, US Highway 41 would be extremely congested in 2035 if no countermeasures are taken. In these trip distribution maps, the wider the band the higher the truck volume.

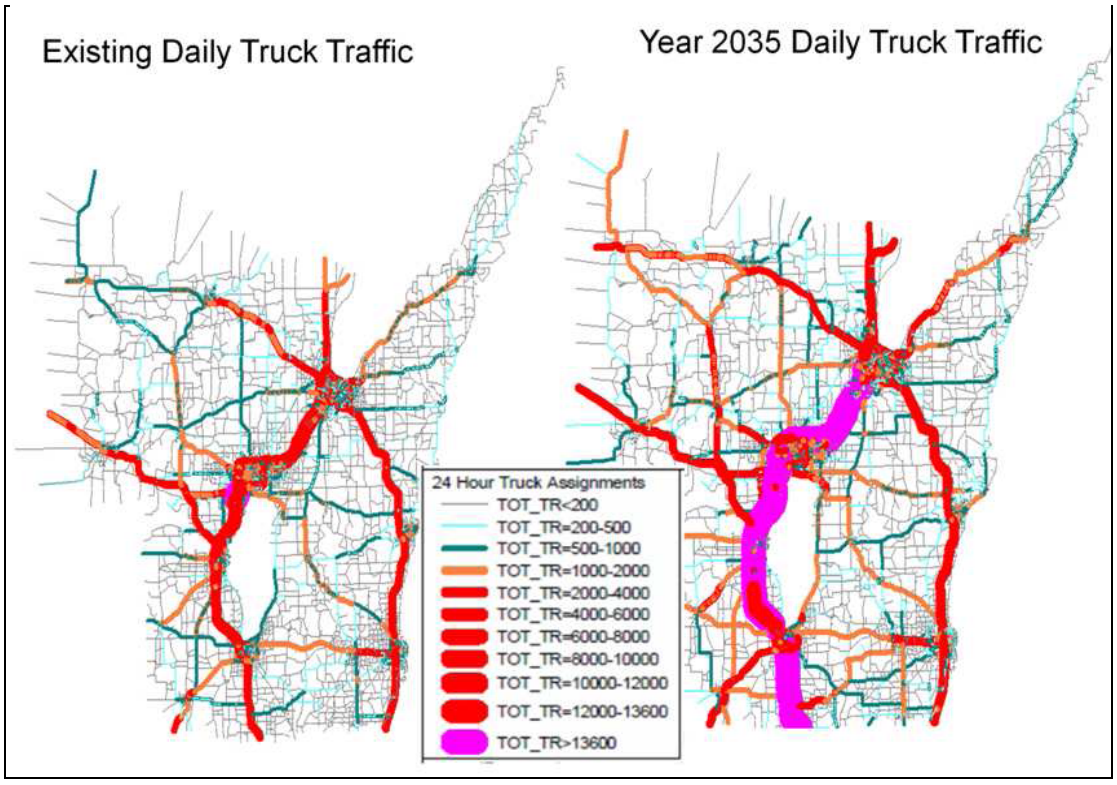

Figure 5. Base year and forecast year truck traffic as given by the NE Regional Model.

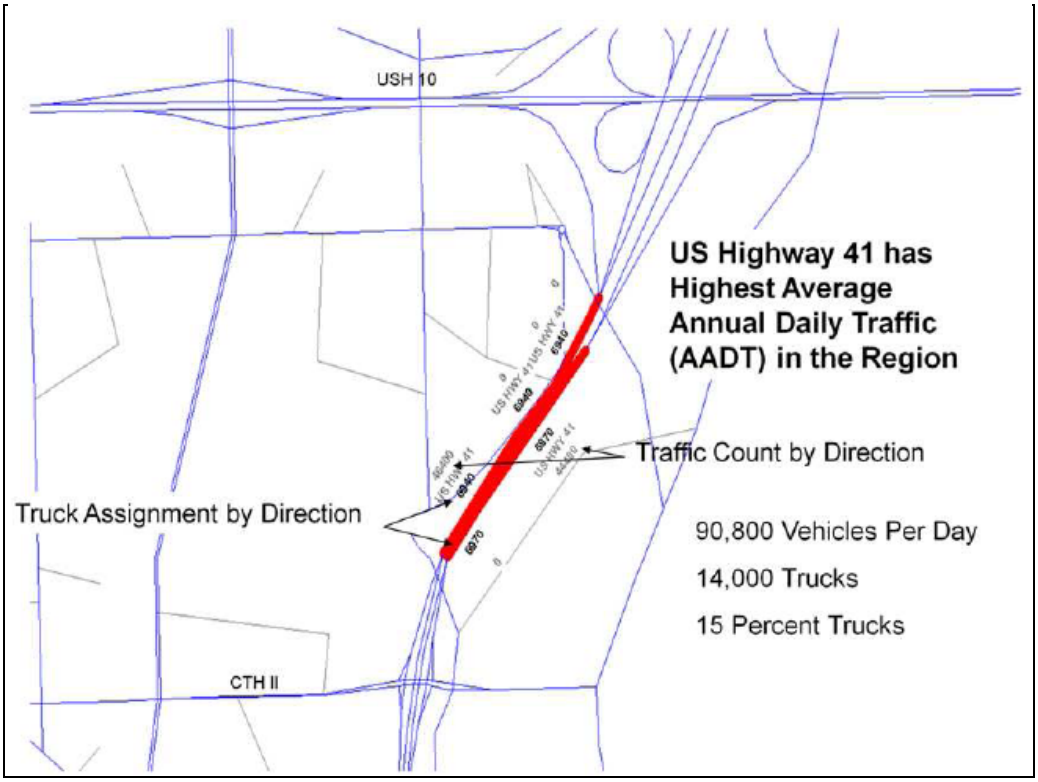

Figure 6. Highway links with the highest truck traffic.

Verifying Internal-External Truck Traffic

Looking specifically at truck traffic, the model shows about 2200 trucks per day entering and leaving the region via US-151 just south of Waupun (Figure 7). This is consistent with the estimates produced by the Wisconsin Statewide Travel Demand Model.

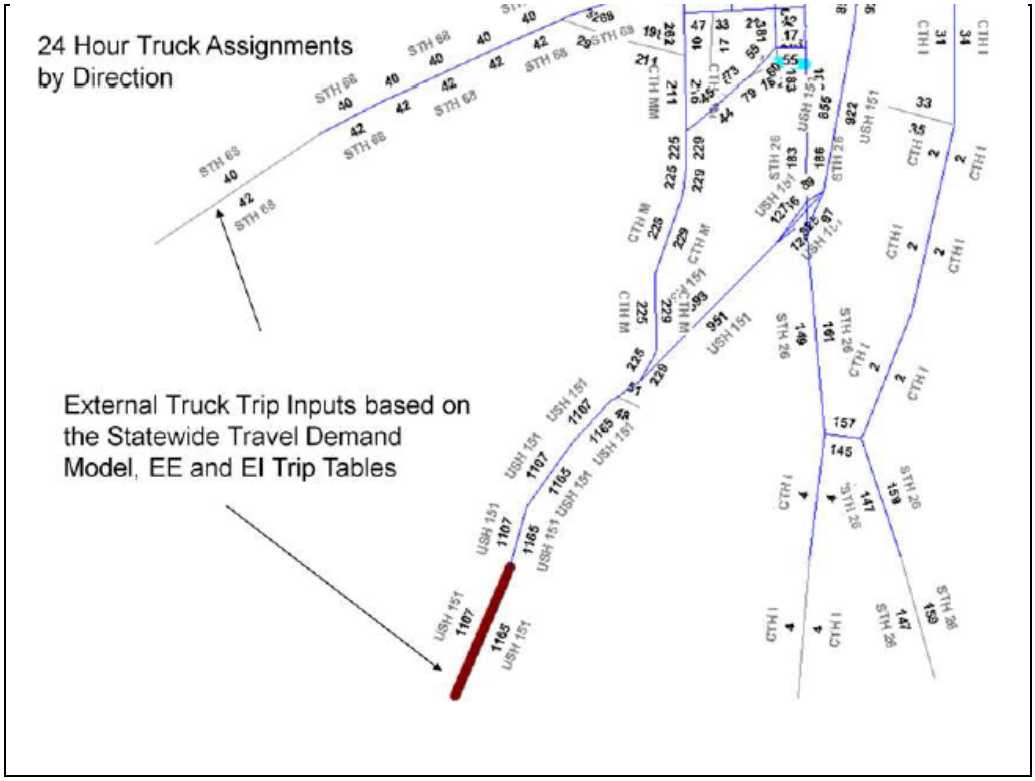

Figure 7. External-Internal trips near Waupun.

Verifying Against Count Data

Figure 8 through Figure 11 give examples of the model truck assignment matching the actual truck count reasonably well. The inside gray label is the actual truck count and the darker outside label is the link volume from model assignment.

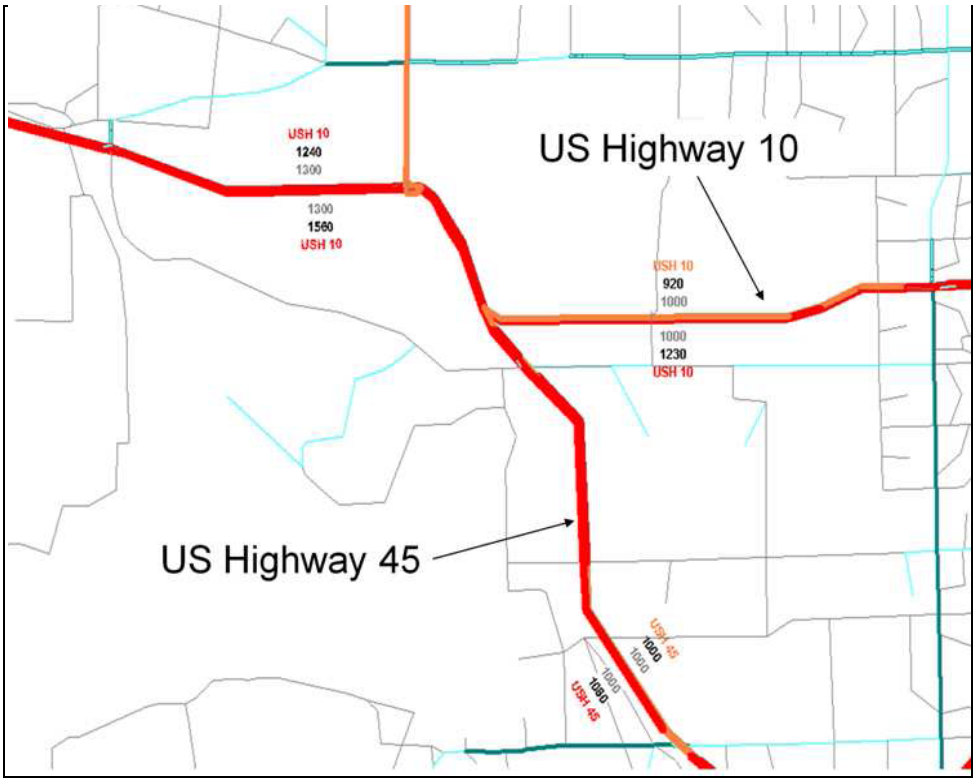

Figure 8. Model estimates against traffic counts – Example 1.

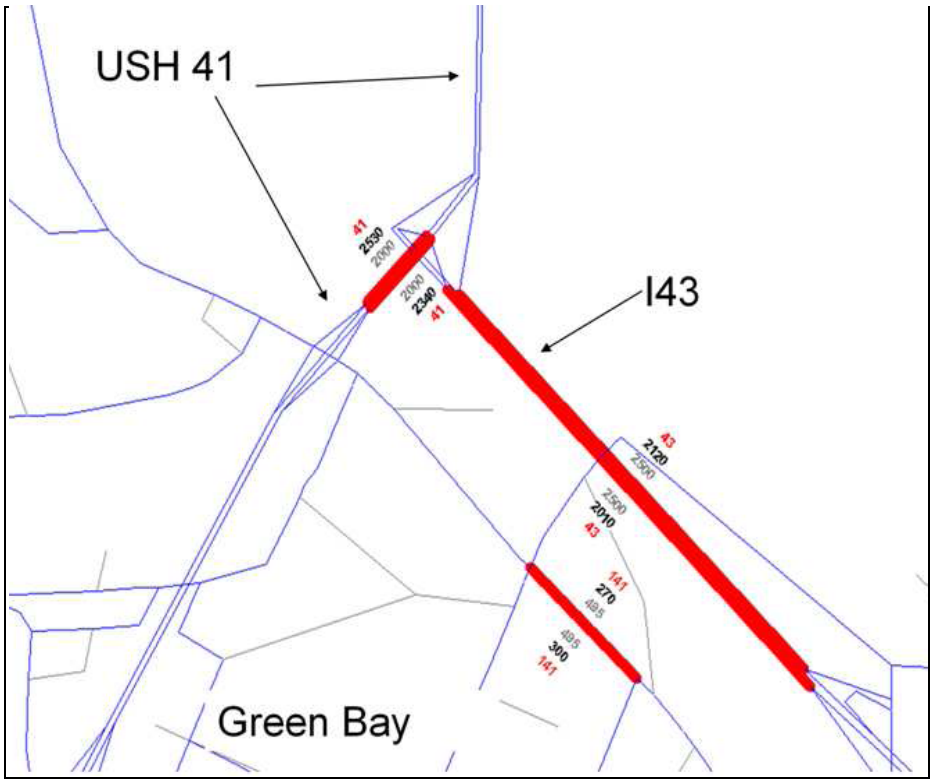

Figure 9. Model estimates against traffic counts – Example 2.

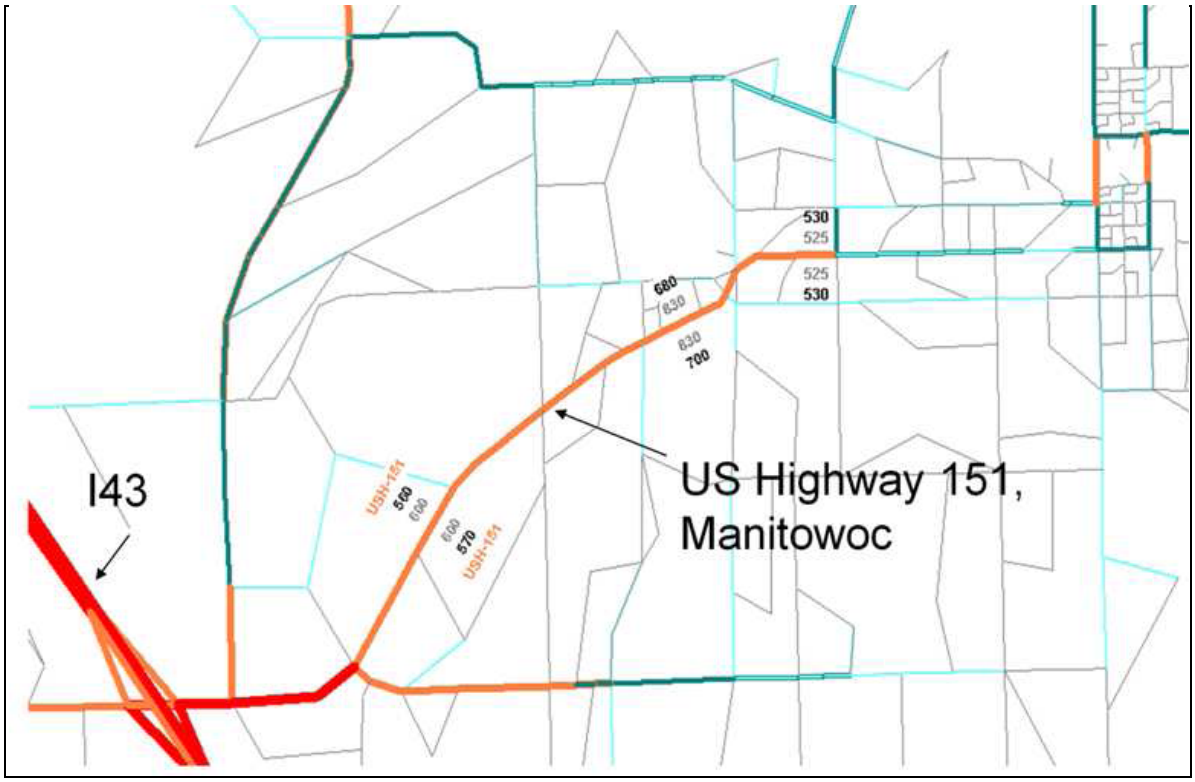

Figure 10. Model estimates against traffic counts – Example 3.

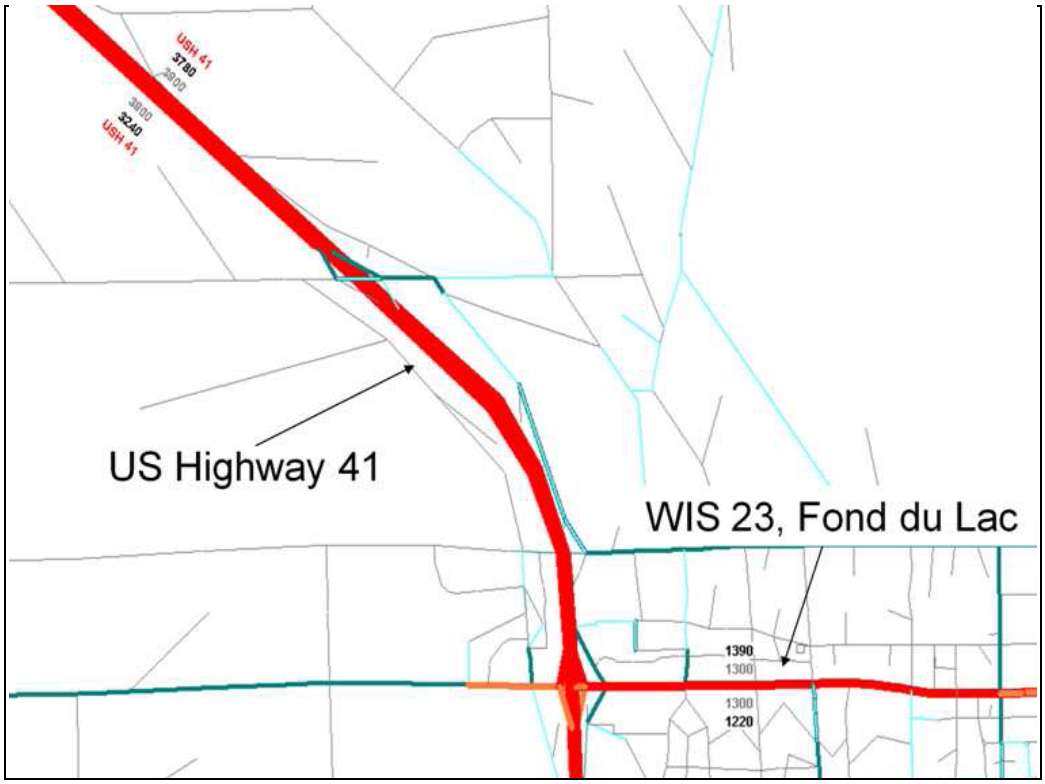

Figure 11. Model estimates against traffic counts – Example 4.

Conclusions

The evaluation effort undertaken as part of this study suggests that the NE Regional Model is capable of illustrating the roadways with the greatest anticipated travel demand. As such, the model can assist in forming policies and prioritizing transportation investments. The model can be a powerful tool for recognizing critical corridors and connections for the efficient movement of goods and services throughout the region.

Appendix A: Freight Advisory Council Brochure