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TRAVEL DEMAND MODELING FOR THE SMALL AND MEDIUM SIZED MPOs IN ILLINOIS

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16. Abstract

Travel demand modeling is an important tool in the transportation planning community. It helps forecast travel characteristics into the future at various planning levels such as state, region and corridor. Using travel demand modeling to evaluate different situations (changes in land use and/or transportation network) would allow Metropolitan Planning Organizations' (MPOs) staff make educated decisions regarding growth and improvements to their respective regional transportation networks. Several small (50,000< population <200,000) and medium (200,000 <population <500,000) sized MPOs in the state of Illinois utilize TDM for different transportation planning purposes, most commonly, the Long Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP). Some of the small and medium sized MPOs in the state of Illinois are unable to utilize TDM tools primarily due to lack of available resources and guidelines at the regional and state level. This study sought to establish the framework necessary for the development, maintenance, and application of small and medium sized MPOs' TDMs. It is crucial for the local, regional, and state agencies to play a collaborative role in the transportation planning process. This study established a framework for developing travel demand models at the MPO regional level considering their limited available resources. Special attention was given to simplicity and accuracy of the travel model development process. Extensive calibration and validation checks were recommended, as accuracy of travel forecasting is of high importance. As an important part of this study, a statewide group, the Illinois Modeling Users Group (IL-MUG) was created to support, set standards and guide the development, implementation, and maintenance of travel demand models in small and medium sized MPOs in Illinois.

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DISCLAIMERS

EXECUTIVE SUMMARY

Travel demand modeling is an important tool in the transportation planning community. It helps forecast travel characteristics into the future at various planning levels such as state, region and corridor. Using travel demand modeling to evaluate different situations (changes in land use and/or transportation network) would allow Metropolitan Planning Organizations' (MPOs) staff make educated decisions regarding growth and improvements to their respective regional transportation networks. In addition to forecasting traffic volumes for Long Range Transportation Planning and making policy decisions regarding allocating transportation funding, Travel Demand Models (TDM) can also be used for corridor planning and other micro level planning studies. Several small (50,000< population <200,000) and medium (200,000 <population <500,000) sized MPOs in the state of Illinois utilize TDM for different transportation planning purposes, most commonly, the Long Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP). Some of the small and medium sized MPOs in the state of Illinois are unable to utilize TDM tools primarily due to lack of available resources and guidelines at the regional and state level.

This study sought to establish the framework necessary for the development, maintenance, and application of small and medium sized MPOs' TDMs. It is crucial for the local, regional, and state agencies to play a collaborative role in the transportation planning process. A statewide model users group is necessary to act as a forum for the exchange of ideas, tips/techniques and issues involving the development and use of TDMs within a state. The model users group provides and shares information on the latest modeling advancements, regional projects and other topics of interest to the transportation/land use modeling community.

Also, this study addresses the statewide modeling current practices in the United States and highlights issues and benefits of statewide modeling and the integration of state and regional (MPO level) travel demand models. The statewide travel demand model is an effective tool to perform comprehensive modeling at the statewide level. A statewide model helps forecast travel between urban areas in the state and even outside the state, forecast freight and tourist travel, analyze long distance travel, and estimate project level forecasts in rural areas. Illinois is the only state in the Midwestern region with no active statewide travel demand model.

Major outcomes of the study include the following:

A COMMON FRAMEWORK FOR DEVELOPMENT AND IMPLEMENTATION OF TDMS IN SMALL AND MEDIUM SIZED MPOS IN ILLINOIS

This study established a framework for developing travel demand models at the MPO regional level considering their limited available resources. Special attention was given to simplicity and accuracy of the travel model development process. Extensive calibration and validation checks were recommended, as accuracy of travel forecasting is of high importance. Resources available and support structures for TDM development and/or improvements, and implementations were also highlighted.

As an important part of this study, a statewide group, the Illinois Modeling Users Group (IL-MUG) was created to support, set standards and guide the development, implementation, and maintenance of travel demand models in small and medium sized MPOs in Illinois. The IL-MUG has been acting as a forum for the exchange of ideas, tips/techniques and issues involving the development, applications, and improvements of travel demand models utilized by the small and medium sized MPOs in Illinois.

ESTABLISHING FOUNDATION OF STATEWIDE TRAVEL DEMAND MODEL

The study provided the current status of statewide travel modeling practices across the United States and identified issues, opportunities, and resources pertinent to developing a statewide travel model. Regional (MPO level) travel models are important components of developing statewide travel models as a statewide travel model is formed through integration of regional travel models.

ENHANCING TRAFFIC FORECASTING CAPABILITIES OF EXISTING TDMS

The study prepared a set of specific recommendations targeted to enhance travel forecasting capabilities for each of the nine small and medium sized MPOs with functional travel demand models. The MPO specific recommendations were based on the region-level analysis of needs, goals and objectives specified in the MPO Long Range Transportation Plans. Most recommended travel demand forecasting enhancement tools for the small and medium sized MPOs include:

- Addition of mode-choice model: The mode-choice model helps forecasting transit and non-motorized trips for the urbanized area and helps analyzing land use and infrastructure development scenarios targeted to promote sustainable, transit, and other active modes of transportation (e.g., walking, bicycling) oriented developments.
- Performing comprehensive calibration and validation checks for all the travel demand modeling steps utilizing the Federal Highway Administration's recommended guidelines.
- Preparing model documentation: Travel demand modeling steps and updated components should be documented for future reference. Calibration and validation checks for all the travel demand modeling steps should be appropriately documented.
- Addition of peak hour travel model: This model helps analyzing congested conditions in the regional transportation network due to future anticipated traffic growth and land-use and infrastructure developments.
- Performing periodic updates of the travel demand model: The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. It is recommended to update the TDM steps during the LRTP update process.

ESTABLISHING AN EFFECTIVE TRANSPORTATION PLANNING TOOL FOR THE ILLINOIS DEPARTMENT OF TRANSPORTATION

The small and medium sized MPOs with newly developed and/or improved versions of existing travel demand models would provide better transportation planning tools for the Illinois Department of Transportation. This would lead to improved highway planning, and ultimately to a highway network better suited for Illinois' economic future.
This study identified uses, benefits, and the level of functionality necessary for travel demand forecasting tasks for the small and medium sized MPOs in Illinois. It also listed resources necessary to develop, validate, maintain, and operate travel demand models for small and medium sized MPOs in Illinois. The study successfully created the Illinois Modeling Users Group (IL-MUG), which is acting as a group to support, facilitate information sharing, and provide guidelines related to travel demand forecasting activities in small and

medium sized MPOs in Illinois. The study also identified benefits and opportunities for the development of statewide travel demand model for Illinois and the integration of the regional travel models (MPO travel models) into the statewide model.

Based on the study literature reviews, survey data analysis, visions, goals, and objectives of the current Long-Range Transportation Plans of the small and medium sized MPOs in Illinois, current and upcoming federal and state policies and requirements for transportation planning projects, and available resources this study recommends the following:

- Three small MPOs in Illinois: Danville Area Transportation Study, Kankakee Area Transportation Study, and Decatur Urbanized Area Transportation Study should develop functional travel demand models for their urbanized areas. Staff of these three MPOs, the Illinois Department of Transportation, and Illinois Modeling Users Group members should work together to pool resources necessary to develop, calibrate, and validate travel demand models (as outlined in Chapters 6 and 7) for these three MPOs.
- Nine small and medium sized MPOs in Illinois with existing functional travel demand models in place should update, improve, and validate their travel demand models (as described in Chapters 6 and 7) for enhancing accuracy and travel forecasting capabilities.
- The Illinois Department of Transportation should establish a statewide program to promote and support travel demand modeling practices for regional and state level transportation planning projects in Illinois. This program will be tasked to:

    - Establish appropriate goals and responsibilities between MPOs and IDOT to advance travel forecasting practice in Illinois.
    - Facilitating resources for the small and medium sized MPOs to develop and/or improve their travel demand models.
    - Supporting the Illinois Modeling Users Group as a technical support and information sharing group for the small and medium sized MPOs in Illinois.
    - Adopt federal guidelines for travel demand model calibration and validation steps for regional travel demand models.
    - Promote peer reviews of existing regional travel demand models through the Illinois Modeling Users Group and the Travel Model Implementation Program of FHWA.
    - Promote partnership between state universities and Illinois MPOs through intergovernmental agreements to advance the research and practice of travel demand modeling in Illinois.
    - Develop and keep current a travel forecasting handbook to provide relevant information to travel demand modeling practitioners in Illinois.
    - Assist MPOs in examining data requirements for developing and validating travel demand models.
    - Support the development of a statewide travel demand model for Illinois.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

Travel demand modeling is an important tool in the transportation planning community. It helps forecast travel characteristics into the future at various planning levels such as state, region and corridor. Using travel demand modeling to evaluate different situations (changes in land use and/or transportation network) would allow Metropolitan Planning Organizations' (MPOs) staff make educated decisions regarding growth and improvements to their respective regional transportation networks. In addition to forecasting traffic volumes for Long Range Transportation Planning and making policy decisions regarding allocating transportation funding, Travel Demand Models (TDM) can also be used for corridor planning and other micro level planning studies. Several small (50,000< population <200,000) and medium (200,000 <population <500,000) sized MPOs in the state of Illinois utilize TDM for different transportation planning purposes, most commonly, the Long Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP). Some of the small and medium sized MPOs in the state of Illinois are unable to utilize TDM tools primarily due to lack of available resources and guidelines at the regional and state level.

This study sought to establish the framework necessary for the development, maintenance, and application of small and medium sized MPOs' TDMs. It is crucial for the local, regional, and state agencies to play a collaborative role in the transportation planning process. A statewide model users group is necessary to act as a forum for the exchange of ideas, tips/techniques and issues involving the development and use of TDMs within a state. The model users group provides and shares information on the latest modeling advancements, regional projects and other topics of interest to the transportation/land use modeling community. As a part of this project, the Illinois Modeling Users Group (IL-MUG) was created involving all the small and medium sized MPOs in Illinois, the Illinois Department of Transportation (IDOT), and representatives from the Federal Highway Administration (FHWA).

Also, this study addresses the statewide modeling current practices in the United States and highlights issues and benefits of statewide modeling and the integration of state and regional (MPO level) travel demand models. The statewide travel demand model is an effective tool to perform comprehensive modeling at the statewide level. A statewide model helps forecast travel between urban areas in the state and even outside the state, forecast freight and tourist travel, analyze long distance travel, and estimate project level forecasts in rural areas. Illinois is the only state in the Midwestern region with no active statewide travel demand model.

1.1 OBJECTIVES

The objectives of the study were:

- Identifying uses and benefits of travel demand forecasting on a regional basis (for small and medium sized MPOs).
- Identifying level of travel demand forecasting functionality necessary to meet the needs of each small and medium sized MPOs in Illinois.
- Identifying resources necessary to develop, validate, maintain, and operate travel demand forecasting capabilities on a regional basis.
- Identifying resources necessary to create a statewide group/organization to support, set standards and guide the creation implementation and maintenance of travel demand models in small/medium sized MPOs in Illinois.

- Identifying issues, benefits and opportunities for the development of a statewide travel demand model and the integration of the regional models into the statewide model.

1.2 REPORT ORGANIZATION

This report is organized into the following chapters:

- Chapter 1 – Introduction and Objectives – This chapter provides introduction to the project and highlights the study objectives.

- Chapter 2 – Literature Review – This chapter documents existing research on statewide and regional travel demand modeling; including issues, benefits and application of travel demand modeling specific to small and medium sized MPOs.

- Chapter 3 – Travel Demand Modeling Status in Small and Medium Sized MPOs in Illinois – This chapter highlights the results of the comprehensive survey of existing practices and needs of transportation planning and travel demand modeling among twelve small and medium sized MPOs in Illinois.

- Chapter 4 – Formation of Illinois Modeling Users Group – This chapter provides the background, functions, and benefits of forming a travel model users group. It also highlights the details of newly formed Illinois Modeling Users Group.

- Chapter 5 – Review of Existing Modeling Processes for Small and Medium Sized MPOs in Illinois – This chapter presents reviews of existing processes used by small and medium sized MPOs in Illinois for transportation planning needs in general and traffic forecasting in particular.

- Chapter 6 – Travel Demand Modeling Needs for Small and Medium Sized MPOs – This chapter discusses the required functionalities of the travel demand model for each small and medium sized MPOs based on their specific characteristics, functions and needs.

- Chapter 7 – Resources Needed to Achieve the Required Functionalities – This chapter identifies the resources needed to achieve the required functionalities of the travel demand model for each MPO.

- Chapter 8 – Implementation Plan – This chapter presents an implementation plan for development and validation of a travel demand model by each MPO. The implementation plan highlights the support structures, maintenance, update cycles, and performance standards for the travel demand model for each MPO.

- Chapter 9 - Statewide Travel Model Issues – This chapter outlines the issues and opportunities for development of a statewide travel model and integration of regional models into the statewide models.

- Chapter 10 – Major Outcomes of the Study – This chapter highlights the major findings of the study including key qualitative/quantitative results and/or trends.

- Chapter 11 – Recommendations and Conclusions.

CHAPTER 2 LITERATURE REVIEW

The purpose of this review is to provide practitioners and representatives serving small- and medium-sized MPOs with a general overview of the different approaches to travel demand modeling at the MPO level. It also provides information about the best tools available to help MPOs make informed decisions regarding travel demand modeling. Moreover, it offers an overview of statewide Travel Demand Modeling (TDM) current practices in the United States, highlighting issues, benefits, and applications of state and regional (MPO level) travel demand models. The summary also lists functions of existing travel demand modeling technical support groups for implementing TDM techniques in local and state levels in a coordinated manner.

2.1 TRAVEL DEMAND MODELING: DEFINITIONS AND PURPOSE

People travel in order to participate in some land-based activity, making the demand for travel a derived demand. Travel demand forecasting predicts the number, type, origin and destination, and distribution of “trips” on a transportation network as a function of land use patterns. A “trip” is defined as travel between two points for one purpose, for instance, between home and work, or home and school, or work and shopping. Therefore, more than one mode can be used for the same trip (e.g., walk or dropped off at a bus stop). Usually, travel demand is expressed in terms of vehicles (vehicle-trips); however, it can also be defined in terms of individuals (person-trips) or goods (truck-trips).

Travel demand forecasting tools allow practitioners to measure and evaluate the impact of changes to the transportation network and surrounding land uses on the traffic volumes, travel paths, and travel modes. Using travel demand modeling tools, planners, engineers, and economists make informed transportation infrastructure planning decisions. Travel demand forecasting tools help MPO staff make informed decisions regarding expansion and improvements to the transportation network, as part of the long-term transportation planning process.

2.2 APPROACHES USED TO DEVELOP TRAVEL DEMAND MODELS IN SMALL AND MEDIUM SIZED MPOS

Several analytical methods are used to complete transportation studies or prepare transportation plans; travel demand modeling is just one of them. The most commonly used methodology for travel demand modeling is the fours step process that considers generation, distribution, mode choice, and route assignment of trips. Each MPO, depending on its size, travel characteristics, socioeconomic and urban form conditions as well as the availability of data, has specific needs regarding travel demand forecasting models. Therefore, each MPO may thus use a different approach to develop a travel demand model that fits its specific needs. Based on the literature research completed for this project, three main different approaches can be used to define the parameters for developing a travel demand model in small and medium sized MPOs. These include:

- Using transferable “quick response” parameters as explained in the NCHRP Report 187: Quick Response Urban Travel Estimation Techniques and Transferrable Parameters (TRB 1978) and the NCHRP Report 365: Travel Estimation Techniques for Urban Planning (TRB 1998), which is an update of the NCHRP Report 187.
- Borrowing parameters from other similar sized communities/regions which were developed from a local household travel survey.
- Developing sub-area models for major corridor(s) in the MPO area.

Another alternative to travel demand forecasting is to use trend analysis to forecast volumes. In small MPOs, where future volumes are needed on a limited number of roads, this approach has been applied for the purpose of the development of the Long Range Transportation Plan. Trend analysis is centered on identifying and quantifying growth patterns, usually based on historical traffic counts. Equations are formulated using the identified trend and used to extrapolate the traffic volumes for future years.

2.3 TRAVEL DEMAND FORECASTING TOOLS

Several software packages are available to help develop a four-step travel demand model. The common forecasting packages widely used in the United States include CUBE, TransCAD, EMME/2/3, TransCAD and VISUM. QRS II is also a popular software used by small communities with limited resources and modeling experience. All the software packages listed above have the tools needed to support four-step modeling methods with the help of scripting languages. Brief descriptions of these software packages include the following:

CUBE (Developed by Citilabs, Tallahassee, FL, USA) has a good environment to model and manage different scenarios. The model scenario and application manager use hierarchical structure which helps develop various approaches to the modeling process. The software package is comprised of the Cube Base interface and a library of programs to perform various modeling processes. Cube Base is integrated with ArcGIS to provide access to geodatabases, edit the model network and display map data. Cube Voyager module is used for passenger demand modeling. Cube is script-based and uses scripting language similar to TRANPLAN. Details about CUBE can be accessed from Citilabs' website (www.citilabs.com).

EMME/2/3 (Developed by INRO, Montreal, QC, Canada) provides an open approach to modeling, and offers the flexibility of developing a model based on local requirements. The software is provided in separate modules and the user is responsible to put together the model based on modeling needs. A plug-in to the EMME model allows integration with the ArcGIS software. The model is data intensive and lacks default parameters helpful to develop a simple travel demand model with limited resources and expertise. The software is especially useful when analyzing multiple travel modes. The modeling software can prove complex for small and medium sized MPO with limited modeling expertise. Details about EMME can be accessed from INRO's website (www.inrosoftware.com).

QRS II (Developed by the Center for Urban Transportation Studies of the University of Wisconsin, Madison, WI, USA) uses interactive graphics General Network Editor (GNE) to build the model network. The model software is based on quick response methods and supports the planning procedures found in the NCHRP Report 187 and the NCHRP Report 365. Algorithms and a comprehensive set of default parameters for travel demand modeling steps are provided in the model, which can be easily modified as required. This software is especially useful for developing travel demand models for small communities. The model software is inexpensive and fits into the budget of small and medium sized communities. The software costs $390 for a 500-zone model. Details about QRS can be accessed through the developer's website (http://my.execpc.com/~ajh/intro.htm).

TransCAD (Developed by Caliper Corporation, Newton, MA, USA) is combined with ArcGIS into a single integrated platform and includes sophisticated GIS features such as polygon overlay, buffering, and geocoding. TransCAD uses GIS Developer's Kit (GISDK) interface, to develop the travel demand modeling process and to create add-in applications. TransCAD provides alternate methodologies for each step of the transportation forecasting process and also features a number of tools to analyze and display assignment results. The software package can be integrated with TransModeler for traffic simulation and 3-D visualization. Details about TransCAD can be accessed from the Caliper Corporation's website (www.caliper.com).

VISUM (Developed by PTV AG, Karlsruhe, Germany) is a GIS user-friendly software package which integrates all relevant modes of transportation on one consistent model network. VISUM uses GIS for display and network editing. The model software is integrated with VISSIM, a popular micro-simulation tool. VISUM offers a various post assignment analysis options including travel time isochrones and intersection modeling. VISUM is based on the TMODEL2 structure (a popular TDM software package among smaller MPOs) and also incorporates multi-modal capabilities. VISUM also readily imports models from other software packages, including Cube, TransCAD, EMME/2, and TModel2. Details about VISUM can be accessed from the PTV AG's website (www.ptvag.com).

In addition to the software packages already described, the Federal Highway Administration (FHWA) funded creating an open-source activity based travel forecasting tool, Transportation ANalysis and SIMulation System (TRANSIMS), developed by the Los Alamos National Laboratory. TRANSIMS is capable of completing traffic assignment with trip based data, commonly referred to as "Track 1" implementation. This makes TRANSIMS an appropriate TDM software package for MPOs currently utilizing trip-based TDM. The TRANSIMS package is available free of cost. However, strong GIS capabilities and technical expertise in modeling are needed for application of TRANSIMS tools. It has the potential of being widely used in the future to develop metropolitan travel demand models at the MPO level and statewide models.

2.4 SUPPORT STRUCTURE FOR REGIONAL TRAVEL DEMAND MODELING

State transportation agencies and the FHWA play an important role in the development and improvement of the metropolitan travel demand models. The NCHRP Report 288: Metropolitan Travel Forecasting, Current Practice and Future Directions[3] published in 2007 showed that sixteen state transportation agencies provide MPOs with formal guidance for travel forecasting. The modeling support given by these state transportation agencies includes guidance, setting minimum standards and/or staff training. The majority of the MPOs with a population less than 200,000 depend on the state transportation agency or consultants for model development and applications.

208 of the 384 MPOs in the United States are located in areas with a population between 50,000 to 200,000.[3] The TRB Special Report 288 identified that the state transportation agencies make forecasts for 42% of the MPOs, develop models for 7% of the MPOs, and provide technical assistance for 28% of the MPOs. Figure 1 shows the involvement of the states and the MPOs in metropolitan travel modeling. The Travel Model Improvement Program (TMIP), sponsored by the FHWA helps support the model forecasting process by providing feedback and recommendations through the peer review program. Several states also organize MPO Model Users Groups (MUG) to provide services such as staff training and technology transfer to the local agencies.

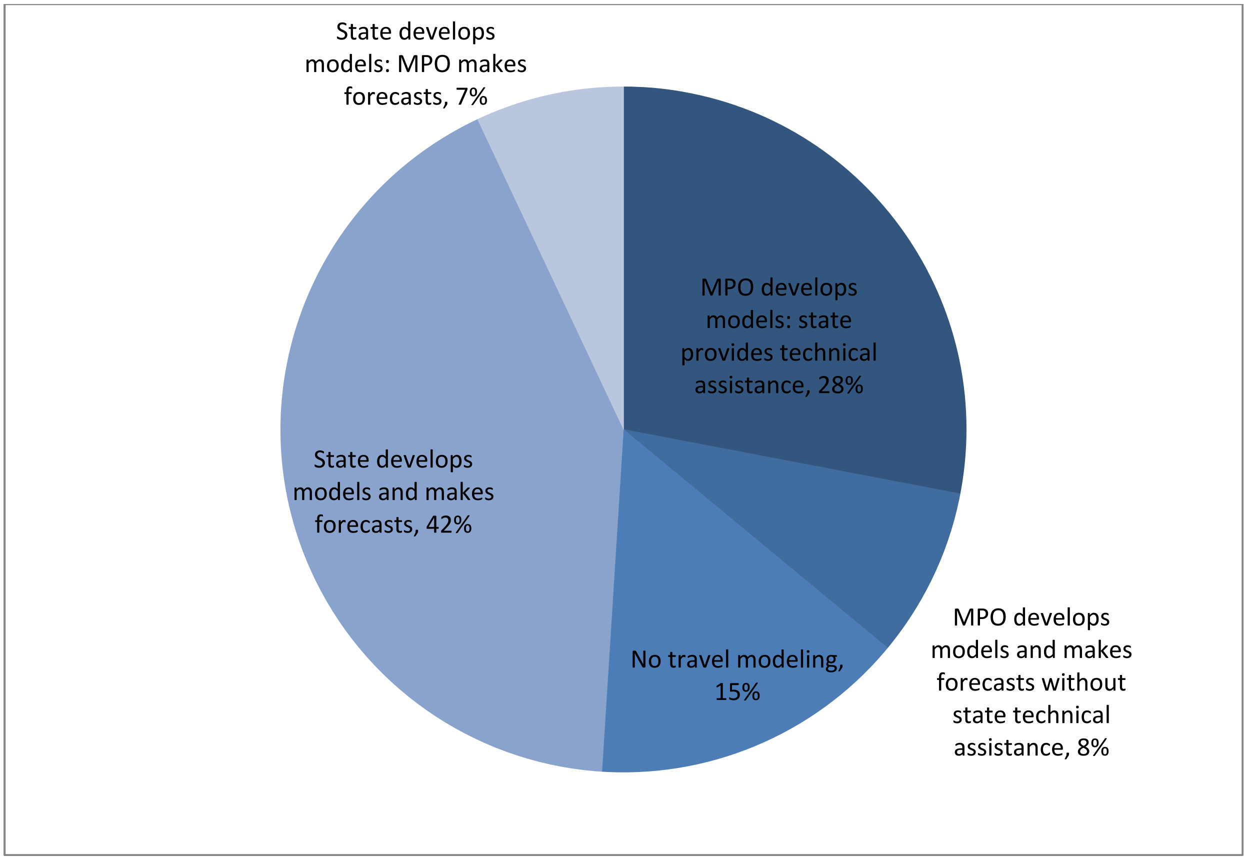


Figure 1. State and MPO Involvements in Metropolitan Travel Modeling (TRB 2010).

2.5 MAINTENANCE AND UPDATE CYCLES FOR A TRAVEL DEMAND MODEL

The constant change in socio-economic conditions and traffic characteristic of a region warrants a frequent update and maintenance of the travel demand model. The model is usually updated when additional functionalities need to be incorporated into the forecasting process, when revised socio-economic information is available, or when a household travel survey is conducted for the region. The travel demand model inputs are usually updated every three to five years, depending on the Long Range Transportation Plan cycle. The update cycle for models in non-attainment areas is every three years. Small changes to the model such as adjusting the model script, network and land-use changes can be made annually or on an as needed basis. More extensive revisions such as revising socio-economic data, changing the model parameters, adding a truck/transit module, or changing the structure of the model require considerable time and effort.

The staff resources devoted to travel forecasting depend on the size of the MPO and the applications of the model. Small sized MPOs (population < 200,000) usually receive a modest amount of federal funding which makes it difficult for them to allocate staff resources for travel demand modeling. A survey completed by the Urban Transportation Monitor in 2006 found that MPOs with population less than 200,000 usually have one full-time modeler on staff[2]. However, several small MPOs hire consultants to improve/update their travel demand models due to the lack of financial resources to hire a permanent full time staff to work on the travel demand model (FHWA 2010b). Hiring modelers with specific travel forecasting skill sets is considered challenging by smaller MPOs. A small MPO requires several years' worth of "PL Funds" and "Section 5303" funds/metropolitan transit planning funds to budget the development of a travel demand model. Other federal funding sources available may include congestion mitigation, and air quality (CMAQ), and surface transportation program (STP) (FHWA 2010a).

2.6 PERFORMANCE STANDARDS FOR TRAVEL DEMAND MODELS

The credibility of the travel demand model results depends on the ability of the model to closely forecast future traffic. The FHWA's Travel Model Improvement Program recently published the 2nd edition of the Travel Model Validation and Reasonability Checking Manual (FHWA 2010b), which provides guidelines for the technical staff assigned to the development, maintenance, or application of travel models. The manual clearly defined common terms related to travel model calibration, validation, and reasonability testing process. Figure 2 shows an overview of the travel model development and application process.

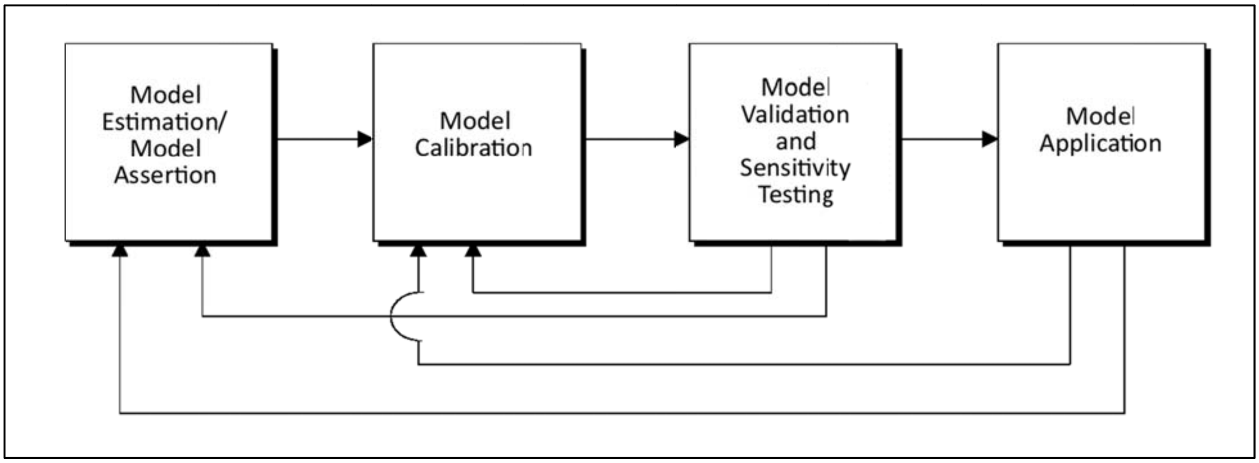


Figure 2. Overview of Travel Model Development and Application (FHWA 2010b).

Travel model application for projecting future year conditions and policy options requires checking the reasonableness of the projections, which might reveal a need to return to the model estimation or calibration steps (FHWA 2010b).

The Travel Model Validation and Reasonability Checking Manual (2nd edition) specified the following five primary validation steps for a travel model:

1. Specifying a Model Validation Plan
2. Collection and Assessment of Validation Data
3. Validation of Model Components
4. Validation of Model System
5. Documentation of Validation Results

Small and medium sized MPOs are recommended to comply with the above mentioned validation steps for their travel models, in order to increase their models' credibility.

CHAPTER 3 TRAVEL DEMAND MODELING STATUS IN SMALL AND MEDIUM SIZED MPOs IN ILLINOIS

One of the study objectives was aimed at identifying the travel demand model functional requirements of small and medium sized Metropolitan Planning Organizations (MPOs) in the state of Illinois. A comprehensive survey on the existing practices and needs of transportation planning and travel demand modeling existing practices and needs was conducted among the twelve small and medium sized MPOs in Illinois. This chapter contains a summary of the survey responses and lists travel demand modeling functional requirements most suitable for the small and medium sized MPOs in Illinois.

3.1 SURVEY DETAILS

The survey listed questions related to MPO's long-range and short-range transportation planning processes and tools. Appendix A contains the list of survey questions. The survey was prepared and distributed with the help of *Survey Monkey*, a widely used online survey platform. The survey was sent to the twelve small and medium sized MPOs in Illinois in February 2009. The survey response rate was 100%.

The survey was designed to be a self-administered survey. However, follow-up telephone interviews were conducted with all the respondents to clarify some answers and complete the skipped and/or incomplete responses. The survey questions were categorized in the following specific sections:

- **MPO Description:** The survey began by identifying respondents and asking for community information and the type of transportation planning studies they do. It first asked respondents to identify themselves in order to allow for possible follow-up.
- **Planning Tools:** This section asked respondents about technical aspects of transportation studies, including projects in which a travel demand model was used or is planned to be used, surveys conducted for the purpose of developing their travel demand forecasting models, and types of micro-simulation software used for planning studies in their regions.
- **Travel Demand Model Description:** This section asked respondents to describe their travel demand model (spreadsheet or commercial software) that allows for the calculation of the estimated future traffic including staff availability, type of model used for travel forecasting, geographical area covered, data sources, model components, data used for forecasting purposes, and model documentation.
- **Model Validation:** This section mainly requested information about methods used for validation of travel demand models.
- **Trip Generation:** The information requested included time period used for the trip generation model, trip generation approach used, and trip purposes (Home Based, Non Home Based, etc.).
- **Trip Distribution:** This section asked respondents for the time period used for trip distribution model and the type of trip distribution model used, such as Gravity Model, Destination Choice (Logit) or any other model.
- **Mode Choice:** In this section, the requested information included time period used for the mode-choice model, modes of transportation included in the mode-choice model and type of mode-choice model used (Diversion Curves, Regression Equations, Multinomial Logit, Nested Logit or any other.)
- **Trip Assignment:** This section asked respondents to define time periods and assignment methods used for highway trips, as well as if transit trips were considered for assignment; and if so, time periods and assignment methods used for transit trips.

- **Other Model Features:** In this section, the respondents were asked to provide specific details about particular features of their models such as toll roadways, trucks trips and/or HOV lanes.
- **Other:** This last section gave the opportunity for respondents to provide detailed information about specific features of their travel demand models and what areas of their models need improvement.

3.2 PROFILE OF SURVEY RESPONDENTS

As noted, the twelve respondents to the survey comprised all small and medium sized MPOs in Illinois. Table 1 shows the name and a brief description of each MPO surveyed.

As can be seen in Table 1, the majority of the MPOs surveyed (10 out of 12) are categorized as a small MPO (population less than 200,000).

Table 1. Details on Surveyed MPOs

Name	Population (2000 Census)	LRTP Update Date	States involved in Planning Process
Danville Area Transportation Study (DATS)	53,223	Summer 2010	Illinois
DeKalb Sycamore Area Transportation Study (DSATS)	55,085	July 2010	Illinois
Stateline Area Transportation Study (SLATS)	58,000	September 2011	Illinois & Wisconsin
Kankakee Area Transportation Study (KATS)	65,000	October 2009	Illinois
Dubuque Metropolitan Area Transportation Study (DMATS)	77,018	October 2011	Illinois & Iowa
Decatur Urbanized Area Transportation Study (DUATS)	105,420	November 2009	Illinois
McLean County Regional Planning Commission (MCRPC)	118,000	Spring 2011	Illinois
Champaign County Regional Planning Commission (CRRPC)	123,885	December 2009	Illinois
Springfield Area Transportation Study (SATS)	160,000	March 2010	Illinois
Tri-County Regional Planning Commission (TCRPC)	247,000	May 2010	Illinois
Rockford Metropolitan Agency for Planning (RMAP)	270,414	June 2010	Illinois
Bi-State Regional Commission (BSRC)	292,577	March, 2011	Illinois & Iowa

3.3 TRAVEL DEMAND MODELING STATUS IN MPOS

Table 2 shows the application status of Travel Demand Modeling (TDM) tools in the twelve MPOs surveyed. Of the MPOs surveyed, ten out of twelve MPOs have utilized TDM tools developed and maintained either in-house or by consultants to fulfill their long-range and/or short-range transportation planning needs.

Table 2. TDM Application Status

Name	Population (2000 Census)	TDM Availability	TDM Type	Development/ Maintenance Responsibility	Number of In-House TDM Staff
Danville Area Transportation Study (DATS)	53,233	No	N/A	N/A	None
DeKalb Sycamore Area Transportation Study (DSATS)	55,085	Yes	Trip Based	Consultant/Consultant	None
Stateline Area Transportation Study (SLATS)	58,000	Yes	Trip Based	State Consultant(WI)/State Consultant	None
Kankakee Area Transportation Study (KATS)	65,000	No	N/A	N/A	None
Dubuque Metropolitan Area Transportation Study (DMATS)	77,018	Yes	Trip Based	MPO (in house)/MPO (in house)	1
Decatur Urbanized Area Transportation Study (DUATS)	105,420	No	N/A	N/A	None
McLean County Regional Planning Commission (MCRPC)	118,000	Yes	Trip Based	Consultant, MPO (in house)	1
Champaign County Regional Planning Commission (CCRPC)	123,885	Yes	Trip Based	MPO (in house)/MPO (in house)	1.5
Springfield Area Transportation Study (SATS)	160,000	Yes	Trip Based	Consultant/ MPO (in house)	2
Tri-County Regional Planning Commission (TCRPC)	247,000	Yes	Trip Based	Consultant/ MPO (in house)	1
Rockford Metropolitan Agency for Planning (RMAP)	270,414	Yes	Trip Based	MPO (in house)& Consultant/MPO (in house) & Consultant	1
Bi-State Regional Commission	292,577	Yes	Trip Based	MPO (in house)/ MPO (in house)	1

Table 2 also shows that seven MPOs have in-house staff maintaining and updating the TDM. Three MPOs receive TDM technical assistance from the Iowa and Wisconsin Departments of Transportation for development and maintenance purposes.

Figure 3 shows common applications of TDM tools by each of the MPOs surveyed.

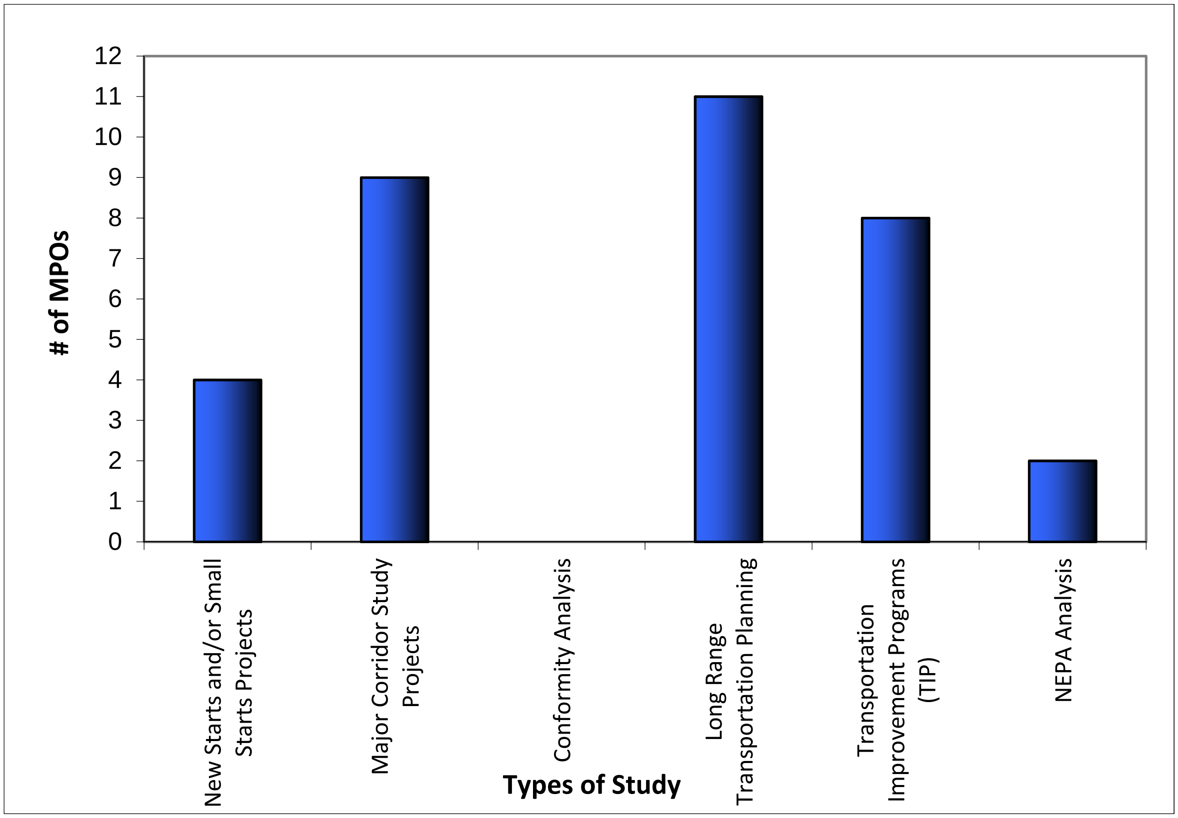


Figure 3: Application of TDM Tools.

The most common application of Travel Demand Models is for the development of the Long Range Transportation Plan followed by evaluating the Transportation Improvement Programs and major corridor studies. Two MPOs (Danville Area Transportation Study and Decatur Urbanized Area Transportation Study) utilized spreadsheet based trend analysis tools for traffic volumes projections instead of using typical four step travel modeling tools. Other applications of TDM in MPOs are New Starts projects and NEPA analysis.

Figure 4 shows types of TDM packages utilized by the surveyed MPOs. Among the twelve Metropolitan Planning Organizations in Illinois, CUBE and TransCAD are the most popular TDM software packages.

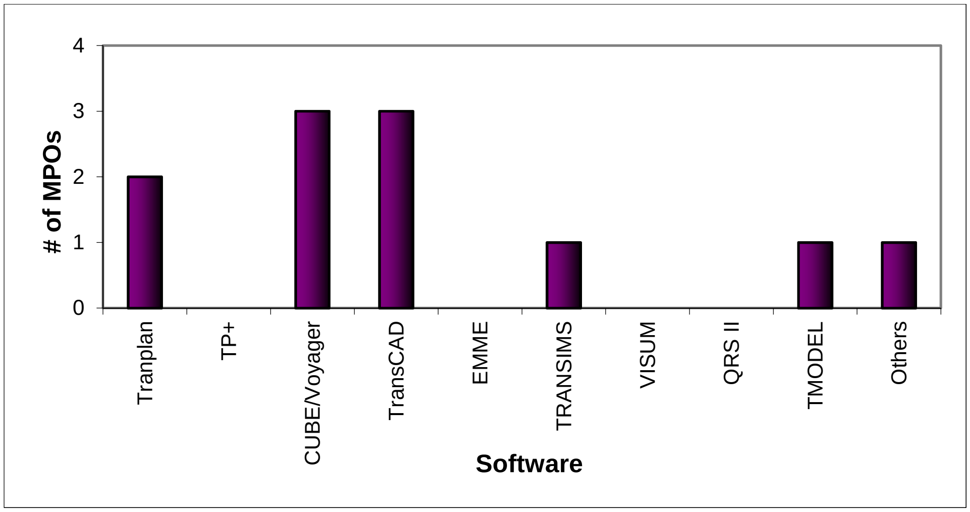


Figure 4. TDM Software Packages.

3.4 DETAILS OF TDM TOOLS

As can be seen in Table 2, all existing TDMs utilized by the MPOs surveyed are trip-based. Figure 5 shows the different components of these TDM packages. Figure 5 shows Trip Generation, Trip Distribution and Highway Assignment are the most important components of the TDM packages. The percentage of transit, bike, and walk trips are negligible for the majority of the MPOs surveyed. Thus, only two of the MPOs have Mode-Choice models in place as part of their TDM.

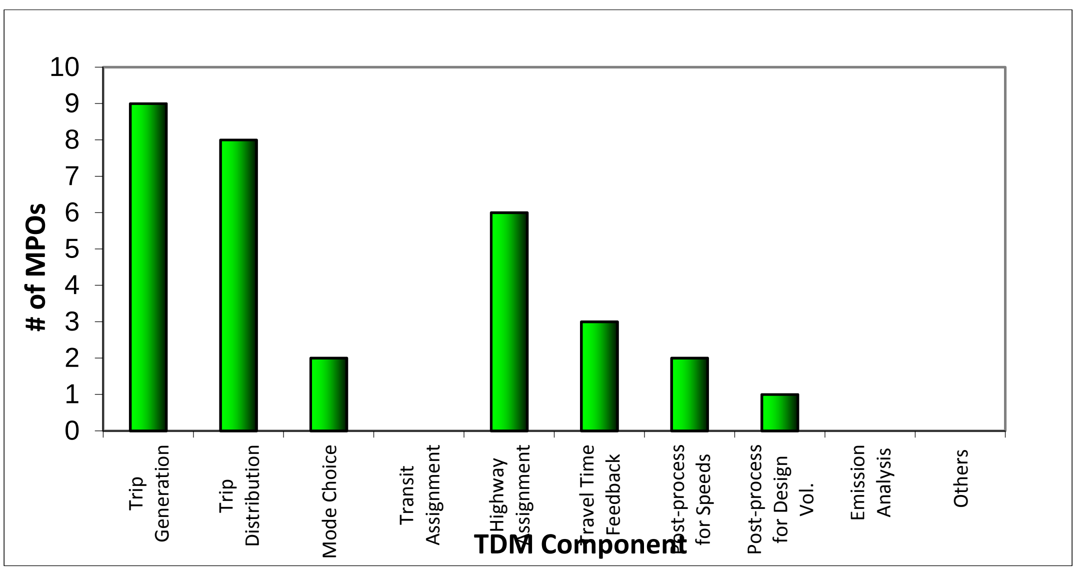


Figure 5. Components of TDM Packages.

Only the Champaign County Regional Planning Commission conducted a Household Travel Survey to use the survey results to define the parameters for the development of its TDM. In general, the other eleven small and medium sized MPOs in Illinois with TDMs utilize data from different national data sources. Figure 6 shows trip generation input data sources for the MPOs surveyed.

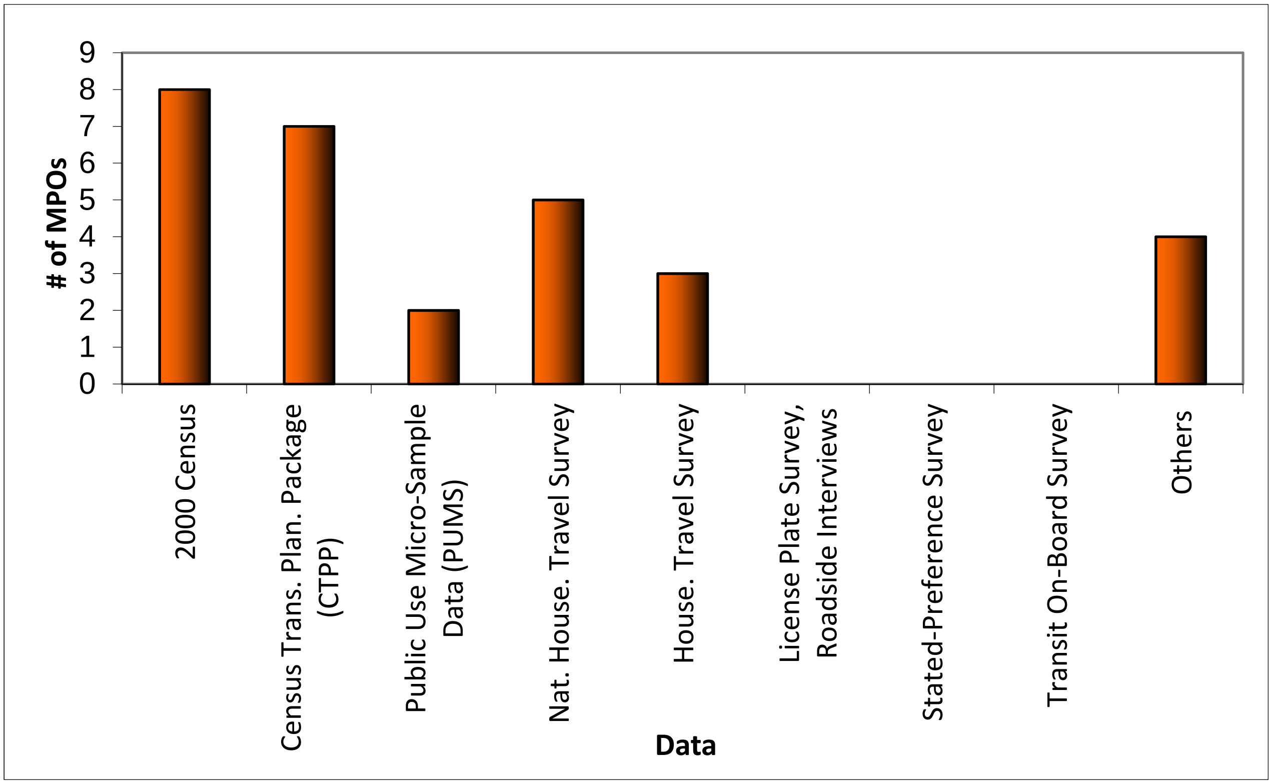


Figure 6. Trip Generation Data Sources.

Figure 7 shows in-house data availability for the MPOs surveyed. The majority of the MPOs maintain and update the socio-economic data (e.g., population, employment) in-house.

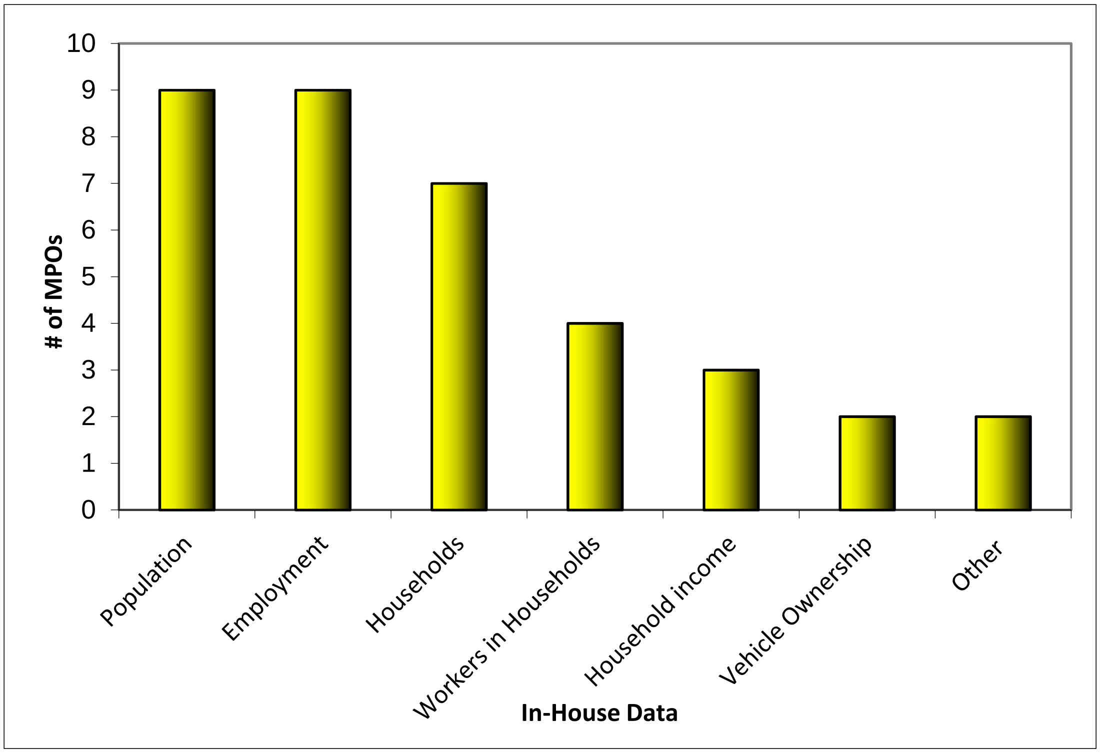


Figure 7. In-house data availability.

3.5 TRAVEL DEMAND MODEL VALIDATION

TDM validation is very important to ensure reliable traffic forecasts. Eight out of the twelve MPOs surveyed validated their travel demand models. Figure 8 shows base years of model validation for the surveyed MPOs.

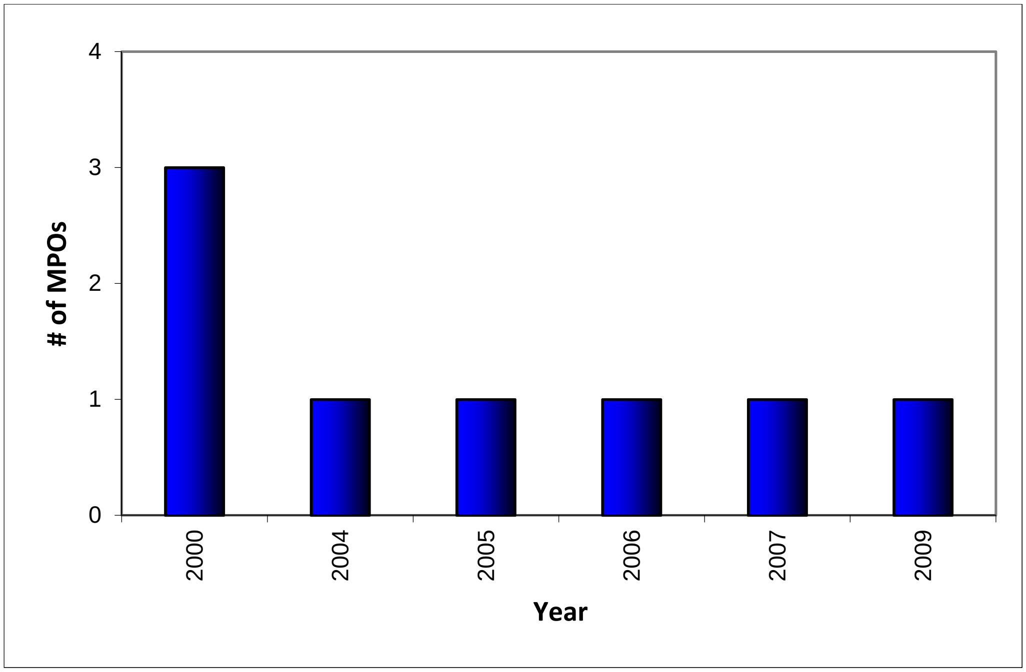


Figure 8. Base years for TDM validation.

Figure 9 shows the different data sources used for TDM validation by the MPOs surveyed. Only a few MPOs used local data for TDM validations.

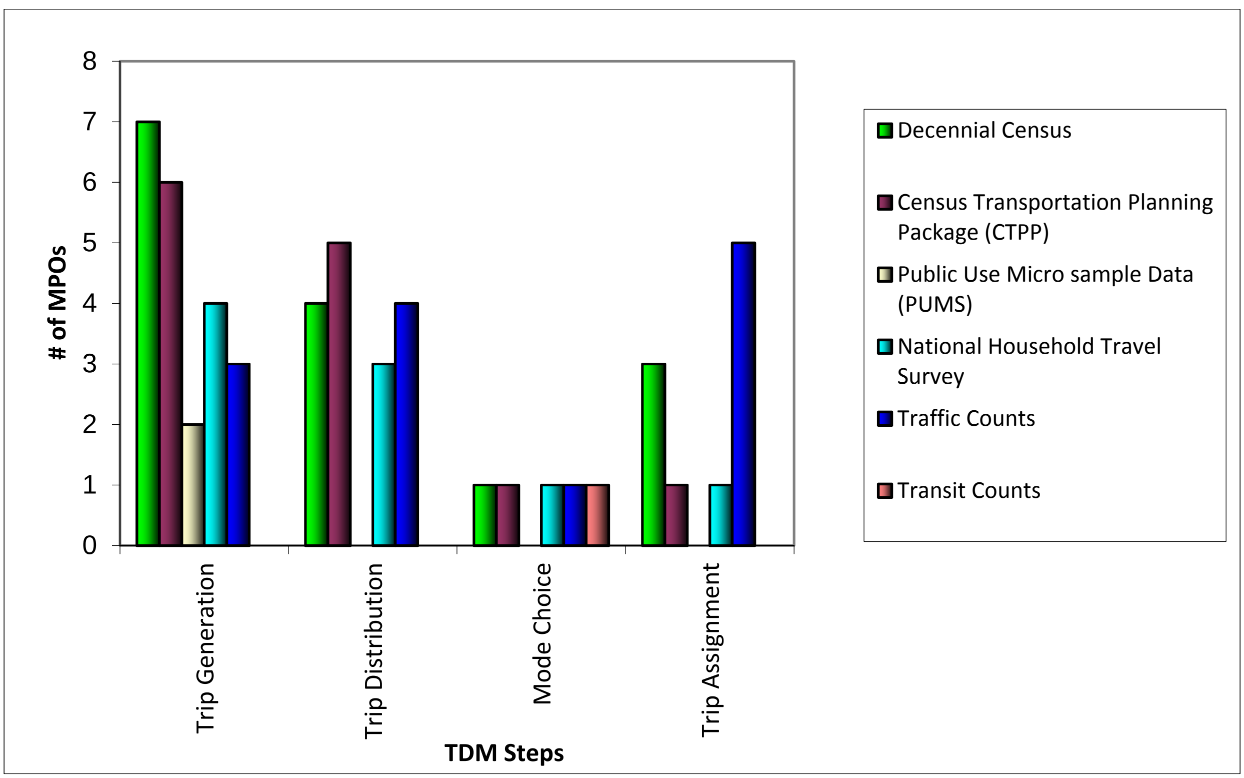


Figure 9. Data sources for TDM validation.

3.6 OTHER ISSUES

As part of the survey, many respondents cited issues such as lack of funding, lack of available expertise and general lack of resources as challenges to the implementation of travel demand modeling as part of the transportation planning process. For many MPOs' staff, there is a limited number of experienced staff (or none at all) dedicated to transportation planning. In some cases, growth is outpacing resources and MPOs cannot find the staff required to complete the work.

CHAPTER 4 FORMATION OF ILLINOIS MODELING USERS GROUP

The goal of forming the Illinois Model Users Group (MUG) was to create a forum for the small and medium sized MPOs currently utilizing or planning to utilize travel demand models in the future. A MUG can act as a forum to educate, inform, and improve travel demand modeling as part of the regional transportation planning process.

4.1 TRAVEL MODEL USERS GROUPS IN THE U.S.

Many state and regional planning agencies across the United States formed MUGs to benefit their travel forecasting process. MUG membership generally consists of staff from local, regional, and state agencies, in addition to members of academia and private consulting firms. The Travel Model Improvement Program (TMIP) of FHWA maintains a list of MUGs and their contact information. Details can be accessed through the TMIP's website http://tmip.fhwa.dot.gov. Table 3 shows a partial list of MUGs across the U.S. (FHWA 2011).

Table 3. Model Users Group Across the United States (Partial List) (FHWA 2011)

Group Name	State/Area
Atlanta Model Users Group	Atlanta, GA
California Central Coast Model Users Group	California Central Coast
Chicago Area Transportation Modeling Users Group	Chicago, IL
Colorado Model Users Group	Colorado
Kentucky Traffic Demand Model Users Group	Kentucky
Midwest Travel Model Users Group	Midwest (IA, IL, MO, NE, WI)
Mn/DOT Travel Demand Modeling Coordinating Committee	Minnesota
North Carolina State Model Users Group	North Carolina
Ohio Travel Demand Model Users Group	Ohio

4.2 ILLINOIS MODELING USERS GROUP

The Illinois Modeling Users Group (IL-MUG) was created in Fall 2009. The first meeting of the IL-MUG was held in Urbana on January 28, 2010. At the time that the group was created, all the MPOs in Illinois were invited to participate in the IL-MUG; however, only the small and medium sized MPOS in Illinois have actively participated in the five meetings held so far since the group's inception in January, 2010.

4.3 ORGANIZATION OF THE IL-MUG

The Illinois Modeling Users Group (IL-MUG) meets once every quarter. The IL-MUG meetings are facilitated/chaired by an IL-MUG member. Attendance at the IL-MUG meetings is open to people interested in transportation/land use modeling, including staff from local, regional, state and federal agencies, in addition to members of academia and consulting. No formal outreach is conducted, but participants are encouraged to inform others who may be interested in participating. The format of the meetings is informal. Sessions usually start with a couple of presentations from practitioners or developers. Presentations are followed by discussion and feedback.

4.4 PURPOSE AND GOALS OF THE IL-MUG

The purpose of the IL-MUG is to promote the exchange of ideas, tips/techniques and issues involving the use of travel demand models in Illinois as well as provide educational and informational materials on new technology, specific projects and other topics of interest to the transportation/land use modeling community and improve travel demand forecasting as part of the regional transportation planning process. The goals of the Illinois Modeling Users Group include:

- Serve as a forum to discuss TDM activities in Illinois.
- Meet once every quarter (four times in a year).
- Assist in the maintenance and enhancement of TDM procedures to promote consistent and reliable modeling practices in Illinois.
- Serve as an organized forum to share experience and expertise in the technical areas related to travel demand modeling in Illinois.
- Serve as a peer exchange platform to discuss modeling techniques and procedures.

4.5 POTENTIAL BENEFITS OF THE IL-MUG

The Illinois Modeling Users Group was created with the intention of providing the Illinois MPOs an opportunity to share with other MPOs, consultants, researchers, etc. modeling information to help develop or improve their local travel demand models. Some of the potential benefits that can be obtained from the IL-MUG's activities are the following:

- Technical assistance from local and state agencies with advanced TDM skills and resources for the MPOs to create and/or improve their travel demand models to fit their local needs.
- Reduced cost of model development, maintenance and improvement as the IL-MUG would facilitate pooling resources together for these activities.
- Facilitate peer reviews of MPO travel demand models with help from the FHWA and state planning agency staff. Peer reviews help overall improvement of travel modeling process.
- Promote advanced travel modeling practices successfully tested in other regions and applicable for its member MPOs.
- Consistency on procedures used by the MPOs when dealing with other agencies'/consultants' requests to use the MPO travel models. (Copies of the Digital Data License Agreements from different MPOs can be found in Appendix B).

CHAPTER 5 REVIEW OF EXISTING MODELING PROCESSES FOR SMALL AND MEDIUM SIZED MPOs IN ILLINOIS

As shown in Table 2, nine out of 12 small and medium sized MPOs in Illinois have travel demand models managed either in house or by consultants/state DOTs. All these TDMs are typical four-step trip-based models. Figure 10 shows the four-step travel demand modeling process.

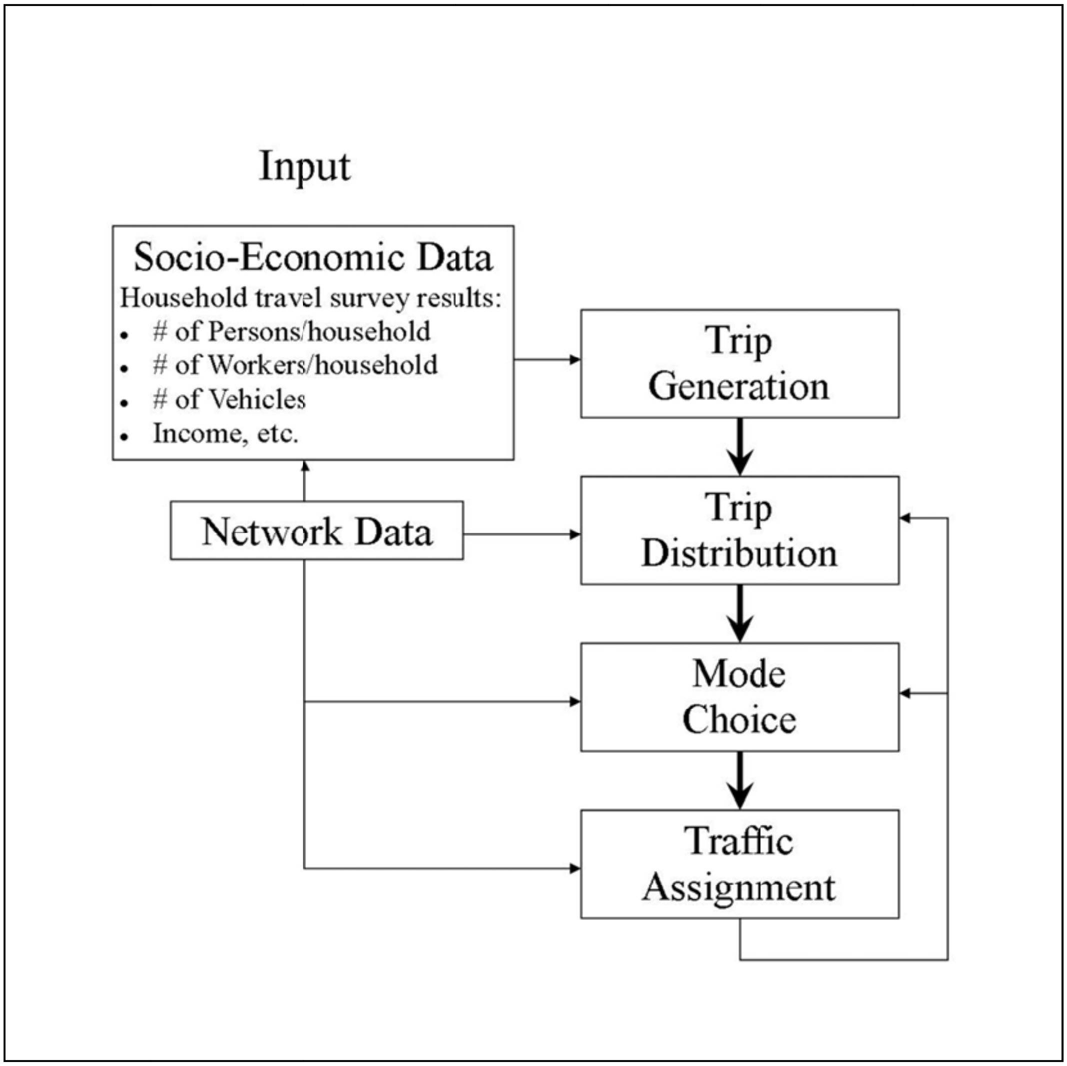


Figure 10. Four-step travel demand forecasting process.

This chapter describes the four-step travel forecasting process in detail and the approach adopted by each MPO in their TDM process.

5.1 MODEL NETWORK AND TRAFFIC ANALYSIS ZONES (TAZ)

The first step in travel demand modeling is to build a roadway network representing the existing street system of the study area. The model network consists of a system of links and nodes. The network links are straight lines representing roadway segments and the nodes represent the intersection of roadway links. Nodes are also used between intersections to change the shape of the roadway link to represent the existing street system. The links contain important roadway attributes including link distance, direction, facility type, number of lanes, lane width, area type, speed limit, capacity, and annual average daily traffic (AADT). Sources for roadway network coding and the link attributes include:

- Census Bureau TIGER files
- Local area GIS shape files
- Department of Transportation (DOT) GIS and roadway data
- Highway Capacity Manual
- NCHRP Reports 187 and 365
- Previous model and field data

Intersections with traffic signals can also be coded in the network by incorporating signal timing information and turning patterns in the network. Additional intersection control data helps in junction modeling where intersection capacity and delay can be estimated.
The model network is mainly comprised of freeways, arterials, collectors and selected regionally significant local roadways providing access to collectors. Freeways, arterials, and collectors in the study area are expected to carry the majority of the traffic. The transit network is coded separately if the transit routes are on bus-only streets or on local streets not coded in the regular highway network. Some of the transit network attributes include access links, access locations, headways, and maximum walk times.

The travel model area is divided into series of small geographic areas called traffic analysis zones (TAZs) to evaluate the traffic flow patterns in the region. The TAZs are characterized by their socio-economic (population and employment) and other factors and are the locations where trips begin (trip producers) and end (trip attractors). A TAZ is represented in the model by a centroid connected to the roadway network via centroid connectors. Typically, centroid connectors represent the local roads of the model network. The spatial extent of a TAZ is based on the U.S. Census block data and is adjusted depending on several factors, including land use information, political/jurisdictional boundaries, street network, and natural barriers. The size of the TAZ also depends on the density of the area and the nature of the model. Urban areas are expected to have smaller TAZs compared to rural areas.

External stations are identified along the intersection of Interstates and major state/county roadways and the model study area boundary to determine the amount of external travel in the model. Figure 11 shows the roadway network, TAZs, and external stations for the Champaign-Urbana Urbanized Area travel model.

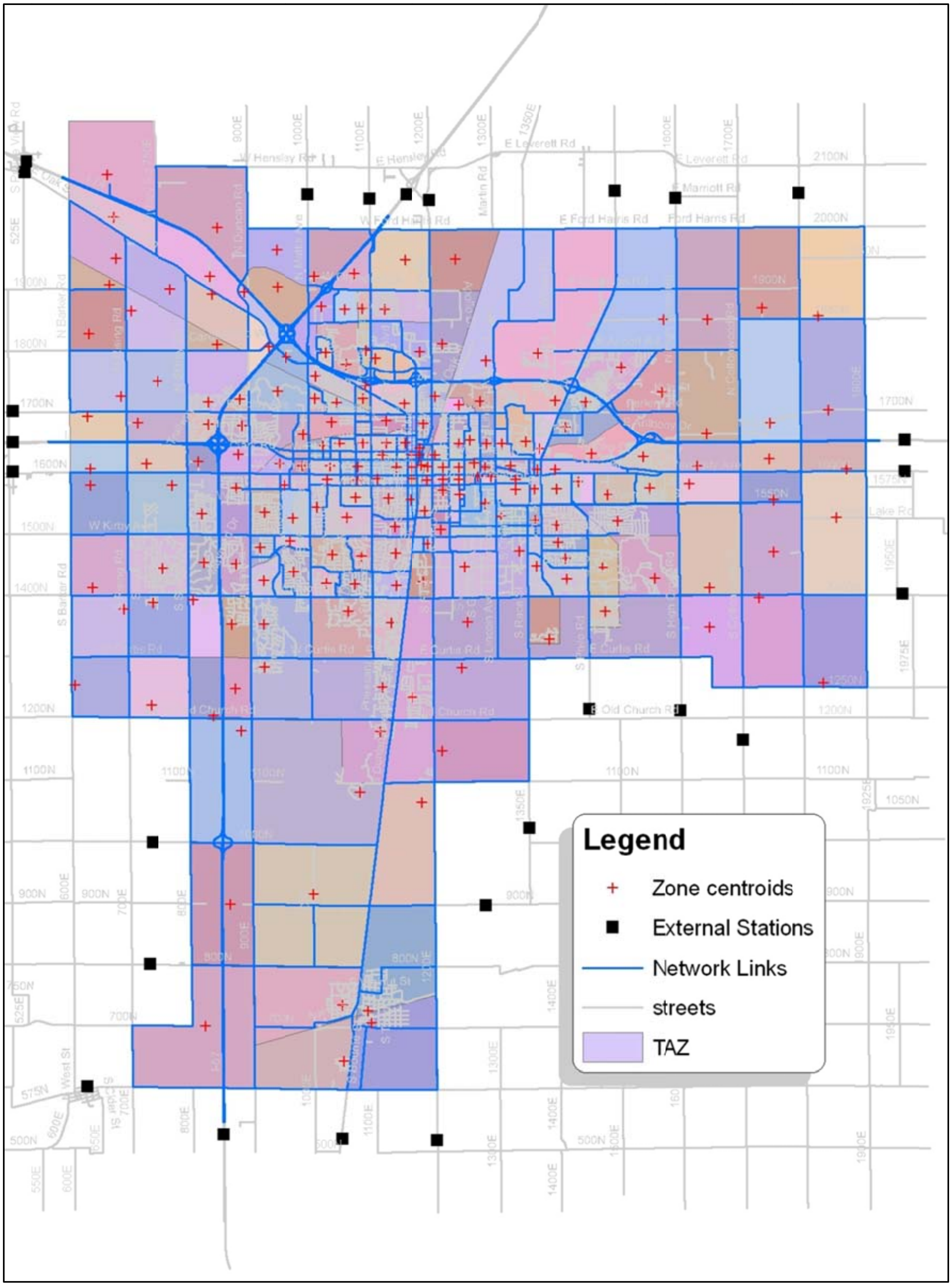


Figure 11. Roadway network, TAZs, and external stations of the Champaign-Urbana TDM.

5.1.1 Model Network and Link Attributes for the Illinois Small and Medium Sized MPO TDMs

Roadway networks for the Illinois small and medium sized MPOs with travel demand models were created from the existing local and state roadway GIS shape files and previous model networks. The link attributes information (including posted speed limit) for the majority of the Illinois MPO TDMs was obtained from the Illinois Department of Transportation (IDOT) and checked against local information. The Dubuque Metropolitan Area Transportation Study (DMATS) and Bi-State Regional Planning Commission models also utilized information from the Iowa Department of Transportation as they share jurisdiction with Iowa and Illinois. The Stateline Area Transportation Study model network is based on speed/capacity tables based on Wisconsin statewide information. Table 4 shows sources of model network inputs for the Illinois small and medium sized MPOs with TDMs.

Table 4. Model Network Input Data Sources

MPO	Model Network Attributes Source	Availability of Peak Hour Model	Availability of Junction/Intersection Data
DeKalb Sycamore Area Transportation Study	• Node and link files from Illinois DOT • Link capacity from Highway Capacity Manual 2000	No	No
Stateline Area Transportation Study	• Model network and attributes were obtained from the Wisconsin DOT	No	No
Dubuque Metropolitan Area Transportation Study	• Node and link files from Illinois and Iowa DOT • Link capacities from Highway Capacity Manual 2000	No	No
McLean County Regional Planning Commission	• Node and link attribute files from Illinois DOT (based on previous TRANPLAN model)	No	No
Champaign County Regional Planning Commission	• Node and link files from Illinois DOT • Link capacities from Highway Capacity Manual 2000 and local data	Yes	Yes

Table 4. Model Network Input Data Sources (Continued)

MPO	Model Network Attributes Source	Availability of Peak Hour Model	Availability of Junction/Intersection Data
Springfield Area Transportation Study	• Node and link files from Illinois DOT • Link attributes from the Southeast Michigan MPO TDM	Yes	No
Tri-County Regional Planning Commission	• Node and link files from Illinois DOT • Link attributes from the NCHRP Report 187	No	No
Rockford Metropolitan Agency for Planning	• Node and link files from Illinois DOT • Link capacities from Highway Capacity Manual 2000 and previous model data	Yes	Yes
Bi-State Regional Commission	• Node and link files from Illinois and Iowa DOT • Link speed/capacity information was obtained from Des Moines MPO in Iowa	No	No

As can be seen in Table 4, the Rockford Metropolitan Agency for Planning, Springfield Area Transportation Study, and Champaign County Regional Planning Commission travel models incorporate intersection signal information into the network nodes, to better estimate movement capacity and delay during the trip assignment process.

5.2 SOCIO-ECONOMIC DATA INPUTS

Another key input into travel demand modeling is the socio-economic data. The trips produced from and attracted to each Traffic Analysis Zone (TAZ) are related to the population, household and employment characteristics of the zone. Reliable input data helps reduce errors later in the travel demand modeling process and the subsequent validation/calibration effort. The household information includes the number of dwelling units, household size, household income, and auto ownership. The employment data input for the model includes employment by type (service, retail, other, etc.).

The U.S. Census data includes Census Transportation Planning Package (CTPP) and American Community Survey (ACS) data. Usually, the input data is refined based on local knowledge and in consultation with local governments and major employers in the region. The regional household and employment data is broken down to the TAZ level.

The accuracy of the model depends on the level of detail and reliability of the socio-economic input data. The socio-economic data for each TAZ is projected for future years based on historical trends, future land use maps, other factors affecting the change in population and employment in the region, and consultation with local agencies.

5.2.1 Socio-Economic Data Sources Utilized by Illinois Small and Medium Sized MPOs

Table 5 shows the data sources used for socio-economic inputs (for model base year) by Illinois small and medium sized MPOs travel models.

Table 5. Socio-Economic Input Data Sources

MPO	**Socio-Economic Data Sources**	
	Household/Population Data	**Employment Data**
DeKalb Sycamore Area Transportation Study	U.S. Census 2000	• DeKalb County Economic Development Corporation
Stateline Area Transportation Study	U.S. Census 2000	• Illinois Dept. of Employment Security • Wisconsin Dept. of Workforce Development
Dubuque Metropolitan Area Transportation Study	U.S. Census 2000	• Illinois Dept. of Employment Security • Iowa Dept. of Workforce Development
McLean County Regional Planning Commission	• U.S. Census 2000 • 2006 Special Census for Bloomington/Normal	• Tetrad Computer Applications Inc. • “Census Database, Business Facts”, Claritas, Inc.
Champaign County Regional Planning Commission	U.S. Census 2000	• Illinois Dept. of Employment Security • 2005 Zip Code Business Patterns • Champaign County Chamber of Commerce • University of Illinois
Springfield Area Transportation Study	U.S. Census 2000	• Illinois Dept. of Employment Security • Longitudinal Employer Household Dynamics • Dunn and Bradstreet Employment Data • US Bureau of Labor Statistics

Table 5. Socio-Economic Input Data Sources (Continued)

MPO	Socio-Economic Data Sources	
	Household/Population Data	**Employment Data**
Tri-County Regional Planning Commission	U.S. Census 2000	• Harris Data • Economic Development Council for Central Illinois
Rockford Metropolitan Agency for Planning	U.S. Census 2000	• Illinois Dept. of Employment Security • Wisconsin Dept. of Workforce Development • Local Chamber of Commerce employment data • US Bureau of Economic Analysis • US Bureau of Labor Statistics
Bi-State Regional Commission	U.S. Census 2000	• Illinois Dept. of Employment Security • Iowa Dept. of Workforce Development • Local School Districts

The socio-economic forecasts for the travel model horizon year are very important and need to be estimated based on reliable sources. The *DeKalb Sycamore Area Transportation Study's* horizon year socio-economic forecasts are based on community land use plans, past development patterns, consultation with community representatives, and MPO staff. Household information for the 2030 forecast year was estimated using the "person per household ratios" obtained from year 2000 U.S Census Bureau data. The area's labor participation rate was used to forecast the 2030 employment data.

The socio-economic forecasts for *Stateline Area Transportation Study* area were developed as part of the Rockford Metropolitan Agency for Planning travel model forecasts. The *Rockford Metropolitan Agency* for Planning forecasts for year 2025 were increased by a constant of 6% for all TAZs in the Stateline Area Transportation Study travel model to derive the socio-economic forecasts for year 2035.

The horizon year socio-economic data for the *Dubuque Metropolitan Area Transportation Study* and *Bi-State Regional Commission* travel models were forecasted based on the historical trends, future land use, and additional input from community planners, public officials and study area residents.

The socio-economic data forecasts for the *McLean County Regional Planning Commission* travel model were derived from the Woods and Poole forecasts.
The *Champaign County Regional Planning Commission's* TDM forecasts for the horizon year 2035 were estimated in-house based on local land-use knowledge, consultation with other local agencies, future land-use and economic development plans.

The population and employment data for the *Springfield Area Transportation Study's* travel model horizon year 2035 was estimated based on historic trends and local knowledge of the region. The Springfield Area Transportation Study utilized existing ratio of jobs/housing to forecast future employment data for year 2035.

The *Rockford Metropolitan Agency for Planning (RMAP)* utilized five separate methods for population projections for the horizon year 2040. These methods include:

- Projections based on RMAP transportation planning study (using local agencies' land-use plans)
- Woods and Pools National Database
- Historical trends of persons per occupied dwelling units
- Census 2000 persons per total number of dwelling unit ratio
- Historical trend line based on population and dwelling unit totals from 1960 to 2000

Employment projections for the horizon year 2040 in the RMAP travel model were based on future land use estimations.

The Land Use Evolution and Impact Assessment Model (LEAM) was utilized by the *Tri-County Regional Planning Commission*'s travel model to forecast the socio-economic data for future analysis years.

5.3 TRIP GENERATION

The trip generation step of the travel demand forecasting process estimates the trips produced/attracted to and from each TAZ in the model. The trip attraction and production for the model TAZs are related to the land-use characteristics and socio-economic data for each zone. The model trips are estimated separately as productions and attractions and are typically stratified into three trip purposes: Home Based Work (HBW), Home Based Other (HBO), and Non Home Based (NHB). The model trips can also be divided into additional trip purposes (e.g., Home-Based Shopping (HBShop), Home-Based-School (HBSc)) to better predict the travel patterns in the region.

The trip production can be estimated using regression equations or cross-classification rates. The disaggregate cross-classification models are known to have advantages over regression models to predict trips based on the non-linear nature of the variables and are more commonly used for trip production estimation. Trip production models use household size and an income variable (household income or auto ownership) as independent variables. Due to the limitations in the availability of detailed employment information, the trip attractions are commonly estimated by statistical regression using TAZ level aggregated data. The inputs required for trip attractions are employment by type (retail, service, other) and the number of households.

Certain facilities in the region may have very different travel characteristics than those represented by the model trip generation rates/equations. Usually, those land uses/establishments are considered to be a separate TAZ and treated as special generators when developing the travel demand model. Common special generators include universities, airports, hospitals, adventure parks, military bases, and in some cases regional shopping centers. Special generators are introduced in the model to closely replicate the travel in the region, using trip attraction rates/equations different than the model defaults. In most models only the trip attractions are added for special generators. Those trip rates can be derived from the Institute of Transportation Engineers (ITE) Trip Generation Handbook or based on experience/ local surveys.

Even though the use of special generators is recommended in the travel demand modeling process to replicate regional travel, its implementation should be restricted as much as possible. A report from the Transportation Research Center at the University of Florida on "Trip Generation Characteristics of Special Generators" (2010) noted that the travel modelers should not be encouraged to adopt the "Special Generators" as the presence of special generators may affect the transferability and generality of the model.

The model trips are generally categorized into Internal-Internal (I-I) trips, Internal-External (I-E)/External-Internal (E-I) trips, and External-External (E-E) trips. The trip with both its origination and destination inside the modeling area is an I-I trip. The trip having one trip end outside the model area and the other trip end inside the model is an I-E or an E-I trip. The trip with both trip ends outside the model study area is defined as an E-E trip. External stations are identified along the periphery of the model study area to determine the amount of external travel entering the modeling area. The point of intersection of Interstates and major state/county roadways and the model study area boundary are designated as external stations. The estimation of I-E, E-I and E-E trips are based on traffic counts at the external stations and external travel surveys or cordon surveys. The external trips can also be estimated using the procedure outlines in the NCHRP Report 365 or based on model information from similar regions.

The trip productions or attractions are balanced by purpose to match the regional control totals, which are usually trip productions due to the reliability of the household data. In cases where detailed employment information is available, trip attractions can also be used as control totals. It is important to note that the internal-external (I-E) trips are included in the regional total production and attraction balancing process. The external production and attraction trips are based on the traffic counts and are not altered during the balancing process. The difference in trips is balanced across the internal-internal (I-I) trips. The NHB productions are replaced with NHB attractions after the balancing process.

5.3.1 Trip Generation Models Used by Small and Medium Sized MPOs in Illinois

Table 6 shows the data sources used for trip production and trip attraction models as well as the model trip stratification for each small and medium sized MPO model in Illinois.

Table 6. Data Sources for Trip Generation Model

Name of the MPO	Trip Production Model Source	Trip Attraction Model Source	Model Trip Purposes
DeKalb Sycamore Area Transportation Study	NCHRP Report 365	NCHRP Report 365	HBW, HBO,NHB
Stateline Area Transportation Study	2001 National Household Travel Survey (NHTS) add-on	Employment & Wage (ES-202) data	HBW, HBShop, HBSc, HBO,NHB
Dubuque Metropolitan Area Transportation Study	Des Moines 2001 National Household Travel Survey (NHTS) add-on	Des Moines 2001 National Household Travel Survey (NHTS) add-on	HBW, HBO, NHB, CV*
McLean County Regional Planning Commission	NCHRP Report 365	NCHRP Report 365	HBW, HBShop, HBSR**, HBO, NHB
Champaign County Regional Planning Commission	Champaign Urbana Household Travel Survey 2002	NCHRP Report 365	HBW, HBSc, HBShop, HBO, NHB
Springfield Area Transportation Study	Based on models from similar regions	Based on models from similar regions	HBW, HBShop, HBO, WBO†, OBO††
Tri-County Regional Planning Commission	NCHRP Report 365, ITE Trip Generation Handbook	NCHRP Report 365	HBW, HBO, NHB
Rockford Metropolitan Agency for Planning	NCHRP Report 365, ITE Trip Generation Handbook	NCHRP Report 365, ITE Trip Generation Handbook	HBW, HBO, NHB, CV*
Bi-State Regional Commission	Des Moines 2001 National Household Travel Survey (NHTS) add-on	Des Moines 2001 National Household Travel Survey (NHTS) add-on	HBW, HBO,NHB, CV*

*CV = Commercial Vehicles; **HBSR = Home Based Social/Recreation; †WBO= Work Based Other;††OBO =Other Based Other

5.4 TRIP DISTRIBUTION

The trip distribution process determines interaction of each zone with all other zones in the model. The input for trip distribution is the balanced zonal productions and attractions from the trip generation step. The most commonly used trip distribution model is the Gravity Model, which is based on Newton's Law of Gravity. In the gravity trip distribution model, the number of trips produced from a zone depends on the magnitude of activities at the destination zone and the spatial separation between the two zones. Other trip distribution models include Destination Choice Models and Intervening Opportunities Model. All the MPOs surveyed as part of this project use the Gravity Model for their trip distribution process. The following equation describes the trip distribution equation:

$$T_{ij} = P_i * \frac{A_j F_{ij} K_{ij}}{\sum_{j=1}^{n} (A_j F_{ij} K_{ij})}$$

Where,

T_{ij} = Number of trips from zone i to zone j
P_i = Number of trip productions in zone i
A_j = Number of trip attractions in zone j
F_{ij} = Friction factor relating to spatial separation between zone i to zone j
K_{ij} = Trip distribution adjustment factor between zone i to zone j

The travel or highway impedance matrix is an input into the trip distribution process. Travel impedance is used to calculate the shortest travel time (path of least resistance) between a zone pair considering various highway impedances (cost, time, distance). Friction factor is a measure of impedance or unwillingness of persons to make a trip based on distance between zones. It is used to enhance the Gravity Model by regulating the trip lengths and trip length frequency distribution for each trip purpose. Friction factors are inversely proportional to the spatial separation of the traffic analysis zones, and can be developed using a household travel study, mathematical function (gamma function), previous models, and model information for other regions with similar characteristics. Adjusting friction factors to reflect the trip patterns in the region is a common validation process. Other highway impedances can also be added to the network based on the characteristics of the region, for example representing toll facilities via value of time equivalents. K-factors can be used to change the attractiveness of trips between two zones. K-factors are used when adjustments are made to the model estimates due to a physical barrier, varied demographics in the region or distinct socio-economic characteristics.

Intra-zonal travel times are calculated for trips traveling within the zone and included in the travel impedance matrix. Even though the intra-zonal trips are not on the model roadway network during the trip assignment process, these trips can be used to determine the amount of internalization (walk and bi-cycling within the zone). Terminal time, which represents the amount of time required to walk to a transit station, parked cars, etc. is also added to each trip end depending on the area type. Turn penalties can be added to the network links to restrict movement or add additional time impedance.

The initial travel time matrix for the distribution process is calculated using the free-flow speed. The free-flow speed (generally the posted speed limit) is not influenced by congestion. An iterative feedback loop is used in the modeling process to determine congested speeds to develop congested trip tables for use in the distribution process. In the process, the initial free flow trip tables are used to assign the trips on the network, and the resultant (congested) travel times are reused in the trip distribution process. The iteration is continued until there is minimal difference in the travel time matrix.

5.4.1 Trip Distribution and Travel Impedance Methods Utilized by Illinois Small and Medium Sized MPOs

All the Illinois small and medium sized MPOs with travel models utilized the "Gravity Model" in the trip distribution step. However, different methods were followed for friction factor calculations.

The *Stateline Area Transportation Study* used the NCHRP Report 365 friction factors values as a starting point and adjusted the values by trip purposes to match trip length distributions observed in the regional National Household Travel Survey (NHTS) data.

The *Dubuque Metropolitan Area Transportation Study* and the *Bi-State Regional Commission* used gamma function to develop friction factors. Gamma function formula[5]:

$$F = A \times t^{b} \times e^{ct}$$

Where,
F = Friction factor;
t = Travel impedance (usually time in minutes)
a, b, c = Model parameters
e = Base of natural logarithms

The McLean County Regional Planning Commission's travel model friction factors were obtained from the previous TRANPLAN model for the area. Additional reasonableness check was performed using Census Journey to Work data and by comparing trip length frequency distributions to other regions.

Friction factors used in the Champaign County Regional Planning Commission travel model were developed based on the local origin-destination travel data from the Champaign-Urbana household travel survey. Also, it is important to mention that the Champaign County Regional Planning Commission travel demand model uses composite travel impedance as part of the trip distribution processes, incorporating cost, time, and distance as the measure of impedance.

Friction factors for the Springfield Area Transportation Study travel model were developed using the gamma function and calibrated using the U.S. Census Journey to Work travel time data and trip length distributions for each trip purpose.

The Tri-County Regional Planning Commission model friction factors were developed using the NCHRP Report 365 look up table and adjusted using the consultant's experience with developing travel demand models for regions with similar population, demographics, and geographic boundaries.

The Rockford Metropolitan Agency for Planning travel model accounts for the delay at toll plazas by translating the cost of tolling into time delay using an average value of time of twenty dollars per hour.

The Stateline Area Transportation Study, Dubuque Metropolitan Area Transportation Study, Champaign County Regional Planning Commission, Springfield Area Transportation Study, Tri-County Regional Planning Commission and Bi-State Regional Commission travel models use iterative feedback loops between the trip distribution and traffic assignment steps for congested travel times.

5.5 MODE CHOICE

The mode choice step estimates the model trips separated by the competing modes of travel available in the region. It splits the production attraction (P/A) matrix from the trip distribution stage into separate matrices for each travel mode. The majority of the small and medium-sized MPOs with travel models in Illinois do not include the mode choice step into their models due to the limited transit mode share in their regions. The mode choice step is commonly estimated using logit models: multinomial logit, incremental logit, and nested logit models. The logit model is a mathematical formulation which estimates the probability of choosing a specific mode based on attributes such as cost and level of service.

After the mode choice split, the production/attraction (person trip) matrices are converted into a vehicular origination-destination (O/D) matrix using auto occupancy factors for each trip purpose. The vehicle trip models are not factored.

Also, as shown in Table 4, the majority of the small and medium sized MPO travel models do not project peak hour traffic assignments. The daily traffic assignment is not sensitive to identify the peak hour congestion in the model region. For small communities with little or no congestion, daily traffic projection may be acceptable. However, for communities experiencing reasonable congestion during certain times of the day, projecting hourly traffic assignment is recommended. The hourly projections are also utilized for air quality/emission analysis, pricing strategies and input into design projects. The hourly traffic can be derived by converting the daily vehicle trip tables into peak hour/ hourly trip tables. This can be done by simply proportioning the daily trips based on the observed hourly traffic count data or by using time-of-day factors for each trip purpose. The time-of-day factors can be derived from local household surveys or obtained from general sources such as the NCHRP Report 365.

5.5.1 Mode Choice Methods and Auto Occupancy Factors Utilized by Illinois Small and Medium Sized MPOs

As shown in Figure 5, only two MPOs out of the twelve small and medium sized MPOs surveyed utilized the mode choice step in their travel modeling process. Both of these MPOs, the *Champaign County Regional Planning Commission* and *Springfield Area Transportation Study* used mode split curves to obtain the percentage of transit trips based on the ratio of the transit impedance to the highway impedance. Transit trip percentage for the base year in the Champaign County Regional Planning Commission's travel model was estimated to be 6% based on the U.S. Census data and the Champaign-Urbana household travel survey data.

Person trip tables are converted into vehicle trip tables before the traffic assignment step. Table 7 shows the sources of auto occupancy factors, which are used to convert person trips into auto trips.

Table 7. Auto Occupancy Factor Sources

MPO	Auto Occupancy Factor Source
DeKalb Sycamore Area Transportation Study	NCHRP Report 365
Stateline Area Transportation Study	2001 NHTS add-on
McLean County Regional Planning Commission	Consultant
Champaign County Regional Planning Commission	Champaign Urbana Household Travel Survey
Springfield Area Transportation Study	CTPP commute data, other similar area models
Tri-County Regional Planning Commission	ITE trip generation rates

5.6 TRAFFIC ASSIGNMENT

Traffic assignment is the final step of the four-step travel demand modeling process which allocates the highway and transit trips onto the model network. Auto and transit trips are usually assigned in separate networks. The heavy vehicles are also assigned separately from the auto trips. Popular traffic assignment models include the *User Equilibrium* model, *Stochastic Equilibrium* model, and *Incremental Assignment* model. The traffic assignment models use a mathematical algorithm to assign trips onto the links between origination-destination zones commonly using capacity restraint assumption. The capacity restraint method allocates trips on the route having the shortest travel time, until the link capacity is reached and then assigns the rest of the trips to alternate routes between zones.

Another traffic assignment technique, *All or Nothing* method, assigns all trips between origination-destination zones to a single route, irrespective of available capacity. The Bureau of Public Roadway (BPR) curves are used to estimate the link travel time as a function of volume to capacity ratio. The BPR curves estimate the change in travel time with respect to change in the volume-to-capacity ratios on a highway link. The resultant model estimated volumes are compared with the base year observed counts to check the ability of the model to reflect the regional travel characteristics. Multiple iterations are performed to allow the travel times to be adjusted to reflect congestion delays.

5.6.1 Traffic Assignment Methodologies used by Illinois Small and Medium Sized MPOs

The *DeKalb Sycamore Area Transportation Study*, *Stateline Area Transportation Study*, *Champaign County Regional Planning Commission*, *Springfield Area Transportation Study*, and *Bi-State Regional Commission* models use the *User Equilibrium* model for traffic assignment. The User Equilibrium model is based on Wardrop's principle which considers equilibrium to be reached when no traveler can reduce the travel time below a specified value between two zones by switching to alternate path.

The *Dubuque Metropolitan Area Transportation Study* and *Tri-County Regional Planning Commission* models assign trips on the model networks using the *Stochastic User Equilibrium* model. The Stochastic Equilibrium model is similar to the User Equilibrium model, except in this method, the traveler has perfect knowledge about the condition of the roadway network and travel costs.

The *Rockford Metropolitan Agency for Planning* travel model utilizes *Incremental Assignment Technique* for the trip distribution process. In the Incremental Assignment technique, only a portion of the trips are assigned on the network at a time. In this assignment, a fraction of the O-D trips are first assigned onto the network. Given the travel times of the assigned trips, another fraction of trips are loaded onto the network. The procedure goes on until all trips are assigned. Moreover, the Rockford Metropolitan Agency for Planning travel model incorporates simultaneous distribution and assignment and Multi-Point Assignment technique in its PM peak model. The distribution and assignment feature allows the distribution to change as travel time increases between zones. Trips are redistributed to other zones depending on the network congestion and adjusted travel times. The multi-point assignment data allows trips to originate from driveways, parking lots, and other places in the zone instead of all trips originating from the centroids.

5.7 TRAVEL MODEL CALIBRATION AND VALIDATION

A travel demand model is not reliable for forecasting traffic, unless it is validated to closely duplicate the existing traffic patterns in the region. The validation process involves comparing the model output against the observed data. The calibration process involves adjusting the model parameters until the model results are comparable to the traffic characteristics in the study region. The Travel Model Validation and Reasonability Checking Manual[5] (2nd edition) defined calibration and validation as:

"Calibration is the adjustments of constants and other model parameters in estimated or asserted models in an effort to make the models replicate observed data for a base (calibration) year or otherwise produce more reasonable results. Model calibration is often incorrectly considered to be model validation."

"Validation is the application of the calibrated models and comparison of the results against observed data. Ideally observed data are data not used for the model estimation or calibration, but practically, this is not always feasible. Validation data may include additional data collected for the same year as the estimation or calibration of the model or data collected for an alternative year. Validation should also include sensitivity testing."

The calibration procedure is performed along with the validation and is an iterative process. The recommended validation and calibration process involves performing validation checks after each model forecasting step to avoid error propagation. Data sources for the validation process include household travel surveys, on-board transit surveys, other travel surveys, socio-economic data not used as model input, NCHRP Report 365 data, National Household Travel Survey (NHTS) data, 2000 Census data, base year traffic counts and data from other regions.

The Travel Model Validation and Reasonability Checking Manual (FHWA 2010b) specified five primary validation steps for a travel model (as described in Section 2.6 of the report). Table 8 shows the typical calibration and validation steps (checks) for travel demand model components/steps.

Table 8. Calibration and Validation Steps for TDM Steps/Components

Model Component/Steps	**Calibration and Validation Checks**
Model Network	• Network connectivity • Coded length vs. straight line length • Centroid and centroid connector location
Socio-Economic Data	• Regional/TAZ Socio-Economic Data • Population & Employment Density by TAZ
Trip Generation	• Trips per household by purpose • Trips per household by region • Trip rates by employment type • Productions vs. attractions
Trip Distribution	• Trip length by purpose • Trip length frequency distribution by purpose • Friction factor • Percent intrazonal trips
Mode Choice	• Estimated vs. observed boardings • Transit screenline/cutline checks
Traffic Assignment	• VMT by functional class and AADT • Traffic volumes by functional class and AADT • Screenline/cutline checks • Regression/correlation • Percent Root Mean Square Error (%RMSE)

5.7.1 Calibration and Validation Checks Performed by Illinois Small and Medium Sized MPOs

5.7.1.1 DeKalb-Sycamore Area Transportation Study

The DeKalb-Sycamore Area Transportation Study's travel model validation steps include screenline analysis and determining Coefficient of Determination, (R^2) between estimated and observed traffic volumes. The R^2 value based on comparison of observed traffic counts and model assigned traffic volumes showed was 0.8. However, the previous FHWA recommended R^2 value for a model network was greater than 0.88 (1997). Six screenlines were established to evaluate the general flow between different sub areas of the model and percentage deviations were less than 10% for all of them.

5.7.1.2 Stateline Area Transportation Study

The Stateline Area Transportation Study's travel model calibration and validation steps were completed using the Wisconsin Model Standard Guide as reference. The model validation steps include the following:

- Checking of trip generation rates with NHTS derived values
- Trip distribution validation for trip length by purpose and with the super-district to super-district movements as observed in the NHTS data
- Traffic assignment validation checks through screenlines/cutlines checks for the model base year

5.7.1.3 Dubuque Metropolitan Area Transportation Study

The Dubuque Metropolitan Area Transportation Study's travel model validation task includes validation checks for every modeling step. These include the following:

- Comparisons of trips per household by region and by purpose with other regions
- Comparing unbalanced production and attraction trips with the FHWA recommended range (10%)
- Comparing average trip lengths by purpose with the FHWA recommended ranges
- Comparing estimated and actual traffic volumes and Vehicle Miles Traveled (VMT) by functional classification with the FHWA guidelines
- Percent Root Mean Square calculations by roadway functional classification and Annual Average Daily Traffic (AADT)
- Screenline checks

5.7.1.4 McLean County Regional Planning Commission

The McLean County Regional Planning Commission's travel model was validated against observed data along with information from the past TRANPLAN model for the area for the base year (2005). The validation checks include the following:

- Aggregate trip generation rates and person trips by purpose calculations. However, the trip rates were not compared with other regions or with the National Household Travel Survey (NHTS) data.
- For the trip distribution step, average trip lengths by purpose and trip length frequency distribution were calculated. Home Based Work (HBW) trip average duration was not compared with the Census Transportation Planning Package (CTPP) data.

- Estimated and actual traffic volumes on the roadway network were compared based on roadway facility type and area type.
- Screenline checks were completed
- Percent Root Mean Square Error calculations for different groups based on AADT

5.7.1.5 Champaign County Regional Planning Commission

The Champaign County Regional Planning Commission's travel model was validated as per the guidelines set by the FHWA's "Model Validation and Reasonableness Checking Manual" published in February 1997. Output from every modeling step was validated using the FHWA guidelines and/or NHTS, and CTPP data. Major validation checks include the following:

- The model trip rates and percentages by purpose were compared against the NCHRP Report 365 rates for an urbanized area with a population between 50,000 to 199,999 and the 2001 NHTS data.
- Trip lengths and trip length frequency distribution obtained from the model distribution step were compared with the observed trip lengths from the household travel survey and from other sources (e.g., CTPP data).
- The model estimated and observed Vehicles Miles Traveled (VMT) values were compared as part of the traffic assignment validation.
- Model estimated link volumes were checked and compared with the observed ADT counts for the base year using % RMSE, coefficient of determination (R^2), screenlines, percent error region wide, percent error by facility type, percent error by volume class, and percent error for individual links.

5.7.1.6 Springfield Area Transportation Study

The Springfield Area Transportation Study's travel model was calibrated and validated at every level of four step modeling: trip generation, trip distribution, mode choice, and traffic assignment. The FHWA's "Model Validation and Reasonableness Checking Manual" published in February 1997 was used as the guideline during the model validation process. Estimated volumes for both traffic and transit links were compared with the observed data.

5.7.1.7 Tri-County Regional Planning Commission

The Tri-County Regional Planning Commission's travel model validation process primarily included validating the traffic assignment step. Screenline comparison checks were completed using twelve screenlines across the model region and as per the guidelines specified in the NCHRP Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design[10].

5.7.1.8 Rockford Metropolitan Agency for Planning

The Rockford Metropolitan Agency for Planning's travel model was validated using guidelines specified in the FHWA's "Model Validation and Reasonableness Checking Manual" published in February 1997**.** Major validation checks include:

- RMAP's travel demand model was calibrated by adjusting trip rates in the trip generation model and the trip rates were checked with the NCHRP Report 365 and compared with the rates from similar urbanized areas.
- Screenline/cutline comparisons for the traffic assignment step using the guidelines specified in the NCHRP Report 255.

- Percent Root Mean Square Error (%RMSE) calculations for each roadway functional classification in the model.
- Comparing model estimated Vehicle Miles Traveled (VMT) data with the observed VMT for the region.

5.7.1.9 Bi-State Regional Commission

Bi-State Regional Planning Commission's travel model was calibrated by adjusting trip rates in the trip generation model and the trip rates were checked with the national averages for the various trip purposes (source: NCHRP Report 365). Traffic assignment step validation checks include screenline/cutline analysis. Twenty seven screenlines and cutlines across the model region were used to compare estimated and observed traffic volumes for the base year 2000. For the model region, there was an 89% area wide fit and an average screenline/cutline fit of 105%.

CHAPTER 6 TRAVEL DEMAND MODELING NEEDS FOR SMALL AND MEDIUM SIZED MPOs AND AVAILABLE RESOURCES

The travel demand model is most commonly used to forecast traffic for Long Range Transportation Plans. Estimating future transportation needs for housing, land use changes, and infrastructure development using the travel demand model is important for successful transportation planning. It is essential for a travel demand model to be reliable to meet the federal requirements, including the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the Clean Air Act Amendments (CAAA), and the National Environmental Policy Act (NEPA). The travel forecasting results are also required for the Federal Transit Administration (FTA) New Start and Small Start projects. The wide range of applications for travel demand modeling include corridor studies, traffic impact studies, major investment studies, sub-area planning, land use changes, toll studies, interchange justification studies, and other transportation related studies. The model can be used to support infrastructure development in rural areas and help analyze economic development, traffic, and air quality impacts in urban areas. Even though travel demand modeling has a wide range of applications, the functionalities of forecasting models are limited depending on the model structure and its accuracy in replicating existing and projecting future traffic.

Small- and medium-sized communities face several challenges to develop and maintain a regional travel demand model, including lack of funds, availability of reliable socio-economic and travel data, and in-house technical expertise. Three small MPOs in Illinois: the Danville Area Transportation Study, the Decatur Urbanized Area Transportation Study, and the Kankakee Area Transportation Study currently do not have any TDM capabilities. Other small and medium sized MPOs in Illinois either employ travel demand models to justify their long-range planning decisions or use the model as an integral part of the transportation planning process.

Developing a travel model for a region requires a significant amount of time and resources. Therefore, utilizing modeling tools for all the possible transportation applications would be highly desirable. Table 9 shows the current TDM applications by the small and medium sized MPOs in Illinois in transportation planning projects.

This chapter focuses on travel demand modeling needs for Illinois small and medium sized MPOs and delineates specific travel model improvements for each of the MPOs to enhance their forecasting capabilities depending on their size, regional characteristics, and their needs.

Table 9. Current TDM Applications by the Small and Medium Sized MPOs in Illinois

Planning Projects	Illinois Small and Medium Sized MPOs								
	DeKalb MPO	Stateline MPO	Dubuque MPO	McLean MPO	Champaign MPO	Springfield MPO	Tri-County MPO	Rockford MPO	Bi-State MPO
New Starts and Small Starts (Transit)								X	
Major Corridor Studies	X		X	X	X	X	X	X	X
Long-Range Transportation Planning	X	X	X	X	X	X	X	X	X
Conformity Analysis									
Transportation Improvement Program	X	X	X	X	X	X	X	X	
NEPA Analysis	X								

6.1 DANVILLE AREA TRANSPORTATION STUDY, KANKAKEE AREA TRANSPORTATION STUDY, AND DECATUR URBANIZED AREA TRANSPORTATION STUDY

As specified in Table 2 of Chapter 3, three small MPOs in Illinois: the Danville Area Transportation Study, the Decatur Urbanized Area Transportation Study, and the Kankakee Area Transportation Study currently do not have any travel modeling capabilities. In addition to lack of funding, these three MPOs do not have staff expertise to develop, apply, and maintain a travel model. Usually, small and medium sized MPOs need to have one full time employee to help develop and maintain the travel demand model.
It is important for these three MPOs to have functional travel models as TDM capabilities would provide the following **major** benefits:

- Justifying the inclusion or exclusion of specific projects in the LRTP through evaluation of the efficacy of projects in fulfilling the LRTP goals and objectives.
- Prioritizing projects for inclusion in the Transportation Improvement Program (TIP).
- Evaluating traffic impacts of major land development/redevelopment in the region.

There are numerous other significant benefits of TDM capabilities. Considering the geographic extent, financial situation, staff availability, and needs of these three MPOs, the above mentioned would be the most direct benefits for them.

These three MPOs should develop simple trip based travel forecasting models using the guidelines provided in the NCHRP Report 365. The use of transferrable data from similar sized communities would considerably reduce the need for additional funding and staff resources needed to develop a travel demand model.

6.1.1 Danville Area Transportation Study (DATS)

The Danville Area Transportation Study currently utilizes a *Microsoft Excel®* based spreadsheet maintained by a consultant for forecasting employment and traffic volumes for transportation studies/projects including the LRTP. The following steps of trip based (four-step model) models are recommended for developing the DATS travel demand model:

- Trip Generation
- Trip Distribution
- Traffic Assignment

At present, the transit mode share for the Danville urban area is very low. Therefore, the short-term recommendation is to not incorporate the mode choice step of the four-step model for the proposed DATS TDM. Additional model functionalities which could be incorporated in the future to help improve the capabilities of the travel demand model include:

- Feedback loop
- Time-of-day factors
- Intersection capacity and control information
- Mode Choice step

6.1.2 Kankakee Area Transportation Study (KATS)

The Kankakee Area Transportation Study currently uses a consultant to develop traffic forecasts for its LRTP. A typical trip based (four-step) travel model is recommended for KATS. The model steps include:

- Trip Generation
- Trip Distribution
- Mode Choice
- Traffic Assignment

A mode choice step is recommended for the Kankakee MPO considering the importance that transit has recently gained in the region, which would also help the MPO to obtain funding for its transit system. Additional model functionalities which could be incorporated to help improve the capabilities of the travel demand model include:

- Feedback loop
- Freight/commercial vehicle model
- Time-of-day factors
- Intersection capacity and control information

6.1.3 Decatur Urbanized Area Transportation Study (DUATS)

The Decatur MPO has a Microsoft Disk Operating System (DOS) based version of a TRANPLAN travel demand model, running on Viper software. The MPO staff pointed out that the model is extremely cumbersome, outdated, and complicated to use. The MPO hired a consultant to perform traffic forecasting for the purpose of developing the Long Range Transportation Plan 2030 for the urbanized area. The TRANPLAN model was used in 2004 to evaluate future year transportation improvements proposed in the 2030 LRTP; however, it was not used in the development of the LRTP 2035, since it was determined that regional conditions had not changed to an extent which would warrant the expense of hiring a consultant to use the model for traffic forecasting purposes.

An important aspect of the DUATS traffic patterns is the presence of a significant number of truck traffic in Decatur's Central Business District (CBD). Plans are being formulated for alternative truck routes around Decatur's CBD. Staff at the Decatur MPO noted the need of a simple travel model which could be easily updated, calibrated, and validated. A consultant hired by the Decatur MPO performed travel surveys in 2004 which could be used in the development of the new travel demand model. The following trip based modeling steps are recommended for the development of the DUATS travel demand model:

- Trip Generation
- Trip Distribution
- Mode Choice
- Trip Assignment

Incorporating freight/commercial vehicle forecasting in the modeling process would help evaluating efficacy of the potential alternative truck routes around Decatur's CBD. Additional model functionalities which could be incorporated to help improve the travel demand model capabilities include:

- Feedback loop

- Time-of-day factors
- Intersection control and capacity information
- Freight/commercial vehicle model

6.2 DEKALB-SYCAMORE AREA TRANSPORTATION STUDY (DSATS)

The DeKalb-Sycamore Area Transportation Study (DSATS) is the designated MPO for the DeKalb Sycamore Urbanized Area, including the City of DeKalb, the City of Sycamore, the Town of Cortland, DeKalb County and Northern Illinois University.
The travel demand "Proto" model was developed for DSATS as part of the 2030 Long Range Transportation Plan. The model is referred to as a "sketch-up" model since it lacks vigorous validation checks. The model is based on TransCAD. The Dekalb Sycamore Area Transportation Study MPO is interested in developing an in-house travel model in the future. Currently, DSATS neither has any staff dedicated to work on travel demand modeling nor the expertise to develop a travel demand model. The Dekalb Sycamore MPO does not have specific funding allocated to travel demand modeling; instead, travel demand modeling tasks are completed when there is remaining funding available after completing other planning tasks. DSATS utilizes the traffic forecasts from the travel demand model for major corridor studies, to develop the Long Range Transportation Plan and the Transportation Improvement Program, and National Environmental Policy Act (NEPA) analysis.

The DSATS travel model is currently capable of projecting daily (24-hour) traffic volumes. The model does not have a mode choice component as well. One of the key objectives of the DeKalb-Sycamore urbanized area Long Range Transportation Plan was to support transit improvements and reduce pollutants and greenhouse gas emissions. The overall Vehicle Miles Traveled (VMT) in the region are projected to grow 95% between 2004 and 2035 based on current development trends. The DeKalb MPO is currently conducting a transit facility needs analysis study to evaluate existing transit operations and make recommendations on improving and/or expanding transit in the area. It is estimated that approximately 2 million students, staff, and residents of the City of DeKalb ride the Huskie transit line annually. TransVAC, a service provided by the Voluntary Action Center provides around 12,000 demand response rides per month. Based on transit rides statistics, it is recommended to use a mode choice step in the travel forecasting process to estimate the transit demand in the future and support transit planning and improvements in the region.

The City of DeKalb experiences heavy truck traffic due to the presence of several major truck traffic generators, including the distribution center for Goodyear (200-250 trucks/day), 3M (200-300 trucks/day), Nestle (150-250 trucks/day), and Target (700 trucks/day). The percent of truck traffic on DeKalb area roadways ranges from 5.2% to 17.6%. A freight/truck forecasting process is recommended to be included in the modeling process to analyze the impact of the truck traffic on the regional roadway network.

As mentioned in Chapter 5, DSATS travel model's calibration and validation steps mainly include traffic assignment step validation through screenline analysis and calculation of coefficient of determination (R^2) for the whole roadway network's estimated and observed traffic volumes.

Additional recommendations to improve the existing travel model include setting up an iterative loop between the trip distribution and traffic assignment step to allow using congested travel time in the trip distribution process to better represent actual vehicle travel time on the network. Also, inclusion of intersection capacity and control information would enable the junction modeling capability for the existing travel model.

Based on the above stated discussions, the following improvement steps are recommended for the DSATS travel model:

- Peak hour traffic assignment (peak hour model)

- Adding mode choice model
- Freight/commercial vehicle forecasting
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines
- Feedback loop
- Adding Intersection control and capacity information (junction modeling)

6.3 STATELINE AREA TRANSPORTATION STUDY (SLATS)

The Stateline Area Transportation Study (SLATS) provides transportation planning services for the Beloit Urbanized Area, in Wisconsin and Illinois. The planning area for the SLATS includes the City of Beloit, Town of Beloit, Town of Turtle, Rock County, City of South Beloit, Village of Rockton, Rockton Township, and Winnebago County. The Stateline Area Transportation Study travel demand model includes the Wisconsin portion of the study area and a small section of Winnebago County in Illinois. The remaining portion of Winnebago and Boone Counties in Illinois are included in the Rockford Metropolitan Agency for Planning (RMAP) travel demand model.

The Stateline Area Transportation Study travel demand model is a 24-hour person trip model developed on the Cube Voyager platform. SLATS does not have staff resources or expertise to maintain the existing travel demand model; therefore, the statewide consultant for Wisconsin, developed and maintains the SLATS model. The travel demand model is currently being used for the development of the region's Long Range Transportation Plan and Transportation Improvement Program.

The SLATS Long Range Transportation Plan 2035 recognizes the potential need to consider mass transit expansion. The Beloit Transit Development Plan (TDP) was developed in 2004, focusing on updating the 5-year Beloit Transit System plan, addressing general regional transit issues, evaluating existing routes and schedules, and exploring expansion options, alternative governing approaches, and financial opportunities. The Beloit TDP provided several proposals and recommendations for transit service improvements including route structure, marketing transit system, and regional organization. The ability to forecast transit trips using the mode choice step of the travel demand model can play an important role in the planning and improvement of the transit service.

The 24-hour model used by SLATS cannot estimate the peak hour volumes required to analyze congestion during specific periods of the day (AM and PM peak). Peak hour travel forecasting process should be incorporated in the model to address this issue. Also, intersection control and capacity information is recommended to be included in the model to better analyze congestion on the roadway network during the trip assignment process.

The following additional model components/functionalities are recommended to improve the Stateline Area Transportation Study travel demand model capabilities:

- Adding mode choice step
- Peak hour traffic assignment
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines
- Adding intersection control and capacity information (junction modeling)

6.4 DUBUQUE METROPOLITAN AREA TRANSPORTATION STUDY (DMATS)

The Dubuque Metropolitan Area Transportation Study is the metropolitan planning organization for the Dubuque urbanized area and Regional Planning Affiliation 8 (RPA) in

Iowa. The Dubuque Metropolitan Area Transportation Study also provides planning services to neighboring counties in Illinois and Wisconsin.

The Dubuque Metropolitan Area Transportation Study utilizes a 24-hour vehicle trip forecasting model developed using TransCAD. The Iowa DOT provides technical modeling support for the Dubuque MPO and also financially contributes to pay for the cost of the modeling software. Two part-time and one full time staff are available to work on the Dubuque travel demand model. The Dubuque travel demand model is used for corridor studies, traffic studies, the Long Range Transportation Plan and the Transportation Improvement Program.

According to historical growth rates, the number of vehicle trips in the Dubuque Metropolitan Area Transportation Study model area is expected to grow; thereby, steadily increasing demand for roadway capacity. Developing a suitable transit system in the area could help reduce the vehicle miles traveled (VMT) in the region and relieve roadway congestion. Transit services in the DMATS study area are provided by five agencies. Transit integration initiatives have taken place to promote efficiency in public services through integration and elimination of barriers. Several projects and recommendations are identified in the DMATS Long Range Transportation Plan to develop a transit system in the Dubuque metropolitan area. Therefore, incorporating a mode choice model in the travel demand model can help forecast future transit ridership in the region in order to make better informed planning decisions.

A person trip model is recommended for DMATS to evaluate the alternate modes of travel (e.g. transit) and non-motorized travel in the region. The person trip models are expected to provide more detailed and reliable forecasts and expand the scope of model applications, compared to the vehicle trip model. Estimating future hourly/peak hour travel is recommended to be incorporated into the model to help identify the peak hour congestion in the region. The intersection capacity and control information can be incorporated into the model (TransCAD), to account for intersection delay while assigning trips on the model network.

The following additional model components/functionalities are recommended for the DMATS model:

- Adding mode choice model
- Developing person trip model
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines
- Adding intersection capacity and control information (junction modeling)

6.5 MCLEAN COUNTY REGIONAL PLANNING COMMISSION (MCRPC)

The McLean County Regional Planning Commission is the designated MPO for the Bloomington-Normal metropolitan area. The MPO provides transportation planning services for the City of Bloomington, the Town of Normal, the Village of Downs, and the Village of Towanda.

The model was developed using Cube travel model software package for the East Side Highway Corridor Study. The travel demand model was developed by a consultant and is currently being maintained in-house. One full time staff is available to work on the McLean County Travel Demand Model. Recent projects involving major travel demand forecasting include the East Side Highway Corridor Study.

McLean County is the home of two universities, Illinois State University and Illinois Wesleyan University, which provide significant ridership for the local transit system. University campuses produce and attract a significant number of non-motorized trips. The McLean County RPC is actively involved in improving the regional transit system and has been implementing the recommendations provided in the Community Transit Demand Study performed in 2003. At the end of Fiscal Year 2006, annual transit ridership was 1,372,486 for fixed routes and 15,673 for para-transit. The McLean County LRTP aims to support measures that would make it practical for more people to use transit. It is recommended to include the mode choice step in the travel demand modeling process. The use of mode choice model helps determine the transit growth and potential routes based on several independent factors, including transit network, travel behavior, land use changes, and socio-economic inputs.

The MCRPC travel model is recommended to include a peak hour traffic assignment model into the travel model to derive the hourly traffic from the daily forecasts, for use in projects requiring peak hour analysis. An iterative feedback loop between the trip distribution and trip assignment steps is recommended to use congested travel time when distributing trips between zones. The intersection capacity and control information can be included in the model to better analyze the congestion on the urban roadway network. As discussed in Chapter 5, the MCRPC travel model should have additional validation checks for all the modeling steps. This would increase the model's forecasting credibility. The FHWA recommended guidelines for model validation should be followed.

The following additional model components/functionalities are recommended for the MCRPC model:

- Adding mode choice model
- Calibration and validation checks for every modeling step
- Incorporating an iterative feedback loop
- Adding peak hour model
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines
- Adding intersection capacity and control information (junction modeling)

6.6 CHAMPAIGN COUNTY REGIONAL PLANNING COMMISSION (CCRPC)

The Champaign County Regional Planning Commission (CCRPC) is the MPO responsible for providing transportation planning services for the Champaign-Urbana Urbanized Area which includes the cities of Champaign and Urbana and the villages of Savoy and Bondville.

The CCRPC travel demand model uses Cube software package for the person and auto trip model. A local household survey was performed in 2002 to analyze the travel characteristics of the region and help develop the travel demand model. One full time and one half time employees are on staff to work on the travel demand model. The CCRPC travel demand model is used for corridor studies, the Long Range Transportation Plan, Transportation Improvement Program, traffic impact analyses, future roadway structure analyses, and other transportation related studies. Recent projects utilizing the CCRPC travel demand model include the 2035 CUUATS Long Range Transportation Plan: Choices, the University Avenue Corridor Study, the Staley-Rising Corridor Study, the St. Mary's Road Corridor Study, and traffic impact evaluations of a proposed major roadway projects.

The Champaign-Urbana urbanized area is at the intersection of three interstate highways and several state and U.S. national routes. The industries in the urbanized area produce a significant amount of truck/commercial vehicle traffic on the regional network. The CCRPC Long Range Transportation Plan recognizes the need for a truck route system in the urbanized area to effectively manage the schedule and the infrastructure required for truck movement in the region and to mitigate truck freight congestion. A freight/commercial vehicle forecasting model is recommended for the CCRPC model to achieve these goals.

The Champaign-Urbana urbanized area is also the home of the University of Illinois flagship campus. The University of Illinois with more than 50,000 students, faculty, and staff exhibits unique travel characteristics. A significant amount of non-motorized trips are generated at the university campus. Due to the unique trip patterns of the university, it is recommended to be included as a special generator in the CCRPC travel model. The CCRPC travel demand modeling steps should be validated following the updated FHWA's TDM validation guidelines. The following additional model components/functionalities are recommended for the Champaign County RPC travel model:

- Adding the University of Illinois campus as a special generator
- Freight/Commercial vehicle model
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines

6.7 SPRINGFIELD AREA TRANSPORTATION STUDY (SATS)

The Springfield Area Transportation Study (SATS), which is part of the Springfield-Sangamon County Regional Planning Commission (SSCRPC), provides transportation planning services for the Springfield urbanized area.

The SATS travel demand model was developed using TransCAD travel model software package. Two full time employees are available on staff to work on the SATS travel demand model. The model is also updated by a consultant every five years. The SATS model utilizes the travel demand model for the development of the Long Range Transportation Plan, Transportation Improvement Program, railroad simulation model development, economic corridor/economic activity center study, future infrastructure developments, and other transportation planning efforts.

The intersection control and capacity information can be included in the model (TransCAD) to better estimate the capacity and the delay of the roadway network. The current mode choice model is based on mode split curves. In the future, a complete mode choice model with inclusion of non-motorized trips will be beneficial to evaluate future scenarios involving transit oriented developments. The following additional model components/functionalities are recommended for the SATS travel model:

- Adding a complete mode choice model with non-motorized trip assignment capability
- Adding intersection capacity and control information (junction modeling)
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines

6.8 TRI-COUNTY REGIONAL PLANNING COMMISSION (TCRPC)

The study area for the Tri-County RPC travel demand model includes Peoria, Tazewell, and Woodford Counties.

The 24-hour forecasting model was developed using Cube Voyager. The Tri-County RPC uses the Land Use Evolution and Impact Assessment Model (LEAM) to develop socio-economic forecasts for future analysis years. The Tri-County Regional Planning Commission has one full time staff assigned to work with the travel demand model. However, the model was developed by a consultant. The model applications to date include land use projections, corridor studies, origin and destination studies, traffic projections and distributions for use in traffic impact studies and intersection improvements, and sub area traffic studies. Recent projects involving travel demand forecasting include Pekin El Camino and Petri Lane corridor studies, sub area and corridor analysis in the Main Street traffic study, the Eastern Bypass corridor study, and the Orange Prairie/Pioneer Parkway extension studies.

The Greater Peoria Mass Transit District (GPMTD) operates public transportation in the Peoria-Pekin urbanized area under the name of CityLink. CityLink ridership has been and is expected to steadily increase due to planned improvement in the regional transit service, cost of personal transportation, and the general awareness in the community. The CityLink transit ridership for 2009 was more than 3 million riders. The Tri-County RPC Long Range Transportation Plan aims at increasing the regional transit ridership by at least 2% each year or 60,000 additional rides per year. This initiative will achieve another goal of the LRTP to reduce the vehicle miles traveled by 25% over the next 25 years at a rate of 1% each year. It is recommended to include a Mode Choice model as a component in the travel demand modeling process. The model helps determine the transit growth and potential routes based on several independent factors, including transit network, travel behavior, land use changes, and socio-economic inputs.

As discussed in Chapter 5, the Tri-County travel model validation checks primarily included screenline/cutline analysis after the Traffic Assignment step. The travel model should be updated through a complete calibration and validation checks using the FHWA guidelines for every model steps. These checks would increase the accuracy of model's forecasts.

The Tri-County travel model is a daily (24-hour) trip forecasting model. The TCRPC Long Range Transportation Plan notes that the potential for congestion is the greatest during morning and late afternoon due to work and school trips. Deriving hourly traffic as part of the forecasting process helps identify congested roadways during the study period. TCRPC should also consider using special generators in the travel demand model to represent the land use with unique trip characteristics in the region (e.g. Bradley University, Caterpillar). The Tri-County travel model should also incorporate a freight forecasting model considering significant existing industrial land-use and multiple interstate highways within its planning boundary. The following additional model components/functionalities are recommended for the Tri County travel model:

- Adding mode choice model
- Adding special generators in the model
- Freight/commercial vehicle forecast model
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines
- Peak hour model
- Adding intersection capacity and control information (junction modeling)

6.9 ROCKFORD METROPOLITAN AGENCY FOR PLANNING

The Rockford Metropolitan Agency for Planning (RMAP) modeling area includes Winnebago County, Boone County and the State Line Area Transportation Study (SLATS) remaining portion of the Beloit Urban Area in Wisconsin – Rock County.

The RMAP travel model employs a PM peak model using both TMODEL2 (TM2) and VISUM. RMAP recently converted from TMODEL2 to VISUM for the PM peak model. However, both models are used to development traffic projections for base year comparisons and interface with 24-hour and ADT traffic data from IDOT's website, RMAP's Congestion Management Analysis, other traffic data collected by several of the areas local unit of government/consultants and to develop projected year traffic. A consultant has been hired to help develop and maintain the model. RMAP has two full time staff member available to work on the travel demand model. The RMAP travel demand models are used for the Long Range Transportation Plan, Transportation Improvement Program, corridor studies, phase one Project Development Reports (PDR), and Intersection Design Studies (IDS). The RMAP travel model was merged with the CMAP model to use in the Alternative Analysis for the FTA New Start/Small Start project to evaluate possibility of extending Metro/Commuter Rail to the RMAP area.

The transit ridership for the Rockford region in 2004 was around 1.3 million (per year) trips by fixed routes and 100,331 trips for demand response. Additional residential development in the urban core, encouraged in the RMAP Long Range Transportation Plan, is expected to increase the regional transit ridership. Rockford Mass Transit District (RMTD) significantly restructured its fixed route service in 2003 and is looking into the feasibility of a bus transfer center on the east side of Rockford to improve transit service. A transit feasibility study recommended that Roscoe and Rockton join South Beloit to create a mass transit district. The transit ridership projection is important to plan and improve the regional transit system. The use of mode choice component in the travel model should be considered to evaluate transit patterns in the region and as a federal requirement for New Start/Small Start projects.

A person trip model is recommended for RMAP to evaluate the active modes of travel (e.g. walking, bicycling). The person trip model is expected to provide more detailed and reliable forecasts and expand the scope of model applications, compared to the vehicle trip model. The RMAP model is validated by comparing observed and model estimated VMT and traffic volumes along screen lines. Additional model validation checks for the trip generation, trip distribution, and mode choice steps as per the FHWA guidelines are recommended to increase reliability of the model's forecasting capabilities.

The following additional model components/functionalities are recommended for the RMAP travel model:

- Adding mode choice model
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA's TDM validation guidelines

6.10 BI-STATE REGIONAL COMMISSION (BSRC)

The Bi-State Regional Commission is the designated MPO providing transportation planning services for the greater Bi-State region of the Quad Cities in Iowa/Illinois. Henry, Mercer, Rock Island, and Whiteside Counties in Illinois and Muscatine and Scott Counties in Iowa are part of the MPO study area. The travel demand model for the Bi-State MPO includes the Iowa-Illinois Quad Cities area.

The Bi-State MPO uses TransCAD to forecast daily vehicular traffic in the study area, except the trip generation and trip distribution steps for which it uses a spreadsheet and Cube Base program, respectively. TransCAD software was selected in coordination with the Iowa DOT, which provides technical assistance and concession on the software license fee. Bi-State MPO has one full time staff working on the travel demand model. The Bi-State Regional Commission model is used for transportation plans, corridor studies, and congestion management studies. Recent projects involving major travel demand forecasting components include the Long Range Transportation Plan 2035 for the Quad City Area, IA/IL.

The use of a person trip model has several additional potential applications compared to a vehicle trip model, and is also essential to study transit and non-motorized trips in the region. The current vehicle trip model limits the applications of the model to study transit alternative in the region. Bi-State Regional Commission is in the process of developing a person trip model to replace the vehicle trip forecasting process.

The Bi-State Long Range Transportation Plan (LRTP) described the number of activities being undertaken by the local transit provider to improve and market transit ridership. A feasibility study is underway to study rapid transit corridors in the Quad Cities region, as a tool for regional economic development. The transit ridership for the Quad Cities area in 2004 was 3,798,369 unlinked trips. Using a yearly average increase of 2.2%, the transit ridership for the horizon year of 2035 is estimated to be 6.6 million trips. The mode choice step in the travel demand model can be used to better forecast the transit trips based on several factors, including transit network, travel behavior, land use changes, and socio-economic inputs.

The Bi-State Long Range Transportation Plan notes that typically 10 to 20 percent of the regional VMT take place during the peak hours. Considering that one of the Bi-State LRTP 2035 goals is to “promote efficient system management and operation,” a peak hour model will help achieve this goal through analyzing the congested areas and improving transportation system operations.

Intersection control and capacity information can be included in the model nodes to estimate the intersection movement capacity and delay, which will address the LRTP 2035 goal of “promoting efficient system management and operation.” Bi-State Regional Commission should also consider the using special generators in the travel demand model to better represent the trip characteristics of the region (e.g. university, hospitals).

The following additional model components/functionalities are recommended for the Bi-State model:

- Adding mode choice model
- Adding Peak hour model
- Adding Person trip model
- Calibration and validation steps for all the model input data and each of the travel model steps as per the guidelines specified in the updated FHWA’s TDM validation guidelines
- Adding intersection capacity and control information (junction modeling)

CHAPTER 7 RESOURCES NEEDED TO ACHIEVE THE REQUIRED FUNCTIONALITIES

This chapter discusses simpler methods and tools for developing a trip based travel model for small and medium sized MPOs in Illinois considering their limited available resources. It is important to note that every component of the travel demand model is dependent on quality input data. Therefore, considering the importance of accurate and reliable data and the limited financial resources available for small and medium sized MPOs to obtain this data, Table 10 summarizes the possible data sources that can be used for every step in the typical four-step travel modeling process.

Table 10. Trip-based Modeling Steps, Data Requirements and Sources

Model Steps and Data Requirements	Possible Data Sources
Model Network	• Census Bureau TIGER files • Local area GIS files • State DOT GIS shape files
Network Attributes • Number of lanes • Link distance and speed • Facility type/link capacity • Area type	• Highway Capacity Manual • NCHRP Report 365 • Previous model and field data • Data from similar regions • State DOT roadway inventory data
Traffic Analysis Zone	• U.S. Census Block data • Local land use GIS shape files • Aerial map of the region • Local GIS shape files of roadways and rail roads and natural and physical barriers
Socio-Economic Data • Population • Household Information ▪ By income group ▪ By household size ▪ By auto ownership	• U.S. Census data • Summary Tape Files3 • CTPP data • ACS data • NHTS data • Local assessor’s office

Table 10. Trip-based Modeling Steps, Data Requirements and Sources (continued)

Model Steps and Data Requirements	Possible Data Sources
Socio-Economic Data • Employment ▪ By retail ▪ By service ▪ By basic	• U.S. Department of Labor ES-202 File • State Department of Employment Security • Commercial database • Local Chamber of Commerce and/or Economic Development Organization
Trip Generation • Production and Attraction Rates • Special Generators	• NCHRP Report 365 • Local Household Travel Survey • NHTS data • Trip rates from similar regions • ITE Trip Generation rates • ITE Trip Generation Rates • Special Generator survey • Trip rates from similar generators from other travel models
Trip Distribution • Friction factors	• NCHRP Report 365 • Local household travel survey • Local Origin-Destination survey or from similar regions • NHTS data • Friction factors from similar regional models
Mode Choice • Transit network • Transit impedance ▪ Out-of-vehicle time ▪ In-vehicle time • Mode choice coefficients	• NCHRP Report 365 • Local transit district routes and timetable information • Transit on-board survey • NHTS • Transit parameters from similar regional models
Auto Occupancy Factors	• NCHRP Report 365 • Local household travel survey • NHTS data • Factors from similar regional models
Trip Assignment • Volume-delay function	• NCHRP Report 365 • Bureau of Public Roads (BPR)

Table 10. Trip-based Modeling Steps, Data Requirements and Sources (continued)

Model Steps and Data Requirements	**Possible Data Sources**
Calibration and Validation • Model network	• Field observations • Aerial maps
• Socio-economic data ▪ TAZ population and employment information	• Census journey to work data • NHTS data • Zip code business pattern data
• Trip Generation ▪ Total person trips per household per capita ▪ Total person trips by purpose	• NCHRP Report 365 • NHTS data • Trip rates from other similar regional models
• Trip Distribution ▪ Trip lengths by purpose ▪ Trip length frequency distribution	• CTPP data • Local household travel survey • NCHRP Report 365 • Parameters from other similar regional models
• Mode Choice ▪ Transit trips ▪ Mode Choice coefficients ▪ Transit impedances	• Transit ridership data • NCHRP Report 365 • Census journey to work data • Transit information from other similar regional modelS
• Trip Assignment ▪ Vehicle Miles Traveled ▪ Comparing projected and observed volumes by roadway functional class and AADT. %RMSE calculations. ▪ Screenline/cutline analysis	• FHWA Travel Model Validation and Reasonability Checking Manual 2nd Edition • Local traffic data • Highway Performance Monitoring System data • Information from similar regional travel models
• Recommended Guidelines	• State guidelines (if available) • FHWA Travel Model Validation and Reasonability Checking Manual 2nd Edition

7.1 SOFTWARE SELECTION

The selection of travel modeling software tools/package mainly depends on the following factors:

- Specific needs of the MPO
- Availability of funds

- Cost of acquiring software, support services, and training

Section 2.3 provided brief descriptions of travel modeling software packages currently commercially available in the market. The Illinois Modeling Users Group (IL-MUG) can help to select the most appropriate modeling package for a member of the group. Moreover, IL-MUG members could provide technical support for model development, periodic update, and maintenance. Utilizing modeling software being used by other small and medium sized MPOs in Illinois will assist in the peer review process and help with the potential integration of regional models into the statewide travel model in the future.

7.2 TRAVEL MODEL STUDY AREA BOUNDARY

The first step of the travel forecasting process is to identify the model study area. The study area for a MPO generally includes the urbanized area boundary and the surrounding area forecasted to be urbanized area in the next 20 years (Metropolitan Area Boundary). The model study area boundary is also referred to as the cordon line. The modeling area boundary information can be obtained from the regional Long Range Transportation Plan (LRTP). It should be noted that the urban and the urbanized area boundaries are expected to change based on the 2010 census data.

7.3 TRAFFIC ANALYSIS ZONE (TAZ) DELINEATION

The model study area is divided into smaller geographical areas called Traffic Analysis Zones (TAZs) to analyze the travel behavior in the region. The TAZ boundaries are determined based on census tract/block information, existing and future land uses, roadway network, and physical barriers. The decennial census data is the primary source for the household information used in model forecasting. Therefore, as far as possible the TAZ boundaries are developed to match the census tracts and census block groups. This helps in deriving the zonal household information with minimum data manipulation. The TAZs should preferably encompass homogenous land uses, all residential or all commercial, since the model cannot capture the intra-zonal travel. The TAZ boundaries are also restricted by arterial/major streets, since the regional models focus on forecasting traffic on major arterial and collector streets in the study area. The physical or topographical barriers such as large water bodies (e.g. rivers) and railroads also restrict the boundary of the TAZ. The TAZs for a regional model can be created using GIS by overlapping multiple layers of data such as aerial photographs, US census boundaries, street network, socio-economic data layers and local terrain.

The number of the TAZs in the model study area depends on the size of the model and the land use mix in the region. The dense urbanized area (CBD) of the model is expected to have smaller and a lot more TAZs compared to a rural area. To account for vehicular trips not originating within the study area, external stations are identified at the boundary of the model area. The external stations are at the point of intersection of major roadways with the cordon line. The report titled “A Recommended Approach to Delineating Traffic Analysis Zones in Florida”[9] prepared by Cambridge Systematics in association with AECOM for the Florida DOT, presents the best practices to define a model TAZ.

The centroid represents the point of trip origin or destination within a zone. The centroid should be placed at the center of activity in the TAZ and not at the geographical center. The centroid location can be determined based on the land use maps, aerial photographs and local knowledge of the region. Each centroid is connected to the roadway network using one or more centroid connectors. The length of the centroid connector (distance from the centroid to the roadway link), affects the number of trips loaded on each connector when multiple centroid connectors are used. Multiple centroid connectors are recommended to avoid abrupt traffic changes at one point on the street network.

7.4 TRAVEL MODEL NETWORK

The model network consists of links which represent the roadway segments and nodes representing the intersection of roadway links. The nodes are also used between intersections to change the shape of the roadway link to represent the existing street system. The major roads including the collectors, arterials, and freeways are coded into the model network. Local streets are rarely coded into the model network. The local streets in the model are usually simulated by the centroid connectors. The GIS software is commonly used to help develop the model network. All modeling software packages are integrated with the GIS software to readily import and edit the network shapefiles. The GIS software is also used in the later modeling stages to modify TAZ structure, manipulate the socio-economic data, maintain a database, and display the output assignment network.

The Illinois DOT GIS inventory provides the highway network shapefiles (updated 2009) for each county in the state, **http://www.dot.state.il.us/gist2/select.html**. The GIS shape files contain the regional roadway network along with link attributes including functional classification, mile post information, and speed category. The roadway network can be altered as required using the modeling software.

Another source for the regional roadway network is the Census Bureau's TIGER/Line GIS shapefiles. The Topologically Integrated Geographic Encoding and Referencing (TIGER) system files are digital database of geographic features, such as roads, railroads, rivers, lakes, legal boundaries, census statistical boundaries, etc. covering the entire United States. The TIGER/Line shapefiles include geographic entity codes that can be linked to the Census Bureau's demographic data. The TIGER/Line shapefiles can be accessed from the following location: **http://www.census.gov/geo/www/tiger/** . The 2010 TIGER/Line shapefiles are supposed to be released on a rolling basis since November 30, 2010. The following link provides information on working with the TIGER/Line files: **http://www.census.gov/geo/www/tiger/wwtl/wwtl.html** . Other local city and county GIS files and field information can also be used to develop the travel demand model network. The roadway link attributes are required in the model for trip distribution (travel impedance) and the trip assignment (capacity) process. The important network link attributes include link distance, link speed, and capacity. Other network link attributes include link direction, facility type, number of lanes, lane width, area type, access type (controlled or uncontrolled), and annual average daily traffic (AADT). The Illinois DOT Highway GIS inventory contains roadway link information including Average Daily Traffic (ADT) counts, roadway functional classification, number of lanes, roadway name, and roadway length (distance), and link speed category. Table 11 shows the speed category used in the Illinois DOT shape files. The posted speed limits are commonly used as the link free flow speed in the model network.

Table 11. Speed Category Used in the IDOT GIS Database

Speed Category	Speed (mph)
1	> 80
2	65 - 80
3	55 - 64
4	41 - 54
5	31 -40
6	21- 30
7	6 - 20
8	< 6

The network link capacity can be derived from the Highway Capacity Manual (HCM) 2000 or by using the Highway Capacity Software (HCS). The capacities are usually based on the Level of Service (LOS) for which the highway system is being evaluated. The NCHRP Report 365 presents the initial per-lane default capacities based on area type, facility type, and link speed for level of service E (ultimate capacity). These capacities are as per the 1985 HCM guidelines. Table 12 shows the roadway network link capacities (traffic volumes per hour per lane) by roadway functional classification and land use area type for the Champaign County Regional Planning Commission's travel demand model.

Table 12. Roadway Network Link Capacities for the CCRPC TDM

Facility		**Area Type**				
		Very High Density Commercial/Residential	High Density Commercial	Moderate Density Commercial	High/Moderate Density Residential	Very Low Density Commercial/Residential
		1	2	3	4	5
Centroid Connector	0	9999	9999	9999	9999	9999
Local	1	400	550	550	600	700
Collector	2	500	600	650	700	850
Minor Arterial	3	600	700	750	850	1050
Major Arterial	4	800	850	900	950	1150
Freeway Ramp	5	1300	1300	1300	1400	1500
Freeway to Freeway Connector	6	1400	1400	1400	1500	1500
Freeway	7	1900	1950	2000	2000	2050

The model network and attributes can also be imported from the old TRANPLAN models developed by Illinois DOT for the MPOs in early 1990s. This can be used as the starting point and adjustments can be made to the network links and link attributes as required.

An alternate network should be created for the transit system, if some roadway links in the area are used exclusively by transit service or have different regulation for the transit vehicle (e.g. one-way street). The transit network should be developed based on the individual route itineraries, transfer points, and stop locations. Transit network attributes include transit speed, minimum and maximum headways, and walk or auto access time. The model network for the future scenarios is created based on the existing plus planned and/or committed roadway network. The planned and/or committed roadway improvements are usually included in the regional Long Range Transportation Plan and other planning documents. Alternate network scenarios can be created to analyze potential roadway improvements.

7.5 SOCIO-ECONOMIC DATA FOR MODEL INPUT

The socio-economic data for the model includes the household and employment information aggregated by TAZ. The household information including the population, income by household, and auto-ownership by household can be derived from the decennial census data. The latest 2010 census data is partially released and is currently being rolled out. Unlike the 2000 census data, the latest decennial census data does not include the household income and auto-ownership information.
http://2010.census.gov/2010census/index.php

The decennial Census Bureau long form has been replaced with the American Community Survey (ACS). The American Community Survey is a monthly survey conducted by the U.S. Census Bureau with the same questions the Census 2000 long form. The ACS 5-year estimates provides household information for census tract level: http://2010.census.gov/2010census/index.php. The Census Transportation Planning Package (CTPP) extracts the information required for transportation planning from the 5-year ACS data, including place of residence, place of work, and journey-to-work information at the census tract level: http://www.fhwa.dot.gov/ctpp/index.htm. The 2001 National Household Travel Survey (NHTS) transferability tool also provides the number of households by household size and by auto ownership down to the census tract level. The NHTS socio-economic data is derived from the 2000 Census Summary File 3 (SF3) and Census Transportation Planning Package (CTPP):
http://www.census.gov/census2000/sumfile3.html. The input data is refined based on local knowledge and in consultation with local governments.

The employment information can be obtained from the Quarterly Census of Employment and Wages (ES 202) data available through the Illinois Department of Employment Security (IDES). The Local Employment Dynamics (LED) provides information on the local work force and labor market conditions. The employment information is available by detailed industry type at metropolitan and county level. This employment source includes 90% of the employment information, except federal government workers, agricultural workers, domestic workers, and the self-employed personnel. IDES provides long term projections (2006-2016) for the metropolitan statistical area. It is recommended to verify the employment data against local data. The employment data can be accessed at the following location: http://lmi.ides.state.il.us/LED/qwi.htm. An issue with the ES-202 data is the inclusion of additional employees at the headquarter offices than actually working at the site. To overcome this issue, the MPO is recommended to consult with local cities and agencies to cross-check the ES-202 employment data. The regional employment information by type is then allocated to each TAZ based on local knowledge of the region, employment survey, land use information, aerial photographs, and in consultation with the city and MPO staff.

The socio-economic data for each TAZ is projected for future horizon years based on historical trends, future land use maps, other factors affecting the change in population and employment in the region, and in consultation with local agencies. The information from the employer on existing and future employment and the local comprehensive plans should be used to determine which TAZs would experience growth in employment.

7.6 TRIP GENERATION

The trips generated from a TAZ depend on the land uses and the density of the development within the zone. Trip generation is estimated using trip production and trip attraction models. The trip production model commonly uses disaggregate socio-economic data such as household classified by vehicle ownership, household classified by size, or household classified by income group. The trip attractions can be estimated by statistical regression using TAZ level aggregated data.

The NCHRP Report 365 summarizes the trip characteristics for urban areas with different population size, based on the travel surveys collected since the 1985 NPTS survey and from the 1990 NPTS survey. The National Household Travel Survey (NHTS) sponsored by the Bureau of Transportation Statistics (BTS) and Federal Highway Administration (FHWA), provides comprehensive data on travel and transportation patterns in the United States. The primary objective of the survey was to collect a national sample of person trip-based data to establish a relationship between personal travel characteristics and the travel demographics in the country. The trip rates/equations suggested in the NCHRP Report 365 are considered applicable for estimating regional trips in small and medium sized communities. The person trip rates provided in the report should be used as initial input parameters into the model and should be adjusted based on the regional validation checks. The report presents tables to estimate person trip rates given the household size (independent variable) and a variable describing the wealth of the household, e.g. income or auto-ownership. The report provides information to estimate:

- Percent of households by autos owned in each income category
- Average daily person trips given the income distribution and number or person per household
- Average daily person trips given the number of autos owned and number or person per household
- Average daily person trips given an income distribution and the number of autos owned
- Percent average daily person daily trips by purpose

More generalized trip rates are also provided in the report, when the regional income variable is not available. The trips are classified into three basic trip purposes: Home Based (HBW), Home Based Other (HBO) and Non Home Based (NHB). Additional trip purposes can be included in the modeling process when the local trip characteristics are available (e.g. local household travel survey). The more the trip purposes, the more sensitive the model is to the socio-economic changes in the region.

The NCHRP Report 365 recommends trip attraction estimation for the three basic model trip purposes (HBW, HBO, NHB) based on the employment type (retail, service, and other) and the number of households in the TAZ. Different trip attraction estimates are suggested for CBD and non-CBD area types.

After the 1990 NHTS travel survey, on which the NCHRP Report 365 trip characteristics are based, the national person travel survey was conducted in 1995, 2001 and 2009. The USDOT agencies (FHWA, BTS, and NHTSA) provide a transferability tool based on the

2001 NHTS survey which transfers the national survey results to smaller geographical areas such as census tract and TAZs. The transferability tool provides estimates of regional or local travel, daily travel statistics including:

- Person trips per household;
- Person miles of travel per household;
- Non-air person miles of travel per household;
- Vehicle trips per household;
- Vehicle miles of travel per household;
- Person trips by purpose for Home Based Work (HBW), Home Based Shopping (HBS), Home Based Social/Recreational (HBS/R), Home Based Other (HBO), and Non-Home Based (NHB)

The GIS-based transferability tool enables users to download trip statistics for selected Census Tracts and Traffic Analysis Zones (TAZ) and the output dataset is an Excel spreadsheet. The 2001 NHTS sample size included 26,038 national surveys and approximately 40,000 add-on surveys. It should be noted that the NHTS data does not provide accurate estimates for a MPO unless a sufficient number of households in the MPO study area are surveyed. The State or the MPO can purchase add-on surveys for additional sampling of households in the region during the NHTS effort. The 2009 NHTS surveyed 25,150 national samples and 124,637 add-on samples. The transferability tool/capability has not yet been implemented for the 2009 NHTS survey. The 2009 NHTS survey is being analyzed to be included in the update for the NCHRP Report 365 to reflect more current travel characteristics. The trip generation derived from the NCHRP Report 365 includes the regional internal-internal (I-I) trips and also the internal-external (I-E) trips made by residents in the study area.

The zones with unique trip characteristics which cannot be represented by the regular trip attraction and production model are modeled as special generators. The special generator is generally intense trip-attractors. The trip rates for these zones can be derived from the Institute of Transportation Engineer (ITE) Trip Generation Handbook, based on experience/ local survey, or by adjusting trip attraction/production rates.

The estimated trip productions and attractions are balanced to ensure that the trips generated from the households are equal to the trips attracted by the activity centers in the region. The trips are balanced by adjusting either the trip attractions or the trip productions to the control totals by trip purpose. The control totals are usually trip productions since the source of household information is more reliable than that zonal employment information. The methodology for balancing the trip attractions and productions is provided in the NCHRP Report 365.

7.7 TRIP DISTRIBUTION

The trip distribution step links regional trip attractions and productions to create zonal trip matrices. The most commonly used trip distribution model is the Gravity Model. In the gravity trip distribution model, the number of trips produced from a zone depends on the magnitude of activities at the destination zone and the spatial separation between the two zones. Friction factors are the primary impedance used in the gravity model, representing the unwillingness of persons to make a trip due to the separation between the zones. Other travel impedance including highway cost (tolls) can be included in the model to represent the traffic flow conditions in the region. The friction factors are usually calculated using the gamma function.

The NCHRP Report 365 provides synthetic friction factors using the gamma function coefficients from several calibrated models for smaller urban areas. The friction factors can also be obtained from other calibrated models for similar communities. The friction factors are calibrated by comparing against average trip length and the trip length frequency distribution for each trip purpose, which can be derived from the U.S. Census Journey to Work data for HBW trips. Journey to work data provides the reported home to work travel time, including terminal time, for respondents to the US Census long form residing within the modeling boundary (approximated to the nearest Census block). The NCHRP Report 365 also provides methodology to calculate the interzonal travel times and the terminal time which are a part of the travel impedance matrix used in the trip distribution process. Terminal time, which represents the amount of time required to walk to a transit station, parked cars, etc. is also added to each trip end in a different area type based on population and employment history. K-factors can be incorporated into the model to change the attractiveness of the trips between two zones. K-factors are used when adjustments are made to the model estimates due to a physical barrier or unusual TAZ socio-economic characteristics. Turn penalties can be added to the network links to restrict movement or add additional time impedance. Free flow speeds are commonly used in regional models to calculate the shortest travel time between zones. An iterative feedback loop can be set up between traffic assignment and trip distribution steps of the model to use the congested travel time from the assignment step as an input in the distribution process.

7.8 ESTIMATING EXTERNAL TRIPS

The external trips are the trips with one trip end (internal-external or external-internal trips) or both trip ends outside the model study area (external-external trips). External stations are identified along the periphery of the model study area to determine the amount of external travel entering the modeling area, generally the point of intersection of the Interstates and major state/county roadways with the model study area boundary. Ideally, external cordon survey is performed to estimate the external travel. The data collected during an external cordon survey includes vehicle class, trip purpose, and resident status. For small communities with populations less than 100,000, the NCHRP Report 365 provides a methodology for calculating external travel using the ADT counts at the external stations as the input. The Report provides a step-by step procedure to estimate the through trips at the external station, distribution of through trips between external stations, estimation of the external-internal trip, and distribution of internal-external and external-internal trips by trip purpose.

7.9 MODE CHOICE

The mode choice step estimates the model trips separated by the competing modes of travel available in the region. It splits the production attraction (P/A) matrix from the trip distribution stage into separate matrices for each travel mode. The mode choice step is commonly estimated based on logit models: multinomial logit, incremental logit, and nested logit models. The logit model is a mathematical formulation which estimates the probability of choosing a specific mode based on attributes such as cost and level of service. For small and medium sized communities, when one other mode (bus service) is primarily the competition to the auto mode, the multinomial logit model satisfies the requirement. The logit model is data extensive and requires input parameters derived from household travel surveys and an on-board transit survey. The input information includes the transit travel time (out-of-vehicle time, in-vehicle time, walk time, wait time), number of transfers, transit fare, auto costs, household income and auto ownership, household size, number of workers and land use characteristics.

The incremental logit model on the other hand has less extensive input requirements and is the most transferable between urban areas among the three models. The downside of the incremental model is that it cannot forecast traffic in the areas which does not already have an existing transit service. The NCHRP Report 365 outlines the procedure to develop a mode-choice model based on the incremental logit formulation. The level of service variable used to calculate the probability of a mode includes in-vehicle travel times, out-of-vehicle time (walk, wait, and transit time) and cost of travel. The report presents the model coefficients for the level-of service variables from various calibrated urban area models. For small and medium sized communities, with limited transit service, mode split factor can be used to determine the percent of person trips using transit. The mode split curve gives the percentage of transit trips based on the ratio of the transit impedance to the highway impedance. Transit impedance comprises the initial wait time, transfer wait time, out of vehicle time and the in-vehicle time. Such mode split models are sensitive mainly to auto travel time. The estimated transit trips should be checked against the local transit ridership data for reasonableness.

7.10 AUTO-OCCUPANCY FACTOR

After the mode choice split, the production/attraction (person trip) matrices are converted into a vehicular origination-destination (O/D) matrix using auto occupancy factors for each trip purpose. The vehicle trip models are not factored. The auto occupancy factors for an urban area typically depend upon on the population size, trip purpose, time of day, income level and facility type. The NCHRP Report 365 presents the average auto occupancy factors based on the 1990 NPTS survey. The auto occupancy factors are presented for each trip purpose (HBW, HBShop, HBSoc, HBO, and NHB) based on urban area size, income level and time of day. Table 13 shows the auto occupancy factors (based on local household travel survey in 2002) for the Champaign County Regional Planning Commission's travel model and the NPTS data for Champaign-Urbana region.

Table 13. Auto Occupancy Factors for the CCRPC Travel Model

Purpose	CCRPC Travel Model	National Personal Travel Survey (NPTS)		
		1977	1983	1990
HBW	1.1	1.3	1.3	1.1
HBSc	1.2	-	-	-
HBShop	1.4	2.1	1.8	1.7
HBO	1.7	2	1.8	1.8
NHB	1.6	-	-	-
HBS/R	-	2.4	2.1	2.1

7.11 TIME OF DAY FACTORS

The travel forecasting modeling procedures produce person/vehicle trips over a 24 hour period. The traffic during AM peak period is expected to be most critical for air quality analysis. The PM peak period is critical for roadway capacity analysis when heavy traffic and congestion is experienced. The peak hour volumes can be derived by either post-processing highway links using link-based peak-hour factors or factoring the daily trip tables by purpose prior to trip assignment.

Time-of-day module can be incorporated into the model to distribute the mode specific daily model trips throughout the 24 hour period on an hourly basis. Time of day factors represent the percent of traffic during each hour of the day, vary by trip purpose, and are used to convert the daily O/D trip matrix into hourly trip matrices. When mode specific surveys and counts are not available, the time of day factors are assumed to be the same for all modes of travel. The NCHRP Report 365 provides generalized percent travel by time of day and by purpose for the different urban population groups based on the 1990 NPTS survey. The report also provides the diurnal distribution of trips by time and purpose. Figure 12 shows the hourly distribution of HBW and HBO trips for the Champaign County Regional Planning Commission's travel model (based on local household travel survey, 2002).

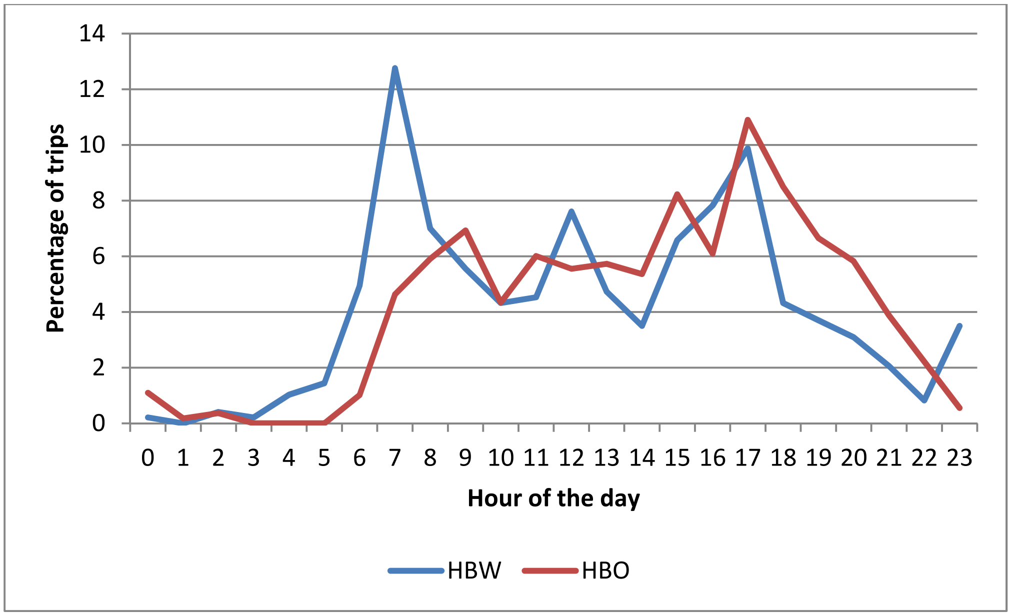


Figure 12. Hourly distribution of HBW and HBO trips for the CCRPC travel model.

7.12 TRAFFIC ASSIGNMENT

The traffic assignment models use a mathematical algorithm to assign trips onto the links between origination-destination zones, commonly using capacity restraint assumption. The popular traffic assignment models include the user equilibrium model, stochastic equilibrium model, and incremental assignment model. All the modeling software packages are capable of performing the above mentioned and additional assignment procedures. The input to the trip assignment process is the volume-delay function (Bureau of Public Records (BPR) Curves), which presents the relationship of the assigned volume and resulting delay on roadway link due to congestion. The BPR curves give the change in travel time with respect to change in the volume to capacity ratios on a highway link. The BPR equation is given as follows:

$$T = T_0\left[1 + a\left(\frac{v}{c}\right)^b\right]$$

Where,

T = link travel time
T_0 = link travel time at free-flow link speed
a and b = BPR parameters

7.13 MODEL CALIBRATION AND VALIDATION

Travel model development process requires a significant amount of time and resources. Therefore, it makes sense for an agency to use the model as much as possible for transportation planning applications. To avoid unexpected and unreliable results for travel models, every modeling steps should be calibrated and validated as per the federal, state, and regional guidelines (if available). Definitions of model calibration and validations are discussed in Section 5.7.

Tables 7 and 10 showed appropriate calibration and validation checks for a typical four-step travel demand modeling steps. The Travel Model Validation and Reasonability Checking Manual (TRB 2010b) specified five primary validation steps for a travel model (as described in Section 2.6). It is strongly recommended to follow these guidelines for all the existing and future travel demand models for the small and medium sized MPOs in Illinois.

7.14 ADDITIONAL TRAVEL MODEL COMPONENTS

In addition to the basic four steps (as discussed above) of a trip based model, the following additional travel model components were also recommended for some of the small and medium sized MPOs in Illinois:

- Feedback loops
- Junction modeling
- Freight/Commercial vehicle model
- Special generators

7.14.1 Feedback Loops

The traditional four-step model steps are implemented in a sequential, linear, and independent fashion. However, independent treatment of model components separates decisions regarding origin-destination, mode choice, and route selection/assignment. As a result, discrepancy between the input travel times used for trip distribution and mode choice steps becomes evident.

Feedback loops are used to reach equilibrium in the modeling process or between modeling steps. Feedback loop process can be defined as the sequential iterative approach where the demand or representation of regional travel patterns by trip purpose is no longer estimated independently and irrespective of network supply as a result of having link costs updated for each iteration of the feedback process (FHWA 2009). Therefore, the travel times used to determine trip patterns during the trip distribution process and the resulting congested travel times from trip assignment become increasingly consistent with each iteration of the feedback loop process. As shown in Figure 10, typically the most common feedback structure is to link trip distribution, mode-choice, and traffic assignment steps.
All the commercially available travel modeling packages discussed in Section 2.3 of have capabilities to incorporate feedback loops between the travel modeling steps.

7.14.2 Junction Modeling

Junction data includes intersection geometry and control (e.g., control type, phase, cycle time) data. This data is used in the trip assignment process to estimate the delay at each intersection. Figure 13 shows the intersections coded in the junction file for the Champaign County Regional Planning Commission’s travel model.

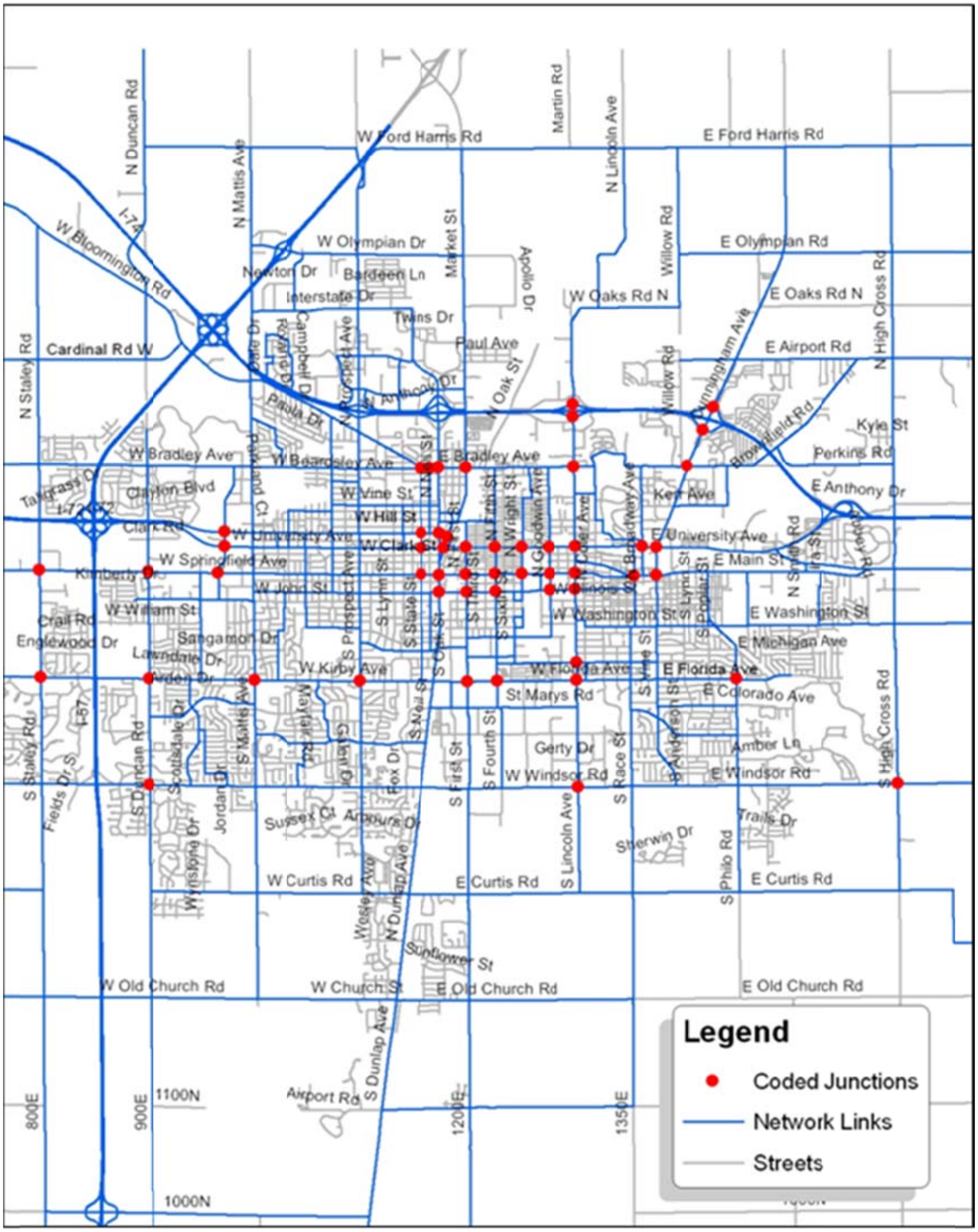


Figure 13. Intersections in the Junction File for the CCRPC Travel Model.

7.14.3 Freight/Commercial Vehicle Modeling

The freight/commercial vehicle forecasting is often neglected in the regional modeling process, even though the roadway network may carry a significant amount of truck/freight traffic. This may be due to lack of information about freight modeling, complexity of truck forecasting process and/or the limited regional truck data. Freight forecasting is important since it has a significant impact on the roadway network in terms of congestion and pollution. The federal law governing planning for transportation planning (23 USC 133 and 23 USC 134) as well as for transit planning (49 USC 5303 and 49 USC 5304) requires that states and MPOs consider freight and related issues in the LRTP, TIP, and annual work elements.

The freight/commercial vehicle models are either commodity based or vehicle-trip based. The commodity based approach uses commodity weight and size for modeling whereas the trip based models are based on the number of vehicles/trucks. The detailed truck models used in large MPOs and state agencies require significant effort, resources, and truck forecasting knowledge. The share of truck traffic in small and medium sized MPOs is considerably small. Taking into account the amount of resources which can be spared for freight forecasting in small urban areas, simple freight forecasting model(s) proposed in the FHWA's Quick Response Freight Manual II (QRFM), published in September 2007 is recommended.

The QRFM provides several freight forecasting techniques including simple growth factor methods, "four-step" forecasting process, commodity models, hybrid models, and economic models. The document also provides transferable model parameters for truck/freight forecasting and identifies the required data sources. The "four-step" freight forecasting process is recommended for integrating the freight assignment into the regional passenger travel demand model. The four-step truck forecasting process involves trip generation, distribution and assignment steps. The socio-economic data is common for the freight and passenger models, along with the freight trip information. The freight trips (productions and attractions) are distributed using the gravity model and assigned to the roadway network. The freight trips can be pre-assigned to links before the passenger auto trips are assigned or the truck origin-destination trip table can be assigned to the network at the same time as passenger auto trips.

7.15 TRAINING RESOURCES

Travel demand model development and maintenance tasks warrant periodic trainings for MPO staff members assigned to the travel modeling. Several training resources are available for Illinois small and medium sized MPOs for free and/or at very low cost. Table 14 shows details of training resources available for small and medium sized MPOs in Illinois.

Table 14. Available Training Resources

Training Type	**Source/Offered by**	**Cost**
Online: Webinars	• FHWA's TMIP • TDM software vendors	Free of cost
Onsite training	• Offered by vendors • Offered by MUG members	• $200 to $400 per training day • Free or very low cost
Training manuals and guidelines	• TDM software vendors • FHWA's TMIP	• Available with the purchase of software package • Free of cost

7.16 FINANCIAL RESOURCES

Lack of financial resources is one of the major impediments to developing and maintaining a travel demand model in house for a small or medium sized MPO in Illinois. Based on current transportation planning policies and practices at the federal, state, and regional levels it is apparent that travel demand modeling and related land use and air quality modeling will be the core elements of regional transportation planning in the future.

7.16.1 Federal Level

At the federal level, it is more likely that the new 8-hour air quality standards (ozone) for mobile sources emissions would be introduced for metropolitan areas. Some of the small and medium sized MPOs in Illinois may find their regions listed as nonattainment regions. Therefore, the upcoming new federal transportation bill should make explicit provisions for development, validation, and maintenance of regional travel and air quality models and for selective upgrades. These provisions are needed to achieve consistency with acceptable modeling practices and to address emerging transportation planning issues. As a result, some of the small and medium sized MPOs with little or no functional travel demand models would be eligible for federal funding. Moreover, several federal agencies, the Federal Highway Administration, Federal Transit Administration, Federal Housing and Urban Development, and the U.S. Department of Energy offer competitive grant opportunities which can be explored to receive funding to develop and/or upgrade an existing travel demand model.

7.16.2 State Level

At the state level, the Illinois Department of Transportation should consider providing additional funding and technical support for the small and medium sized MPOs as part of the State Implementation Plan (SIP) planning process for complying with the Federal Clean Air Act, administered by the Environmental Protection Agency. Moreover, additional state funding programs (e.g., State Planning and Research) can be utilized for development and/or improvement of regional travel demand models.

7.16.3 Regional and Local Level

At the local and regional levels, small and medium sized MPOs can group together and develop and/or enhance travel and air quality models. The Modeling Users Group would be a good platform for such activities. Small and medium sized MPOs may also explore the opportunity to receive funding as part of a large land development (e.g. industrial) and/or infrastructure development (e.g. highway project) projects in their region.

CHAPTER 8 IMPLEMENTATION PLAN

This chapter outlines the implementation plan for the development and/or updating the existing travel demand models for the small and medium sized MPOs in Illinois. The implementation plan highlights the development, updates, validation, support structure, and maintenance issues for the new or existing travel demand models for each small and medium sized MPO in Illinois.

8.1 DANVILLE AREA TRANSPORTATION STUDY, KANKAKEE AREA TRANSPORTATION STUDY, AND DECATUR URBANIZED AREA TRANSPORTATION STUDY

As discussed in Chapters 3 and 5, the Danville Area Transportation Study, the Kankakee Area Transportation Study, and the Decatur Urbanized Area Transportation Study currently do not have travel demand models in place. The TDM implementation plan for these three agencies includes the following steps:

- Step 1: Development of a trip-based travel model
- Step 2: Calibration and validation of the travel model
- Step 3: Application of the travel model for transportation planning projects
- Step 4: Periodic updates and maintenance of the travel model
- Step 5: Addition of supplementary recommended travel model components
- Step 6: Model documentation

8.1.1 Step 1. Development of a trip-based travel model

Chapter 7 elaborately discussed the travel demand model development process from scratch. Table 10 showed the typical travel modeling steps and corresponding data sources. It is recommended to vigorously explore all the available data sources for each modeling step during the model development process. As discussed in Section 6.1, a mode-choice model was not suggested for the initial travel model for DATS as the existing transit, walk, and bicycle trips percentage for that region is negligible in comparison to auto trips.

8.1.2 Step 2. Calibration and validation of the travel model

The travel model developed in Step 1 should go through the list of calibration and validation checks identified in Tables 7 and Table 10. The FHWA guidelines for travel model validation checks should be followed.

8.1.3 Step 3. Travel demand model applications

The calibrated and validated travel model should be utilized extensively for different transportation planning projects including the LRTP, TIP, corridor studies, and traffic impact studies.

8.1.4 Step 4. Periodic updates and maintenance of the travel model

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. TDM steps should be updated during the LRTP update process.

8.1.5 Step 5. Addition of supplementary recommended model components

At a later stage, the initial travel model is recommended to be updated by adding a few model components. Recommended supplementary travel demand model components for these three MPOs are shown in Table 15.

Table 15. Recommended Additional Travel Model Steps for DATS, KATS, and DUATS

MPO	Recommended Additional Model Steps
Danville Area Transportation Study	• Mode choice model • Time-of-day factor • Junction model • Feedback loop
Kankakee Area Transportation Study	• Feedback loop • Time-of-day factor • Junction model • Freight/commercial vehicle model
Decatur Urbanized Area Transportation Study	• Feedback loop • Time-of-day factor • Junction model • Freight/commercial vehicle model

Section 7.14 of discussed the above mentioned modeling steps in detail. These additional model steps would require calibration and validation checks. Guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation steps of these model components.

8.1.6 Step 6: Model documentation

Documentation is extremely important during the travel demand model development process. Proper documentation helps recording detailed procedures and processes followed during every modeling step. This practice will help with explaining the model outputs and checking model steps for errors. Model documentation will also be very helpful during the peer review process.

8.2 DEKALB-SYCAMORE AREA TRANSPORTATION STUDY (DSATS)

The TDM implementation plan for the DeKalb-Sycamore Area Transportation Study includes the following steps:

- Step 1: Updating TDM input data
- Step 2: Addition of supplementary recommended travel model components
- Step 3: Periodic updates and maintenance of the TDM
- Step 4: Calibration and validation of each modeling step
- Step 5: Model Documentation

8.2.1 Step 1: Updating TDM input data

The DeKalb-Sycamore Area Transportation Study's current "proto" travel demand model should be updated with newer input data based on 2010 census results and other data sources specified in Table 10.

8.2.2 Step 2: Addition of supplementary recommended travel model components

As discussed in Section 6.2, the following supplementary travel model components were recommended for the DSATS TDM:

- Incorporating peak hour traffic assignment (peak hour model)
- Adding mode choice model
- Adding freight/commercial vehicle forecasting model
- Adding feedback loops
- Adding intersection control and capacity information (junction modeling)

Section 7.14 of discussed the above mentioned modeling steps in detail. These additional modeling steps would require appropriate calibration and validation checks.

8.2.3 Step 3: Calibration and validation of TDM steps

The DeKalb-Sycamore Area Transportation Study's existing travel demand model lacks adequate calibration and validation checks for all the modeling steps. The updated travel demand model with new input data should go through extensive calibration and validation checks as identified in Table 7. Data sources for these checks are shown in Table 10. It is also recommended to follow the guidelines provided in FHWA's Travel Model Validation and Reasonableness Checking Manual during the validation process of these model components.

8.2.4 Step 4: Periodic updates and maintenance of the TDM

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. The TDM steps should be updated during the LRTP update process.

8.2.5 Step 5: Model documentation

DSATS' travel demand model should be documented with detailed description of all the modeling step updates, calibration and validation checks.

8.3 STATELINE AREA TRANSPORTATION STUDY (SLATS)

The Stateline Area Transportation Study's travel demand model has gone through extensive calibration and validation checks and the model maintenance and update responsibilities are carried out by the Wisconsin Department of Transportation. As identified in Section 6.3, the SLATS TDM needs to incorporate a few additional model components to increase forecasting reliability and applicability of the existing TDM. The implementation plan for the SLATS TDM proposed improvements includes the following steps:

- Step 1: Incorporating additional model steps/components
- Step 2: Calibration and validation checks for all the model steps
- Step 3: Expanding application of the travel model
- Step 4: Model documentation

8.3.1 Step 1: Incorporating additional model steps/components

The following additional model components/functionalities are recommended to improve the Stateline Area Transportation Study travel demand model capabilities:

- Adding mode choice step
- Incorporating peak hour traffic model
- Adding intersection control and capacity information (junction modeling)

Data requirements and processes involved with the above mentioned modeling steps were discussed in detail in Chapter 7.

8.3.2 Step 2: Calibration and validation of all the model steps

The addition of supplementary model components would increase the model's applications in evaluating different transportation planning projects. However, the updated model should go through a series of calibration and validation checks mentioned in Table 7 and the guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of these model components.

8.3.3 Step 3: Expanding model applications

The updated travel model should be utilized for additional transportation planning projects including major corridor studies, FTA Small Starts project, etc. Any unreasonable forecasts should be checked for errors.

8.3.4 Step 4: Model documentation

Modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.4 DUBUQUE METROPOLITAN AREA TRANSPORTATION STUDY (DMATS)

The Dubuque Metropolitan Area Transportation Study's travel demand modeling effort receives technical support from the Iowa Department of Transportation. As discussed in Section 6.4, the DMATS travel model should be updated through the addition of several supplementary modeling steps/components. The implementation plan for the DMATS TDM proposed improvements includes the following steps:

- Step 1: Incorporating additional model steps/components
- Step 2: Calibration and validation checks for all the model steps
- Step 3: Expanding application of the travel model
- Step 4: Model documentation

8.4.1 Step 1: Incorporating additional model steps/components

The following additional model components/functionalities are recommended to improve the Dubuque Metropolitan Area Transportation Study travel demand model capabilities:

- Developing person trip model
- Adding mode choice model

- Adding intersection capacity and control information (junction modeling)

Data requirements and processes involved with the above mentioned model steps were discussed in detail in Chapter 7.

8.4.2 Step 2: Calibration and validation of all the model steps

The addition of supplementary model components would increase the model's applications in evaluating different transportation planning projects. However, the updated model should go through a series of calibration and validation checks mentioned in Table 7 and the guidelines provided in FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of these model components.

8.4.3 Step 3: Expanding model applications

The updated travel model should be utilized for additional transportation planning projects including FTA Very Small Starts project. Any unreasonable forecasts should be checked for errors.

8.4.4 Step 4: Model documentation

Modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.5 MCLEAN COUNTY REGIONAL PLANNING COMMISSION (MCRPC)

The McLean County Regional Planning Commission's travel demand model was developed as part of a major corridor study (East Side Highway Corridor Study). As discussed in Section 6.5, the existing travel demand model does not have a mode choice step and needs several recommended improvements. The implementation plan for the MCRPC TDM proposed improvements includes the following steps:

- Step 1: Updating TDM input data
- Step 2: Addition of supplementary recommended travel model components
- Step 3: Calibration and validation of each TDM steps
- Step 4: Periodic updates and maintenance of the TDM
- Step 5: Model documentation

8.5.1 Step 1: Updating TDM input data

The McLean County Regional Planning Commission's existing travel demand model's base year was 2004. It should be updated with newer input data based on 2010 census results and other data sources specified in Table 10.

8.5.2 Step 2: Addition of supplementary recommended travel model components

As discussed in Section 6.5, the following supplementary travel model components were recommended for the MCRPC TDM:

- Adding mode choice model
- Incorporating an iterative feedback loop
- Adding peak hour model
- Adding intersection capacity and control information (junction modeling)

Data requirements and processes involved with the above mentioned modeling steps were discussed in detail in Chapter 7.

8.5.3 Step 3: Calibration and validation of TDM steps

The MCRPC existing travel demand model lacks adequate calibration and validation checks for all the modeling steps. The updated travel demand model with new input data should go through extensive calibration and validation checks identified in Table 7. Data sources for these checks are shown in Table 10. The guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of the model components.

8.5.4 Step 4: Periodic updates and maintenance of the TDM

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. TDM steps should be updated during the LRTP update process.

8.5.5 Step 5: Model documentation

Modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.6 CHAMPAIGN COUNTY REGIONAL PLANNING COMMISSION (CCRPC)

The Champaign County Regional Planning Commission's existing travel demand model was developed and currently maintained by the MPO's staff. As per the discussions in Section 6.6 of Chapter 6, the existing CCRPC travel demand model needs to be improved by adding additional travel modeling components. The implementation plan for the CCRPC TDM proposed improvements includes the following steps:

- Step 1: Updating TDM input data
- Step 2: Addition of supplementary recommended travel model components
- Step 3: Calibration and validation of each TDM steps
- Step 4: Periodic updates and maintenance of the TDM
- Step 5: Model documentation

8.6.1 Step 1: Updating TDM input data

The Champaign County Regional Planning Commission's existing travel demand model's base year was 2005. It should be updated with newer input data based on 2010 census results and other data sources specified in Table 10.

8.6.2 Step 2: Addition of supplementary recommended travel model components

As discussed in Section 6.6, the following supplementary travel model components were recommended for the CCRPC TDM:

- Adding the University of Illinois campus as a special generator
- Adding freight/commercial vehicle model

Data requirements and processes involved with the above mentioned model steps were discussed in detail in Chapter 7.

8.6.3 Step 3: Calibration and validation of TDM steps

The updated travel demand model with new input data should go through extensive calibration and validation checks as identified in Table 7. Data sources for these checks are shown in Table 10. The guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of the model components.

8.6.4 Step 4: Periodic updates and maintenance of the TDM

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. TDM steps should be updated during the LRTP update process.

8.6.5 Step 5: Model documentation

Modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.7 SPRINGFIELD AREA TRANSPORTATION STUDY (SATS)

The Springfield Area Transportation Study's existing travel demand model was developed by a consultant and currently maintained by MPO in-house staff. According to the discussions in Section 6.7, a few travel model improvement steps were suggested for the SATS travel demand model. The implementation plan for the SATS TDM proposed improvements includes the following steps:

- Step 1: Addition of supplementary recommended travel model components
- Step 2: Calibration and validation of each TDM steps
- Step 3: Periodic updates and maintenance of the TDM
- Step 4: Model documentation

8.7.1 Step 1: Addition of supplementary recommended travel model components

As discussed in Section 6.7, the following supplementary travel model components were recommended for the SATS TDM:

- Adding a complete mode choice model with non-motorized trip assignment capability
- Adding intersection capacity and control information (junction modeling)

Data requirements and processes involved with the above mentioned model steps were discussed in detail in Chapter 7.

8.7.2 Step 2: Calibration and validation of TDM steps

The updated travel demand model with new input data should go through extensive calibration and validation checks identified in Table 7. Data sources for these checks are shown in Table 10. The guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of the model components.

8.7.3 Step 3: Periodic updates and maintenance of the TDM

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. It is recommended to update the TDM steps during the LRTP update process.

Step 4: Model documentation

Travel demand modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.8 TRI-COUNTY REGIONAL PLANNING COMMISSION (TRPC)

The Tri-County Regional Planning Commission's existing travel demand model was developed by a consultant. Currently the TDM maintenance responsibility is carried over by both the consultant and MPO in-house staff. As described in Section 6.8, the existing TCRPC TDM needs to add some modeling components/steps to increase the travel model's forecasting capability and overall utilization. The implementation plan for the TCRPC TDM proposed improvements includes the following steps:

- Step 1: Addition of supplementary recommended travel model components
- Step 2: Calibration and validation of each TDM steps
- Step 3: Expanding applications of travel demand model
- Step 4: Periodic updates and maintenance of the TDM
- Step 5: Model documentation

8.8.1 Step 1: Addition of supplementary recommended travel model components

As discussed in Section 6.8, the following supplementary travel model components were recommended for the TCRPC TDM:

- Adding mode choice model
- Adding special generators in the model
- Adding freight/commercial vehicle forecast model
- Performing calibration and validation checks for every model steps
- Adding Peak hour model
- Adding intersection capacity and control information (junction modeling)

Data requirements and processes involved with the above mentioned model steps were discussed in detail in Chapter 7.

8.8.2 Step 2: Calibration and validation of TDM steps

The TCRPC existing travel demand model lacks adequate calibration and validation checks for all the modeling steps. The updated travel demand model should go through extensive calibration and validation checks identified in Table 7. Data sources for these checks are shown in Table 10. The guidelines provided in FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of the model components.

8.8.3 Step 3: Expanding model applications

The updated travel model should be utilized for additional transportation planning projects including FTA Small Starts project. Any unreasonable forecasts should be checked for errors.

8.8.4 Step 4: Periodic updates and maintenance of the TDM

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. It is recommended to update the TDM steps during the LRTP update process.

8.8.5 Step 5: Model documentation

Travel demand modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.9 ROCKFORD METROPOLITAN AGENCY FOR PLANNING (RMAP)

The Rockford Metropolitan Agency for Planning's existing travel demand model needs to incorporate a few additional TDM steps/components to increase forecasting capability. The implementation plan for the RMAP TDM proposed improvements includes the following steps:

- Step 1: Updating TDM input data
- Step 2: Addition of supplementary recommended travel model components
- Step 3: Calibration and validation of each TDM steps
- Step 4: Periodic updates and maintenance of the TDM
- Step 5: Model documentation

8.9.1 Step 1: Updating TDM input data

The Rockford Metropolitan Agency for Planning's existing travel demand model's base year was 2000. It should be updated with newer input data based on 2010 Census information and other data sources specified in Table 10.

8.9.2 Step 2: Addition of supplementary recommended travel model components

As discussed in Section 6.9, the following supplementary travel model component was recommended for the RMAP TDM:

- Adding mode choice model

Data requirements and processes involved with the above mentioned model steps were discussed in detail in Chapter 7.

8.9.3 Step 3: Calibration and validation of TDM steps

The updated travel demand model with new input data should go through extensive calibration and validation checks identified in Table 7 (Chapter 5: Section 5.7). Data sources for these checks are shown in Table 9. The guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of the model components.

8.9.4 Step 4: Periodic updates and maintenance of the TDM

The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. It is recommended to update the TDM steps during the LRTP update process.

8.9.5 Step 5: Model documentation

Modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.10 BI-STATE REGIONAL COMMISSION (BSRC)

The Bi-State Regional Planning Commission travel demand modeling effort receives technical support from the Iowa Department of Transportation. As discussed in Section 6.10, the BRPC travel model should be updated through the addition of several supplementary modeling steps/components. The implementation plan for the BSRC TDM proposed improvements includes the following steps:

- Step 1: Addition of updated input data
- Step 2: Incorporating additional model steps/components
- Step 3: Calibration and validation checks for all the model steps

- Step 4: Model documentation

8.10.1 Step 1: Updating TDM input data

The Bi-State Regional Commission existing travel demand model's base year was 2000. It should be updated with newer input data based on 2010 Census information and other data sources specified in Table 10.

8.10.2 Step 2: Addition of supplementary recommended travel model components

As discussed in Section 6.10 of Chapter 6, the following supplementary travel model components were recommended for the BSRPC TDM:

- Adding mode choice model
- Adding peak hour model
- Adding person trip model
- Adding intersection capacity and control information (junction modeling)

Data requirements and processes involved with the above mentioned model steps were discussed in detail in Chapter 7.

8.10.3 Step 3: Calibration and validation of TDM steps

The updated travel demand model with new input data should go through extensive calibration and validation checks identified in Table 7. Data sources for these checks are shown in Table 10. The guidelines provided in the FHWA's Travel Model Validation and Reasonableness Checking Manual should be followed during the validation process of the model components.

8.10.4 Step 4: Model documentation

Modeling steps and updated components should be documented for future reference. All the calibration and validation checks should be appropriately documented which would include calibration and validation checks for all the model steps.

8.11 TRAVEL DEMAND MODEL SUPPORT STRUCTURE

Travel demand model development, maintenance and updates require significant time and resources for the agencies involved. A well-defined support structure for the Illinois small and medium sized MPOs travel demand models would benefit TDM development, application, update, and maintenance tasks. Table 16 shows recommended support structure for the small and medium sized MPO's travel demand models.

Table 16. Recommended Support Structures for Small and Medium Sized MPOs TDMs

Support Level	Agencies Involved
Local	• MPO in-house staff and/or consultant • TDM software vendor
Regional	• Illinois Modeling Users Group (IL-MUG)
State	• Illinois Department of Transportation
Federal	• FHWA • FTA

The Illinois Modeling Users Group can play an important role of providing technical support at the regional and local level through combining federal, state, and software vendor resources including providing a forum for the discussion of common travel modeling issues and promoting collaborative actions to advance travel demand modeling practices in Illinois.

CHAPTER 9 STATEWIDE TRAVEL MODEL

This chapter outlines the issues and opportunities for the development of a statewide travel model and integration of regional models into statewide models.

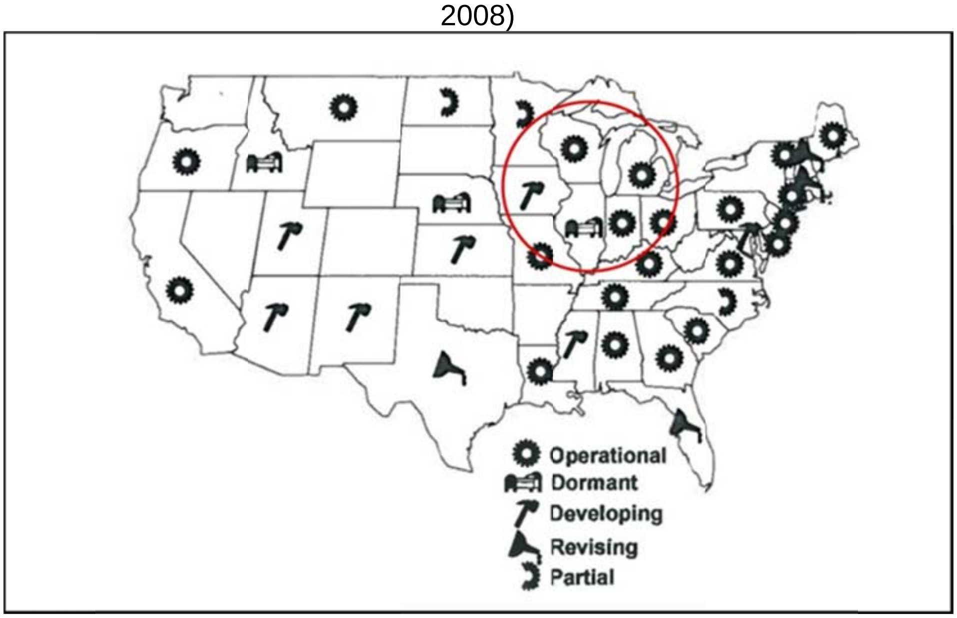
9.1 STATEWIDE TRAVEL MODELING BACKGROUND

Statewide travel modeling efforts are a relatively recent phenomenon, having developed more over the last 15 years). A statewide travel demand model is an important tool to help forecast passenger and freight travel in the state. It is used for statewide system planning, air quality analysis, infrastructure investments, freight planning, corridor planning, and to help aid policy decisions. The statewide model is also utilized to provide input to the urban/MPO travel models.About half of the states in the United States have a statewide model in place. The states without a statewide travel model and even some states with statewide travel models in place handle project-level traffic forecasts through simpler techniques such as growth factors and trend lines (NCHRP 2006). Recently, several states have developed or are in the process of developing a statewide travel demand model to perform comprehensive travel modeling at the statewide level. The improvement to the national socio-economic database, network database, computational power, and guidelines for the modeling process, over the past decade has helped in the development of statewide travel demand model.

9.2 STATEWIDE TRAVEL MODEL STATUS IN THE UNITED STATES

Figure 14 shows the status of statewide travel demand modeling practices in the continental United States as of early Fall 2008 (Horowitz 2008). Midwestern states are shown inside the red circle in Figure 14.

Figure 14. Statewide Travel Modeling Status in the Continental United States (Horowitz 2008)



As shown in Figure 14, Illinois is the only state in the Midwestern region (shown within the red circle) with a “dormant” status on statewide travel demand modeling. Based on Figure 14, 35 states are currently developing, revising, or applying a statewide travel demand model. The NCHRP Synthesis 358: Statewide Travel Forecasting Models (NCHRP

2006) provided the statewide travel modeling status (as of 2005) and future plans for model development/improvement for all 50 states.

The Transportation Research Circular #E-CO75 published in 2005 identified statewide travel modeling status of 16 states which participated in a Peer Exchange program organized by the Transportation Research Board. Table 17 shows the summary of these states' statewide travel demand model status and applications.

Table 17. Summary of Statewide Travel Model Statuses for 16 States

State	Statewide Travel Modeling Status	Typical Applications/Use
Colorado	Non-existent	N/A
Florida	Functional	• Statewide planning • Planning for turnpike district
Indiana	Functional	• I-69 environmental study • Statewide economic analysis • Developing INDOT's 25-year LRTP
Kentucky	Functional	• Corridor studies (I-66, I-69) • New Routes evaluation (I-875)
Louisiana	Functional	• Auto & truck traffic forecasting on the rural arterial system • Statewide planning update to evaluate and prioritize projects • Corridor and project level improvements
Massachusetts	Functional	• Air quality conformity analysis
Michigan	Functional	• Freight modeling • Mode choice modeling
Missouri	Functional	• Corridor study (I-70)
New Hampshire	Functional	• Traffic forecasting to estimate regional traffic growth
New Jersey	Functional	• Corridor planning study (I-287, I-295)
New Mexico	Functional (Freight Model)	• Freight issues
Ohio	Functional	• Route planning • Policy and plan feasibility study
Oregon	Functional	• Statewide and regional transportation study
Virginia	Under development	Intended to: • Estimate intercity/interMPO travel through the rural areas of the state • Prioritization of transportation projects for statewide planning

Table 17. Summary of Statewide Travel Model Statuses for 16 States (Continued)

State	Statewide Travel Modeling Status	Typical Applications/Use
Washington	Non-existent	N/A
Wisconsin	Functional	• Long range plan development • Air quality analysis • Corridor planning • Congestion mitigation planning

As can be seen in Table 16, the majority of the states (14 out of 16) attending the peer exchange session had statewide travel demand models in place and utilized these models for a variety of transportation, environmental, and economic planning projects. Most states developed their statewide travel model using State Planning and Research funds. Few states used funds from general purpose revenues or transportation dedicated revenues and rarely other sources such as from toll road authority (Maine), or congestion mitigation and air quality funds (New Hampshire). The staff working on the travel demand model ranged from a part time employee to three full time employees. All states with statewide travel model hired consultants to develop statewide travel models, while the routine maintenance is done in-house by most states. Model maintenance is a continuous process or on a frequent cycle of 1-2 years. Model revisions/updates are performed between 5 – 10 years, usually based on the statewide plan update cycle.

9.3 BENEFITS OF STATEWIDE TRAVEL MODELS

The statewide travel demand model is an effective tool to perform comprehensive travel modeling at the statewide level, forecast travel between urban areas in the state and even outside the state, forecast freight and tourist travel, to analyze long distance travel, and project level travel forecasts in rural areas. The Iowa Department of Transportation identified the following benefits of statewide travel demand modeling applications (Mescher 2009):

- A useful cost-effective tool to perform:
  - System and corridor studies
  - Reliable and timely travel forecasts
- To determine when and where existing and future capacity deficiencies will occur
- To aid in policy decisions
- To assist in making investment decisions
- Scenario testing or “What If’s?”

Moreover, statewide travel demand modeling practices in the United States identified the following benefits of a statewide travel model (WilberSmith 2009):

- Comprehensive modeling data at a statewide level:
  - Socioeconomic Data
  - Highway Networks
- Ability to measure flows throughout the state and even outside the state
  - County to county
  - City to city
  - MPO to MPO
- Captures long distance travel behavior
  - Freight
  - Tourists
  - Pass through trips
- Can incorporate data from neighboring states
- Fills in the gaps between urban area models for long corridors

- Can create subarea models as needed
- Statewide trip tables can be used for passenger rail analysis
- Can include variable target years so that scenario year data can be interpolated on the fly for any year
- Relatively high levels of accuracy for inter-urban segments of major arterials and freeways
- Captures rural trip making activity
- Cost of STDM development and maintenance is a very small part of major project costs.
- There really is not a viable alternative for the analysis of:
    - Projects that border other states
    - Include long distance truck trips
    - Have intercity corridors

9.4 ISSUES AND OPPORTUNITIES FOR DEVELOPING STATEWIDE TRAVEL MODELS

As discussed in Section 9.3, states with statewide travel models can realize numerous tangible benefits. States without statewide travel model should take initiatives to develop such model for their states. The following major issues need to be addressed while developing a statewide travel model:

- Identifying the need: Developing a statewide travel model requires significant financial and informational resources. State Department of Transportation officials need to identify the potential benefits of having a statewide travel model and prepare a cost benefit analysis for developing such model.

- Lack of financial resources: Gathering financial resources for developing a statewide model can be challenging for some of the states. State legislators need to be fully convinced regarding the benefits of having a statewide travel model. Therefore, budget allocation for developing statewide models would be easier. Moreover, states without statewide travel models can be eligible to receive federal transportation planning grants to develop such model through participating in competitive grant opportunities.

- Lack of quality data: Some states struggle with retrieving reliable data for developing, calibrating, and validating statewide travel models.

- Lack of qualified workforce at the state level: As statewide travel modeling is a relatively new practice, some state transportation agencies lack qualified staff to initiate and/or monitor statewide travel model development projects.

- Lack of regional travel demand models for small MPOs: States with functional regional travel demand models at the MPO level would find it relatively easier to develop a statewide travel model as combining input data from the MPO level would reduce the workload. However, if at the MPO level functional travel demand models are non-existent, developing a statewide travel model would be more difficult.

Opportunities for developing statewide travel models have expanded as more states are joining the efforts to build their own statewide travel models. Federal and state level guidelines and reliable data sources for statewide travel model development, calibration and validation tasks are available.

The following major federal guidelines/resources are available for development of statewide travel models:

- Guidebook of Statewide Travel Forecasting (1999)
- Transportation Research CircularE-C011: Statewide Travel Demand Forecasting (Conference Proceedings) (1999)
- NCHRP Report 8-43: Methods of Forecasting Statewide Freight Movements and Related Performances (2005)
- NCHRP Report 260: Application of Statewide Freight Demand Forecasting Techniques (1983)
- Statewide Travel Demand Models Peer Exchange (2004)
- NCHRP Report 365: Travel Estimation Techniques for Urban Planning (1998)

The following databases can be utilized as sources of input data for model development, calibration, and validation:

- American Travel Survey (1995)
- National Household Travel Survey (http://nhts.ornl.gov/2001/html_files/introduction.shtml).
- Commodity Flow Survey (2002) (http://www.bts.gov/programs/commodity_flow_survey/).
- Vehicle Inventory and Use Survey (2007) (www.census.gov/svsd/www/tiusview.html).
- Transborder Surface Freight Data (http://www.bts.gov/transborder/).
- Freight Analysis Framework (http://ops.fhwa.dot.gov/freight/freight_analysis/faf/).
- Census Transportation Planning Package (http://www.fhwa.dot.gov/ctpp/).
- Public Use Microdata Sample

The following resources from different states can be beneficial for states planning to develop or upgrade their statewide travel models:

- Connecticut Statewide Model: http://www.ct.gov/dot/cwp/view.asp?a=1383&q=259806.
- Florida Statewide Freight Model: webservices.camsys.com/freightmodel/freightmodel.htm.
- Ohio Statewide Model: http://www.dot.state.oh.us/urban/AboutUs/Statewide.htm.
- Oregon Statewide Model: http://www.oregon.gov/ODOT/TD/TP/TMR.shtml.

9.5 STATEWIDE AND REGIONAL/MPO TRAVEL MODELS

Table 18 shows comparisons between statewide and regional travel models in terms of focus, travel modes, and typical applications (ADOT 2009).

Table 18. Comparisons between Statewide and Regional Travel Demand Models

Factor	Statewide Travel Model	MPO Travel Model
Focus	Statewide	Regional/MPO level
Modes of Travel	• Highway • Transit • Intercity Rail • Air	• Highway • Transit • Urban Rail • Non-motorized
Applications	• Statewide Transportation Plan • External Travel for MPO regions • Support small & non-MPO areas • Freights/Goods movement • Intercity Corridor Studies • Economic Development Studies • Long-Distance Travel	• Regional Transportation Plan • Air Quality Conformity • Transit New Starts Requirements • Urban Corridor & Subarea Studies • Transportation Improvement Program • Transportation Demand Management • Microsimulation capability

9.6 INTEGRATION OF REGIONAL TRAVEL MODELS INTO STATEWIDE TRAVEL MODEL

Regional/MPO level travel demand models are considered to be a vital components of developing statewide travel demand models. State Transportation Agencies (STAs) and MPOs need to work closely with each other in developing and maintaining statewide and metropolitan travel models. The Transportation Research Board's (TRB) Special Report 288: Metropolitan Travel Forecasting: Current Practice and Future Direction (2007) highlighted combined efforts of State Transportation Agencies and MPOs on model development and metropolitan travel forecasting. The following collaborative efforts between STAs and MPOs were identified in the report:

- Sixteen states provide MPOs with formal guidance for model development and forecasting.
- Florida and Kentucky require that all MPOs use the same software for travel modeling.
- Fourteen states (Arkansas, Connecticut, Delaware, Georgia, Michigan, Montana, North Carolina, North Dakota, Ohio, Rhode Island, Texas, Virginia, Wisconsin, and Wyoming) are responsible for model development and forecasting for many or all MPOs in the state.
- Some states had formal guidelines, some had less formal minimum standards, and some provided training for MPO staff. In all these cases, the states had a clear intent to achieve uniformity of practice and quality assurance of the modeling work being done by the MPOs.

CHAPTER 10 MAJOR OUTCOMES OF THE STUDY

The travel demand forecasting technique is utilized by the majority of MPOs in the United States (85%). In Illinois, nine out of 12 small and medium sized MPOs currently utilize the TDM technique in various transportation and environmental planning related projects. All the existing functional travel models in small and medium sized MPOs in Illinois are traditional four-step (trip based) travel models, and improvements are needed at different extents for each of these travel models.

This study sought to establish a framework necessary for the development, maintenance, and application of small and medium sized MPOs' TDMs. It addressed the statewide travel modeling current practices in the United States and highlighted issues, opportunities and benefits of statewide modeling and the integration of state and regional (MPO level) travel demand models. Major outcomes of the study include the following:

A COMMON FRAMEWORK FOR DEVELOPMENT AND IMPLEMENTATION OF TDMS IN SMALL AND MEDIUM SIZED MPOS IN ILLINOIS

This study established a framework for developing travel demand models at the MPO regional level considering their limited available resources. Special attention was given to simplicity and accuracy of the travel model development process. Extensive calibration and validation checks were recommended, as accuracy of travel forecasting is of high importance. Resources available and support structures for TDM development and/or improvements, and implementations were also highlighted.

As an important part of this study, a statewide group, the Illinois Modeling Users Group (IL-MUG) was created to support, set standards and guide the development, implementation, and maintenance of travel demand models in small and medium sized MPOs in Illinois. The IL-MUG has been acting as a forum for the exchange of ideas, tips/techniques and issues involving the development, applications, and improvements of travel demand models utilized by the small and medium sized MPOs in Illinois.

ESTABLISHING FOUNDATION OF STATEWIDE TRAVEL DEMAND MODEL

The study provided the current status of statewide travel modeling practices across the United States and identified issues, opportunities, and resources pertinent to developing a statewide travel model. Regional (MPO level) travel models are important components of developing statewide travel models as a statewide travel model is formed through integration of regional travel models.

ENHANCING TRAFFIC FORECASTING CAPABILITIES OF EXISTING TDMS

The study prepared a set of specific recommendations targeted to enhance travel forecasting capabilities for each of the nine small and medium sized MPOs with functional travel demand models. The MPO specific recommendations were based on the regional-level analysis of needs, goals, and objectives specified in the MPO Long Range Transportation Plans. The most strongly recommended travel demand forecasting enhancement tools for the small and medium sized MPOs include:

- Addition of mode-choice model: The mode-choice model helps forecast transit and non-motorized trips for the urbanized area and helps analyze land use and infrastructure development scenarios targeted to promote sustainable, transit, and other active modes of transportation (e.g., walking, bicycling) oriented developments.

- Performing comprehensive calibration and validation checks for all the travel demand modeling steps utilizing the Federal Highway Administration's recommended guidelines.
- Preparing model documentation: Travel demand modeling steps and updated components should be documented for future reference. Calibration and validation checks for all the travel demand modeling steps should be appropriately documented.
- Addition of peak hour travel model: This model helps analyze congested conditions in the regional transportation network due to future anticipated traffic growth and land-use and infrastructure developments.
- Performing periodic updates of the travel demand model: The travel model steps should be periodically updated with newer input data and methods to keep the model compatible and consistent with the socio-economic and roadway capacity changes. The TDM base year should be periodically updated based on data availability. It is recommended to update the TDM steps during the LRTP update process.

ESTABLISHING AN EFFECTIVE TRANSPORTATION PLANNING TOOL FOR THE ILLINOIS DEPARTMENT OF TRANSPORTATION

The small and medium sized MPOs with newly developed and/or improved versions of existing travel demand models would provide better transportation planning tools for the Illinois Department of Transportation. This would lead to improved highway planning, and ultimately to a highway network better suited for Illinois' economic future.

CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

This study identified uses, benefits, and the level of functionality necessary for travel demand forecasting tasks for the small and medium sized MPOs in Illinois. It also listed resources necessary to develop, validate, maintain, and operate travel demand models for small and medium sized MPOs in Illinois. The study successfully created the Illinois Modeling Users Group (IL-MUG), which is acting as a group to support, facilitate information sharing, and provide guidelines related to travel demand forecasting activities in small and medium sized MPOs in Illinois. The study also identified benefits and opportunities for the development of statewide travel demand model for Illinois and the integration of the regional travel models (MPO travel models) into the statewide model.

Based on the study's literature reviews, survey data analysis, visions, goals, and objectives of the current Long-Range Transportation Plans of the small and medium sized MPOs in Illinois, current and upcoming federal and state policies and requirements for transportation planning projects, and available resources, this study recommends the following:

- Three small MPOs in Illinois: Danville Area Transportation Study, Kankakee Area Transportation Study, and Decatur Urbanized Area Transportation Study should develop functional travel demand models for their urbanized areas. Staff of these three MPOs, the Illinois Department of Transportation, and Illinois Modeling Users Group members should work together to pool resources necessary to develop, calibrate, and validate travel demand models (as outlined in Chapters 6 and 7) for these three MPOs.
- Nine small and medium sized MPOs in Illinois with existing functional travel demand models in place should update, improve, and validate their travel demand models (as described in Chapters 6 and 7) to enhance accuracy and travel forecasting capabilities.
- The Illinois Department of Transportation should establish a statewide program to promote and support travel demand modeling practices for regional and state level transportation planning projects in Illinois. This program will be tasked to:
    - Establish appropriate goals and responsibilities between MPOs and IDOT to advance travel forecasting practice in Illinois.
    - Facilitating resources for the small and medium sized MPOs to develop and/or improve their travel demand models.
    - Supporting the Illinois Modeling Users Group as a technical support and information sharing group for the small and medium sized MPOs in Illinois.
    - Adopt federal guidelines for travel demand model calibration and validation steps for regional travel demand models.
    - Promote peer reviews of existing regional travel demand models through the Illinois Modeling Users Group and the Travel Model Implementation Program of FHWA.
    - Promote partnership between state universities and Illinois MPOs through intergovernmental agreements to advance the research and practice of travel demand modeling in Illinois.
    - Develop and keep current a travel forecasting handbook to provide relevant information to travel demand modeling practitioners in Illinois.
    - Assist MPOs in examining data requirements for developing and validating travel demand models.
    - Support the development of a statewide travel demand model for Illinois.

REFERENCES

Arizona Department of Transportation, Travel Demand Modeling & Analysis Group- Statewide Travel Modeling: A Presentation to the Arizona Modeling Users Group, 2009.

Federal Highway Administration, Quick Reference Freight Manual II, FHWA-HOP-08-010, Federal Highway Administration, 2007.

Federal Highway Administration, Staffing and Administrative Capacity of Metropolitan Planning Organizations, FHWA, 2010a.

Federal Highway Administration, Travel Model Improvement Program- Travel Model Validation and Reasonability Checking Manual, Second Edition, prepared by Cambridge Systematics, Inc. for Federal Highway Administration, FHWA, 2010b.

Federal Highway Administration, Travel Model Improvement Program, TMIP Website: http://tmip.fhwa.dot.gov/community/user_groups/mug, accessed May 29, 2011.

Federal Highway Administration, Travel Model Improvement Program, Technical Synthesis: Feedback Loops, 2009.

Florida Department of Transportation, A Recommended Approach to Delineating Traffic Analysis Zones in Florida, prepared by Cambridge Systematics, Inc. in association with AECOM Consult for Florida Department of Transportation, Tallahassee, FL, 2007.

Horowitz, A.J., White Paper: Statewide Travel Demand Forecasting, prepared for Meeting Federal Surface Transportation Requirements in Statewide and Metropolitan Transportation Planning: A Conference, University of Wisconsin-Milwaukee, 2008.

Mescher, P., et a., The Iowa Statewide Travel Model: A Standard Model Development Process and Unique Approach, presented at the 88th Annual Meeting of the Transportation Research Board, TRB, 2009.

National Cooperative Highway Research Program, NCHRP Synthesis 358: Statewide Travel Forecasting Models, Transportation Research Board, TRB, 2006.

Transportation Research Board, NCHRP Report 187: Quick Response Urban Travel Estimation Techniques and Transferable Parameters, TRB, Washington DC, 1978.

Transportation Research Board, NCHRP Report 365: Travel Estimation Techniques for Urban Planning, TRB, Washington DC, 1998.

Transportation Research Board, Special Report 288: Metropolitan Travel Forecasting: Current Practice and Future Direction, TRB, Washington DC, 2007.

Transportation Research Board, Transportation Research Circular (#E-C075): Statewide Travel Demand Modeling: A Peer Exchange, Transportation Research Board, TRB, 2005.

Travel Model Improvement Program, Model Validation and Reasonableness Checking Manual, prepared by Barton-Aschman Associates, Inc. and Cambridge Systematics, Inc. for Federal Highway Administration, FHWA, 1997.

University of Florida Transportation Research Center, Trip Generation Characteristics of Special Generators, Gainesville, FL, 2010.

WilburSmith Associates, Statewide Travel Demand Models: Applications & Benefits, presented at the North Carolina Model Users Group, May, 2009.

APPENDIX A: MPO SURVEY

MPO Survey

Agency Name:

Mailing Address:

Executive Director:

Email:

Phone Number: Extension:

Travel Forecasting Manager:

Email:

Phone Number: Extension:

Name of Survey Respondent:

Title:

Email:

Phone Number: Extension:

MPO Description

1. Which states are involved in your MPO planning process?

- ☐ Illinois
- ☐ Iowa
- ☐ Wisconsin
- ☐ Missouri

2. What are the major agencies (e.g., cities, municipalities) participating in your MPO?

3. What is the area in square miles of your MPO region?

4. What is the 2000 census population of your MPO region?

5. Is any portion of your MPO region within the non-attainment for the following?

Ozone	☐ Yes	☐ No
CO	☐ Yes	☐ No
PM10	☐ Yes	☐ No

PM2.5 ☐ Yes ☐ No

NO_2 ☐ Yes ☐ No

6. In which year was your Long-Range Transportation Plan last updated?

7. What is the name of your current Long-Range Transportation Plan?

8. How often is your Long-Range Transportation Plan updated?

- ☐ Less than 3 years
- ☐ Every 3 years
- ☐ Every 4 years
- ☐ Every 5 years
- ☐ Every 6 years

9. Which agencies are involved in travel forecasting for your region for the Long-Range Transportation Plan?

- ☐ MPO (In-house)
- ☐ State (Which Department?)
- ☐ County
- ☐ Municipality

- ☐ Consultant (Name?)
- ☐ Other (Please specify)

Planning Tools

10. Is a travel demand model used in travel forecasting for the Long-Range Transportation Plan? If no, please specify what tool(s) are used for travel forecasting.

- ☐ Yes
- ☐ No

11. If you answered 'No' to the previous question, please indicate whether you are in the process of developing or planning to develop a travel demand model for your region.

- ☐ Yes
- ☐ No

12. Have you utilized or planning to utilize travel demand modeling tools for the following? Please check all that apply.

- ☐ New Starts and/or Small Starts Projects
- ☐ Major Corridor Study Projects
- ☐ Conformity Analysis
- ☐ Long Range Transportation Planning
- ☐ Transportation Improvement Programs (TIP)
- ☐ NEPA Analysis

13. Have you completed or are planning to conduct a household travel survey?

☐ Yes

☐ No

14. In which year was the household travel survey completed (or planning to be completed)? Please specify the year or write N/A.

15. What type of household travel survey was or is going to be completed by your MPO?

☐ Trip based

☐ Activity based

☐ Other (Please specify)

16. Have you utilized or are planning to utilize any of the following micro-simulation software for planning studies in your region? Please specify any additional software used and the type of studies for which each of the selected software was used in the comment box below.

☐ TRANSIMS

☐ CORSIM

☐ VISSIM

☐ AIMSUN

☐ PARAMICS

☐ SYNCHRO

Comments:

Travel Demand Model Description

17. Do you have in-house staff to maintain and apply the travel demand model for your region? If yes, please specify the number and type (e.g., transportation/traffic engineer/planner, IT specialist, etc.) of staff.

☐ Yes

☐ No

18. What type of travel demand model is used for travel forecasting?

☐ Trip based

☐ Activity based

☐ Other (Please specify)

19. Does your current travel demand model boundary include the entire MPO region?

☐ Yes

☐ No

20. Does your current travel demand model boundary include areas outside of your MPO region?

☐ Yes

☐ No

21. Which of the following sources of data are used for your travel demand model development? Please check all that apply.

- ☐ 2000 Census
- ☐ Census Transportation Planning Package (CTPP)
- ☐ Public Use Micro-Sample Data (PUMS)
- ☐ National Household Travel Survey
- ☐ Household Travel Survey
- ☐ License Plate Survey, Roadside Intercept Interviews, etc.
- ☐ Stated-Preference Survey
- ☐ Transit On-Board Survey
- ☐ Others (Please specify)

22. Which of the following components are included in your travel demand model? Please check all that apply.

- ☐ Trip Generation
- ☐ Trip Distribution
- ☐ Mode Choice
- ☐ Transit Assignment
- ☐ Highway Assignment
- ☐ Travel Time Feedback
- ☐ Post-processing for Speeds
- ☐ Post-processing for Design Volume
- ☐ Emission Analysis
- ☐ Others (Please specify)

23. Which of the following socio-economic demographics are forecasted for the long range transportation planning horizon   year? Please check all that apply.

☐ Yes

☐ Population

☐ Employment

☐ Households

☐ Workers in Households

☐ Household income

☐ Vehicle Ownership

☐ Other (Please specify)

24. Who performs the forecasts for the socio-economic demographics listed in the previous question?

☐ MPO (in-house)

☐ State

☐ Consultant

☐ Other

25. Do you have documentation of your travel demand model and model improvement plans for the future?

Model Validation

26. Which year was the current model last validated?

☐ No

27. What base year was used for model validation?

28. What data sources are used for model validation? Please check all that apply.

Data Sources	**Trip Generation**	**Trip Distribution**	**Mode Choice**	**Trip Assignment**
Decennial Census	☐	☐	☐	☐
Census Transportation Planning Package (CTPP)	☐	☐	☐	☐
Public Use Micro sample Data (PUMS)	☐	☐	☐	☐
National Household Travel Survey	☐	☐	☐	☐
Traffic Counts	☐	☐	☐	☐
Transit Counts	☐	☐	☐	☐
Others* (Please Specify)	☐	☐	☐	☐

Trip Generation

29. What is the time period used for the trip generation model?

☐ 24-Hour

☐ Peak/Off-Peak Period

☐ Others (Please specify)

30. What trip generation approach is used?

- ☐ Trip Based
- ☐ Tour/Activity Based
- ☐ Others (Please specify)

31. What type of trip generation model is used? Please check all that apply.

- ☐ Regression
- ☐ Cross Classification
- ☐ Others (Please specify)

32. What trip purposes are included in your model? Please check all that apply.

- ☐ Home Based Work
- ☐ Home Based Retail
- ☐ Home Based non-Retail
- ☐ Home Based School
- ☐ Home Based College/University
- ☐ Non-Home Based
- ☐ Home Based Other
- ☐ Others (Please specify)

Trip Distribution

33. What is the time period used for trip distribution model?

- ☐ 24-Hour
- ☐ Peak/Off-Peak Period
- ☐ Others (Please specify)

34. What type of trip distribution model is used?

- ☐ Gravity Model
- ☐ Destination Choice (Logit)
- ☐ Others (Please specify)

Mode Choice

35. What is the time period used for the mode-choice model?

- ☐ 24-Hour
- ☐ Peak/Off-Peak Period
- ☐ Others (Please specify)

36. Which modes are included in the mode-choice model? Please check all that apply.

- ☐ Auto (Generic)
- ☐ Drive Alone
- ☐ Auto Passenger
- ☐ Two-Person Auto
- ☐ Two or more person Auto
- ☐ Three Person Auto
- ☐ Three or more Person Auto
- ☐ Transit (Generic)
- ☐ Local Bus
- ☐ Express Bus
- ☐ Bus Rapid Transit
- ☐ Light Rail
- ☐ Commuter Rail
- ☐ Walk to Transit
- ☐ Bike to Transit
- ☐ Walk
- ☐ Bike
- ☐ Others (Please Specify)

37. What type of mode-choice model is used?

- ☐ Diversion Curves
- ☐ Regression Equations
- ☐ Multinomial Logit
- ☐ Nested Logit
- ☐ Others (Please Specify)

Trip Assignment

38. What time periods are used for highway trip assignment?

- ☐ 24-Hour
- ☐ Peak/Off-Peak Period
- ☐ Others (Please specify)

39. What assignment method is used for highway trips?

- ☐ All-or-Nothing
- ☐ Equilibrium
- ☐ Iterative Capacity Restrained
- ☐ Incremental Capacity Restrained
- ☐ Others (Please Specify)

40. Are transit trips assigned in your model?

☐ Yes

☐ No

41. What time periods are used for transit trip assignment?

☐ 24-Hour

☐ Peak/Off-Peak Period

☐ Others (Please specify)

42. What assignment method is used for transit trips?

☐ Iterative Capacity Restrained

☐ Incremental Capacity Restrained

☐ Others (Please Specify)

Other Model Features

43. Are truck trips modeled?

☐ Yes

☐ No

44. What type of model is used for truck trips?

☐ Growth Factors

- ☐ Fratar
- ☐ Synthetic O-D Table
- ☐ Others (Please Specify)

45. Does your model include modeling of toll roads?

- ☐ Yes
- ☐ No

46. Does your model include modeling of HOV lanes?

- ☐ Yes
- ☐ No

47. Which of the following components of your model get feedback from highway and transit travel times? Please check all that apply.

- ☐ Land Use
- ☐ Trip Generation
- ☐ Trip Distribution
- ☐ Mode Choice
- ☐ Others (Please Specify)

48. Please list any other additional features of your model.

Other

49. Are you currently working on or planning to move towards activity/tour based modeling from the current four-step travel modeling?

☐ Yes

☐ No

50. What are the best features of your travel demand model?

51. What features of your travel demand model are most in need of improvement?

52. What software packages are used for your travel demand modeling?

- ☐ Tranplan
- ☐ TP+
- ☐ Mode Choice
- ☐ CUBE/Voyager
- ☐ TransCAD
- ☐ EMME
- ☐ TRANSIMS
- ☐ VISUM
- ☐ QRS II
- ☐ TMODEL
- ☐ Others (Please specify)

53. Please list any additional comments you may have about the survey or about travel demand modeling.

Survey Responses

APPENDIX B: DIGITAL DATA LICENSE AGREEMENTS

Champaign County Regional Planning Commission

DIGITAL DATA LICENSING AGREEMENT

CHAMPAIGN COUNTY REGIONAL PLANNING COMMISSION (CCRPC)
1776 E. Washington Street
Urbana, IL 61802
Phone: 217-328-3313 - Fax: 217- 328-2426
http://www.ccrpc.org

THIS AGREEMENT is a license and is made and entered into by and between the Champaign County Regional Planning Commission (hereafter referred to as "MPO") and _________________________(hereafter referred to as "User") for the use of the "CUUATS Travel Demand Model" (See Appendix I) from the Champaign County Regional Planning Commission. Consistent with the MPO's copyright, trade secret, and other intellectual property rights, the MPO hereby grants, and the User hereby accepts, a non-exclusive, non-transferable, revocable license to use the "CUUATS Travel Demand Model", subject to the restrictions and limitations set forth in this Agreement.

WHEREAS, the MPO is the developer of the "CUUATS Travel Demand Model" specified in the Agreement with the right to license and distribute the "CUUATS Travel Demand Model", and

WHEREAS, the User desires a license to use the "CUUATS Travel Demand Model" and the MPO desires to grant such a license to the User for the sole purpose of permitting the user to use the "CUUATS Travel Demand Model" for the ___________________________________ and for no other purpose whatsoever;

NOW, THEREFORE, in consideration of mutual terms, covenants, and conditions set forth herein, the parties hereto agree as follows:

I. USE

A. Permitted Uses By The User:

1) The User may make internal copies of the "CUUATS Travel Demand Model" solely for the purpose of supporting the User for the agreed upon activity;
2) The User may make hard copies of the "CUUATS Travel Demand Model" solely for the purpose of supporting the User for the agreed upon activity. This shall not restrict the User from making hard copies for public and non-commercial use.

B. Restrictions On Use:

1) Unauthorized Use. The User shall not sell, loan, rent, assign, distribute or otherwise transfer the "CUUATS Travel Demand Model" in any digital form or format, (including, but not limited to, networks, timesharing, or multiple **c**entral **p**rocessing **u**nit (CPU) arrangements).
2) Copies. The User shall not duplicate the "CUUATS Travel Demand Model" in digital format except as provided by the Agreement. This User may translate the "CUUATS Travel Demand Model" into other digital formats. These "conversions" shall be

subject to the same restrictions as the "CUUATS Travel Demand Model" under this Agreement.

3) The User agrees to only do changes to the model input (population, employment, TAZ configuration, roadway network).
4) The User cannot make changes to the mathematical equations and parameters and programming code used to create the model.
5) The User will make clear to the general public via a printed and/or verbal disclaimer statement that the transportation model created when doing the changes to the TAZ configuration and roadway network is a new model different than the CUUATS model created for the development of the Long Range Transportation Plan (LRTP).
6) The User agrees to provide the new model to MPO staff at the end of the process.

C. Reserved Rights:

The MPO shall retain all rights, title and interest in the "CUUATS Travel Demand Model" and subsequent digital copies, and any and all derivative works, including the right to license the "CUUATS Travel Demand Model" covered by this license to other users.

II. LIMITED WARRANTY

A. Limited Warranty

1) The MPO shall use its best efforts to ensure that the "CUUATS Travel Demand Model" is delivered free of physical defect.

2) The MPO shall have the sole authority to determine whether the "CUUATS Travel Demand Model", at time of delivery, was free of physical defect.

3) THE "CUUATS TRAVEL DEMAND MODEL" IS PROVIDED "AS IS" WITHOUT WARRANTY OR ANY REPRESENTATION OF ACCURACY, TIMELINESS OR COMPLETENESS. THE BURDEN FOR DETERMINING ACCURACY, COMPLETENESS, TIMELINESS, MERCHANTABILITY AND FITNESS FOR OR THE APPROPRIATENESS FOR USE RESTS SOLELY ON THE USER. THE CHAMPAIGN COUNTY REGIONAL PLANNING COMMISSION MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AS TO THE USE OF THE "CUUATS TRAVEL DEMAND MODEL". THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE USER ACKNOWLEDGES AND ACCEPTS THE LIMITATIONS OF THE "CUUATS TRAVEL DEMAND MODEL", INCLUDING THE FACT THAT THE "CUUATS TRAVEL DEMAND MODEL" IS DYNAMIC AND IS IN A CONSTANT STATE OF MAINTENANCE, CORRECTION AND UPDATE. THE USER ALSO ACKNOWLEDGES AND ACCEPTS THE TERMS AND CONDITIONS OF ANY DISCLAIMERS WHICH MAY ACCOMPANY THE "CUUATS TRAVEL DEMAND MODEL".

B. Liability

The MPO shall not be liable for any activity involving the "CUUATS Travel Demand Model" with respect to the following:

1) Lost profits, lost savings, consequential damages or any other damages;
2) The fitness of the "CUUATS Travel Demand Model" for a particular purpose;
3) The installation of the "CUUATS Travel Demand Model", its use or the results obtained.

C. Remedy

1) User's sole and exclusive remedy for breach of this limited warranty will be to return the "CUUATS Travel Demand Model" within 60 days of receipt.

III. ASSIGNMENT AND TRANSFER

User shall not disclose, lease, sell, distribute, make, transfer, sublicense or assign the "CUUATS Travel Demand Model" or engage in any other transaction which has the effect of transferring the right of use or part of the "CUUATS Travel Demand Model" without prior consent of the MPO.

IV. TERM

A. The term of this agreement shall not be restricted to time except as set forth in paragraph (b) below and shall commence the date the Agreement is executed.
B. The term of the license shall expire at such time the User discontinues use of the "CUUATS Travel Demand Model" unless the User fails to comply with any of the terms and conditions provided herein at which time the license shall be revoked. The license shall be revoked by the MPO given written notice of such revocation to the User.

V. TERMINATION

This agreement and the User's right to use the "CUUATS Travel Demand Model" automatically terminate if it fails to comply with any provision of this Agreement. Upon termination the User shall return all copies of the "CUUATS Travel Demand Model" to the MPO or destroy all copies, in part and in whole, as directed by the MPO.

VI. CREDIT

Any hard copies utilizing any of the "CUUATS Travel Demand Model" shall clearly indicate the source. If the User has modified the data in any way they are obligated to describe the types of modifications they have performed in a document and provide that document to MPO staff. The User specifically agrees not to misrepresent any data, nor to imply that changes made were approved by MPO staff.

VII. CERTIFICATION

A User may request that the MPO certify their results from use of the "CUUATS Travel Demand Model" as conforming to the original design and/or to any data supplied by the MPO. The MPO reserves the right to certify or to decline to certify any results from use of the "CUUATS Travel Demand Model".

VIII. MAINTENACE

The MPO staff is not obligated to maintain the final model under any circumstances, unless the Agency contracting with the User agrees to pay a fee for that service.

IX. INDEMNIFICATION

The User agrees to indemnify and hold harmless the MPO against any and all claims, actions, demands, and damages brought by any third parties or persons against the MPO based on, or arising from, the acts of User done in performance of this agreement or from the User's use of the "CUUATS Travel Demand Model", including costs of defense and attorney fees.

X. GENERAL

A. The parties agree and stipulate that in the event of a dispute, jurisdiction shall reside in the State of Illinois, and this Agreement will be governed and controlled by the laws of the State of Illinois.

B. If any provision(s) of this Agreement shall be held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall not, in any way, be affected or impaired thereby.

This Agreement is subject to the terms and conditions set forth above. This instrument contains the entire Agreement between the parties, and no statement, promises, or inducement by either party or agent of either part that are not contained in this written contract shall be valid or binding.

Under the terms and conditions listed in the above Agreement, the following data is requested:

____

In witness whereof, this Agreement is executed on the date set forth under the party's names.

Champaign County Regional Planning Commission	**User:** ___________________________
Title: ___________________________	Title: ___________________________
Name: __________________________	Name: __________________________
Signature: _______________________	Signature: ________________________
Date: ___________________________	Date: ___________________________

APPENDIX I

MPO Staff Use Only:

Files transferred via:

_____ E-mail

_____ CD-Rom

_____ Diskette

_____ Zip Disk

_____ Other

File Name	File Type

DIGITAL DATA LICENSING AGREEMENT

SPRINGFIELD-SANGAMON COUNTY REGIONAL PLANNING COMMISSION

200 South Ninth Street – Room 212
Springfield, IL 62701
Phone: 217-535-3110 - Fax: 217- 535-3111
www.sscrpc.com

THIS AGREEMENT is a license and is made and entered into by and between the Springfield-Sangamon County Regional Planning Commission (hereafter referred to as "Commission") and **INSERT USER NAME** (hereafter referred to as "User") for the use of data files and TransCAD files from the Sangamon County Travel Demand Model ("Model") from the Commission. Consistent with the Commission's copyright, trade secret, and other intellectual property rights, the Commission hereby grants, and the User hereby accepts, a non-exclusive, non-transferable, revocable license to use the Model, subject to the restrictions and limitations set forth in this Agreement.

WHEREAS, the Commission is the owner of the Model specified in the agreement with the right to license and distribute the Model, and

WHEREAS, the User desires a license to use the Model and the Commission desires to grant such a license to the User for the sole purpose of permitting the user to use the Model for the agreed upon activity and for no other purpose whatsoever;

NOW, THEREFORE, in consideration of mutual terms, covenants, and conditions set forth herein, the parties hereto agree as follows:

I. USE

C. Permitted Uses By The User:

1) The User may make internal copies of the Model solely for the purpose of supporting the User for the agreed upon activity;
2) The User may make hard copies of the Model solely for the purpose of supporting the User for the agreed upon activity. This shall not restrict the User from making hard copies for public and non-commercial use.

D. Restrictions On Use:

1) The Commission shall not be responsible to the User for such hardware or software as may be needed to access and/or utilize the Model provided pursuant to this Agreement.
2) The User shall not sell, loan, rent, assign, distribute or otherwise transfer the Model in any digital form or format, (including, but not limited to, networks, timesharing, or multiple CPU arrangements).
3) The User shall not duplicate the Model in digital format except as provided by the Agreement. The User may translate the Model into other digital formats. These "conversions" shall be subject to the same restrictions as the Model under this Agreement.
4) The User hereby acknowledges and agrees that it will honor all applicable copyrights and such other proprietary claims as shall apply to the Model provided pursuant to this Agreement.

5) The User will make clear to the general public via a printed and/or verbal disclaimer statement that any and all modifications made to the Model constitute a different Model than the Model provided by the Commission.
6) The User agrees to provide the new Model including the Model equations, parameters and scripts (code) to Commission staff at the end of the process.

C. Reserved Rights:

The Commission shall retain all rights, title and interest in the Model and subsequent digital copies, and any and all derivative works, including the right to license the Model covered by this license to other users.

II. LIMITED WARRANTY

D. Limited Warranty

The User hereby acknowledges and agrees that the Commission makes no warranty, express or implied, including the warranties of merchantability or fitness for a particular purpose, regarding the Model data provided pursuant to this agreement, nor assumes any liability or responsibility for the accuracy, functionability, completeness, or usefulness thereof.

The User hereby acknowledges and agrees that the Model data provided pursuant to this Agreement is subject to constant change and is provided "as is," with all faults, and without warranty of any kind as to its accuracy, completeness, or correctness.

The User hereby acknowledges and agrees to assume any and all risk as to the quality, performance, and usefulness of the Model data provided pursuant to this Agreement.

E. Liability

The Commission shall not be subject to liability to the User for human errors, defects, failure of machines, or any material used in connection with the machines, including, but not limited to, tapes, disks, and energy. The Commission shall not be subject to liability to the User for damages including, but not limited to, lost profits or consequential damages, or claims against the User by third parties.

The User hereby acknowledges and agrees that the Commission, its officers, agents, consultants, contractors, and employees are hereby released from any and all claims, actions, causes of action for damages, including, but not limited to, the costs of recovering, reprogramming, or reproducing any information or data, damage to property, damages for personal injury, lost savings, or other special, incidental, or consequential damages arising from the use of, or inability to use, the Model data provided herein.

III. ASSIGNMENT AND TRANSFER

The User shall not disclose, lease, sell, distribute, make, transfer, sublicense or assign the Model or engage in any other transaction which has the effect of transferring the right of use or part of the Model without prior consent of the Commission.

IV. TERM

The User shall have the right to use the Model in conformance with the terms and conditions of this Agreement until INSERT DATE, with such extensions as may be allowed by the Commission in writing.

All rights afforded the User under this Agreement shall terminate as of the date provided in Section IV, Paragraph 1 herein, and the User shall return all Model data provided pursuant by the Commission pursuant to this Agreement within thirty (30) days of the date of termination, as provided in this Paragraph. The User hereby acknowledges and agrees that it shall not retain a copy of said Model data.

V. TERMINATION

This agreement and the User's right to use the Model automatically terminate if it fails to comply with any provision of this agreement. Upon termination the User shall return all copies of the Model to the Commission or destroy all copies, in part and in whole, as directed by the Commission.

VI. CREDIT

Any hard copies utilizing any of the Model shall clearly indicate the source. If the User has modified the data in any way they are obligated to describe the types of modifications they have performed in a document and provide that document to Commission staff. The User specifically agrees not to misrepresent any data, nor to imply that changes made were approved by Commission staff.

VII. CERTIFICATION

A User may request that the Commission certify their results from use of the Model as conforming to the original design and/or to any data supplied by the Commission. The Commission reserves the right to certify or to decline to certify any results from use of the Model.

VIII. MAINTENACE

The Commission staff is not obligated to maintain the final Model under any circumstances, unless the Agency contracting with the user agrees to pay a fee for that service.

IX. INDEMNIFICATION

The User hereby acknowledges and agrees to indemnify and hold harmless the Commission, its officers, agents, consultants, contractors, and employees from any and all liability, claims, or damages arising from or related to the User's use of Model data provided herein, including, but not limited to, the use or inability to use same. This indemnification of the Commission by the User shall survive the termination of this Agreement.

X. GENERAL

This Agreement, and all actions arising from it, shall be governed by, subject to, and construed in accordance with the laws of the State of Illinois.

This agreement is subject to the terms and conditions set forth above. This instrument contains the entire agreement between the parties, and no statement, promises, or inducement by either party or agent of either part that are not contained in this written contract shall be valid or binding.

Under the terms and conditions listed in the above agreement, the following data is requested: __________

In witness whereof, this agreement is executed on the date set forth under the party's names.

SPRINGFIELD-SANGAMON COUNTY REGIONAL PLANNING COMMISSION	**INSERT USER NAME**
Title: ____________________________	Title: ____________________________
Name: ___________________________	Name: ___________________________
Signature: ________________________	Signature: _________________________
Date: ____________________________	Date: ____________________________