The Travel Model Improvement Program

Summary Report

Chattanooga-Hamilton County-North Georgia Transportation Planning Organization (CHCNGA-TPO)
(MPO for Hamilton County, Tennessee & Portions of Catoosa, Dade and Walker Counties, Georgia)

Travel Demand Model Peer Review

Chattanooga, TN
May 23, 2011

Helping Agencies Improve Their Planning Analysis Techniques

TMIP
Travel Model Improvement Program

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Appendices

Disclaimer

The views expressed in this document do not represent the opinions of the Federal Highway Administration (FHWA) and do not constitute an endorsement, recommendation or specification by FHWA. The document is solely a summary of the discussions that took place during the peer review session and supporting technical documentation provided by the peer review host agency.

Acknowledgements

The FHWA wishes to acknowledge and thank the members of the peer review panel for volunteering their time to participate in the discussion of the Chattanooga-Hamilton County-North Georgia Transportation Planning Organization (CHCNGA-TPO) travel demand model and for sharing their valuable insight and experience.

The Peer Review Panel Members were:

Chandra Bhat (University of Texas)
Mei Chen (University of Kentucky)
Jerry Everett (University of Tennessee)
Brian H. Y. Lee (University of Vermont)
Matt Noonkester (Seven Hills Town Planning Group, Inc.)
Guy Rousseau (Atlanta Regional Commission)

Due to transportation issues, Dr. Bhat was unable to attend the peer review panel meeting in person, but did provide a few comments via telephone.

A brief biography for each member of the peer review panel is presented in Appendix C.

Report Organization

This summary report is organized into the following sections:

- **Report Purpose** – Overview of the purpose of this report, including an introduction to the peer review process and the objectives of the peer review
- **CHCNGA-TPO Responsibilities** – Planning responsibilities of CHCNGA-TPO
- **Regional Characteristics** – Introduction to the regional characteristics (demographics, land use and transportation) of the CHCNGA-TPO region
- **Travel Demand Model** – A brief history of travel demand modeling at the CHCNGA-TPO including a discussion of the current model and recent data collection efforts
- **Questions for Peer Review Panelists** – A summary of technical questions posed by CHCNGA-TPO staff to be answered by the peer review panel
- **Recommendations from the Peer Review Panel** – Peer review panel recommendations, including general comments and responses to technical questions

In addition, there are three appendices to the summary report. Appendix A is a list of peer review participants, Appendix B is the peer review meeting agenda, and Appendix C contains brief biographies for each of the peer review panel members.

Report Purpose

This report summarizes a peer review of the CHCNGA-TPO travel demand model and proposed land use model. The peer review was supported by the Travel Model Improvement Program (TMIP), which is sponsored by FHWA. The peer review of travel model and land use models can serve multiple purposes, including identification of model deficiencies, recommendations for model enhancements, and guidance on model applications. Given the increasing complexities of travel demand and land use forecasting practices and the growing demands by decision-makers for

information about policy alternatives, it is essential that travel demand and land use forecasting practitioners have the opportunity to share experiences and insights. The TMIP-supported peer review provides a forum for this knowledge exchange.

The CHCNGA-TPO has a goal of having an integrated land use and travel demand model that:

- meets federal, state, and local needs and requirements,
- is consistent with the current state of professional practice,
- is an affordable and useful planning tool,
- can be productive in two years, and
- can be reasonably maintained in-house

The CHCNGA-TPO's motivation for seeking a TMIP peer review was to obtain guidance that would help them in achieving their travel and land use modeling goal. In this context, the CHCNGA-TPO was seeking input on the following:

1. Establishing the best appropriate design structure for the Travel Demand Model (TDM) and Land Use Model (LUM)

2. Identifying critical activities and milestones for the TDM update and creation of the LUM

3. Identifying critical activities and milestones for the interaction between the TDM and the LUM

4. Evaluating the level of consultant involvement to achieve the scope of work for the TDM and LUM update to ensure calibration to federal standards and optimize technological transfer for the CHCNGA-TPO staff

CHCNGA-TPO Responsibilities

The CHCNGA-TPO is the federally designated Metropolitan Planning Organization (MPO) for Hamilton County in Tennessee and the northern portions of Dade, Walker, and Catoosa Counties in Georgia. Its purpose is to carry out the metropolitan transportation planning activities for these areas. The CHCNGA-TPO is managed by the Chattanooga-Hamilton County Regional Planning Agency and produces three main products: the Unified Planning Work Program, the Long Range Transportation Plan, and the Transportation Improvement Program. The CHCNGA-TPO also evaluates traffic congestion, air quality, mobility, and alternative transportation modes. In addition to working with federal agencies and member jurisdictions (15 cities and 4 counties), the CHCNGA-TPO works closely with the following public agencies in the region who have an interest in or are users of the travel demand model:

Regional Agencies

- Chattanooga Area Regional Council of Governments / Southeast Tennessee Development District
- Coosa Valley Regional Development Center
- Chattanooga Area Regional Transportation Authority
- Georgia Regional Transportation Authority

State Agencies

- Tennessee Department of Transportation
- Tennessee Department of Environment and Conservation
- Georgia Department of Transportation
- Georgia Environmental Protection Division

The CHCNGA-TPO travel demand model serves as the primary forecasting tool for

the jurisdictions in the Chattanooga-Hamilton County-North Georgia region.

Regional Characteristics

The 2007 and estimated 2035 number of households, population, and employment for the CHCNGA-TPO region are summarized in the table below.

Category	2007	2035	Growth
Households	178,557	252,148	41%
Population	425,724	593,335	39%
Employment	218,612	305,061	40%

Approximately 80% of the region's population is in Hamilton County. Nearly 50% of the Hamilton County population is in Chattanooga.

There are a couple of geographic features in the area that are barriers to east-west travel in the region. The Tennessee River generally runs north-south through Hamilton County. There are five bridge crossings in the county, all of which are in the general Chattanooga area. There is another bridge just north of the county line, resulting in a 28 mile section of the river with no crossing. Missionary Ridge is a north-south ridge several hundred feet high that runs through Chattanooga from northern Georgia to nearly the Tennessee River. It is crossed by three tunnels and two at-grade roadways, including I-24 (which has grade and speed issues that affect traffic performance).

The model region includes three interstate freeways (I-75, I-24, and I-59) and eight US highways. Interstate 75 is the main north-south facility in the region and connects to Atlanta, GA in the south and Knoxville, TN in the north. Interstate 24 intersects I-75 on the east side of Chattanooga and travels west through Chattanooga before turning northwest to Nashville, TN. Interstate 59 intersects I-24 west of Chattanooga and heads southwest to Birmingham, AL.

Travel Demand Model

This section briefly describes the history of the CHCNGA-TPO travel model and the current version of the model.

Previous Model Versions

The original CHCNG-TPO travel model was built and run on the MINUTP platform. The model utilized a simple "stick" roadway network and had a course zone system. In 2002 a major data collection effort was performed that included a household survey and an external roadside intercept survey. Data from these sources along with imported data from other regions were used in the early 2000s to convert the travel model to a TransCAD platform with a base year of 2000 and a horizon year of 2030.

The 2000 / 2030 model included a trip generation cross-classification scheme and auto occupancy factors for a highway only mode choice model. Trip rates from the national Quick Response Freight Manual were used for generation of truck trips. The external survey was determined to have been fundamentally flawed by not interviewing mainline vehicles. As such, data from the MINUTP model was adjusted and used for the 2000 / 2030 model. The updated model also included numerous traffic analysis zone (TAZ) splits, resulting in a total of 450 zones, 420 internal and 30 external. The model also had a true shape network with additional detail. The model was a daily model, but included an optional time-of-day model based on temporal distribution data from the household survey. This version of the model was used to produce the 2030 Long Range Transportation Plan (LRTP).

Current Model Version

In the late 2000s the travel demand model was updated again to a 2007 base year and 2035 horizon year. This model version included additional TAZ splits resulting in a total of 628 zones, 590 internal and 38 external. The socioeconomic data inputs

were completely updated. An air quality post processor was implemented using Mobile 6 inputs. This version of the model was used to prepare the 2035 LRTP and was the subject of this peer review.

The 2007 / 2035 model utilizes the same trip production rates that were used in the 2000 / 2030 model. Trip attraction rates were borrowed from the Knoxville Regional Transportation Planning Organization travel demand model. Special generators were used for the airport along with key recreational, educational, and retail facilities.

In the trip distribution module, K-factors are utilized for trips crossing the Tennessee River and the Tennessee / Georgia state line. These K-factors and travel time penalties on Tennessee River bridges were utilized to match observed data. An attempt was made to use household survey data results to develop friction factors, but ultimately it delivered unsatisfactory results. Instead friction factors from the MINUTP model were modified to match average trips lengths.

Mode choice in the CHCNGA model does not include a transit component. Instead, the mode choice module has a vehicle occupancy allocation component that disaggregates vehicles trips by single occupancy vehicles, high occupancy vehicles (HOV), and heavy vehicles. This allows for the analysis of HOV or truck-only lanes.

The highway assignment module is very similar to that of the 2000 / 2030 model. However, the number of locations with count data increased such that nearly 10% of all links had traffic counts associated with them. Adjustments to centroid locations, speeds, capacities, K-factors, and other trip distribution parameters were adjusted to calibrate and validate the model.

Data Collection to Support the Model

Over the last few years the CHCNGA-TPO has collected a lot of data that will be useful in updating the travel model. Recent data collection activities include:

- Household Travel Survey
- On-board Transit Survey
- Bike and Pedestrian Counts
- External Origin & Destination Data
- Traffic Volume, Travel Time, & Speed Data
- Freight Study
- Regional Building Permit, Subdivision, and Rezoning Data
- Regional Land Use Data

A brief summary of each data collection activity follows.

Employment Data

One of the questions posed by the CHCNGA-TPO was regarding available sources for employment data. They compared the number of businesses among data obtained from the Quarterly Census of Employment and Wages (QCEW), the U.S. Postal Service, InfoUSA (private data source), and Dun & Bradstreet (private data source). Compared to the QCEW they found the other three data sources to be two to four times higher. This discrepancy in employment data was of concern to the CHCNGA-TPO.

Bicycle and Pedestrian Data

The CHCNGA-TPO has been collecting bicycle and pedestrian data for about 10 years. This data has been obtained via various methods, including automated counters. The data collection effort has been focused on key corridors that have a lot of non-motorized traffic, which is predominantly in recreation areas. The CHCNGA-TPO would like to know how to improve non-motorized data collection that will support travel modeling.

On-Board Transit Survey Data

The transit on-board survey was conducted in November 2010 and included all of the fixed route and dial-a-ride service with the exception of the free downtown circulator. With this data in hand, the CHCNGA-TPO was looking for guidance on how best to expand the survey results to facilitate route level analysis and forecasting.

Travel Time / Speed Data

Travel time / speed data was collected by a third-party firm that was able to track individual cell phones through the roadway system. This was done by using a series of relatively small grid cells to keep track of individual phones. A limitation of this approach was data contamination by traffic on nearby parallel facilities that fell within the same grid cell. The raw data had to be statistically post-processed to resolve the contamination issue.

External Origin / Destination Data

External origin / destination data was collected in much the same manner as the travel time / speed data. Cell phone data was used to track external movements. The region was divided into grid cells (larger than those used for the travel time / speed) and the movements of individual cell phones were tracked through the network. The resulting matrix will need data manipulation before it is ready for use in the travel model.

Traffic Volume Data

The CHCNGA-TPO has been actively collecting additional roadway volume data for use in model calibration and validation. In addition to gathering available data from the Tennessee and Georgia DOTs, they have collected their own supplemental data at 140 locations. These counts have also supplied valuable vehicle classification data.

Freight / Heavy Vehicle Data

The freight study took a closer look at the quantity of heavy vehicle movements through the region and their impact on the highway system. Over 75% of the freight that moves through the region does so via trucks. Heavy vehicle volumes are particularly high on I-75 where over 60% of the trucks appear to be through trips. These large truck volumes affect the capacity of the roadway system.

Desired Model Enhancements

The CHCNGA-TPO would like to improve its travel demand model and to develop of companion land use model. They would like to use these models to measure and evaluate the impacts of several regional planning initiatives; including the use of scenario planning to contemplate alternative futures for the region and the trade-offs between them.

Land Use Model

The CHCNGA-TPO has been evaluating commercially available land use models and is considering CommunityViz and UrbanSim. These two land use model software packages can serve different purposes and cannot be directly compared. A brief summary of each land use model follows.

CommunityViz

CommunityViz is a GIS-based sketch planning tool useful for short-term evaluations of difference land use scenarios at a project, neighborhood, or municipal level. It is developed by Placeways, LLC in partnership with the Orton Family Foundation and functions as an ArcGIS plug-in. It uses a role-based framework that allows users to specify development constraints, land use plans, suitability and weighting factors, place types, etc. The model will then allocate development based on these parameters. It is relatively easy to use and allows for quick comparison of scenarios. Additional information regarding CommunityViz can be found at *www.communityviz.org*.

UrbanSim

UrbanSim is an open source land use modeling and simulation system that can be used for medium to long term forecasting at a regional level. It was designed by Paul Waddell of the University of California, Berkeley. The UrbanSim software is implemented in Python and is packaged with a graphical user interface that collectively are referred to as the Open Platform for Urban Simulation (OPUS). OPUS provides predictions of potential outcomes of different transportation investments and land use policies. Being a simulation program, OPUS requires a great deal of data and time to be successfully implemented. Additional information regarding UrbanSim can be found at *www.urbansim.org*.

Travel Demand Model

The CHCNGA-TPO would like to incorporate a more robust mode choice model into the overall travel model. They would like to effectively model non-motorized travel, which would be further disaggregated to walk and bicycle trips. For motorized trips they would like to be able to model transit, both local and premium services. They would like to model walk and drive access to transit with the drive access being distinguished by park-and-ride or kiss-and-ride.

The CHCNGA-TPO has interest in the "complete streets" concept where autos, transit, bicycles, and pedestrians all share the same roadway corridor. The CHCNGA-TPO would like to be able to do a better job of evaluating / modeling these types of corridors.

Model Integration

The CHCNGA-TPO would like to integrate the land use and travel demand models so that the results from one model can be readily implemented in the other. This is fairly straightforward in taking land use data and implementing it in the travel model, but becomes more complicated when taking travel model data and implementing it in the land use model. They have given consideration to some type of "accessibility index" that would measure the accessibility of an area (i.e. parcel, TAZ, etc.) by transportation mode.

Through the use of a land use model and the travel demand model the CHCNGA-TPO wants to develop sustainability and transportation performance measures that can be used to evaluate a given scenario's economic, environmental, equity benefits / impacts.

Questions for Peer Review Panelists

Prior to the peer review event, CHCNGA-TPO staff prepared a list of questions to guide the discussion during the peer review. These questions are summarized below, and discussed in detail in subsequent sections of this report.

Data Collection

Questions regarding data collection were:

- How best to improve non-motorized data collection to support travel modeling?
- Which data source and methodology would be best for estimating and forecasting employment?
- Which methodology would be best for to expanding the on-board survey results to facilitate route level analysis and forecasting?

Updating Highway Component of the TDM

Questions regarding updating the highway component of the travel model were:

- Should the re-validation of the highway component wait until the transit and non-motorized components are in place?
- Should the model be able to forecast toll trips?

- Should the model consider gas prices in mode choice?
- If transitioning to an activity-based model, should land use and travel model development tasks be performed simultaneously or sequentially?

Adding Transit / Non-motorized Forecasting to the TDM

Questions regarding adding transit / non-motorized forecasting to the travel demand model were:

- Should assessments of the reasonableness of transit forecasting be by route, stop, and time of day?
- How should the reasonableness of non-motorized forecasting be assessed?
- How can the model best be used to analyze Transportation Demand Management or complete streets concepts?

Land Use Model

Questions regarding a land use model were:

- How can decisions of stakeholders that influence development be modeled without relying on a land use simulation model?
- How are land use models calibrated and validated?
- What are the barriers to developing a land use simulation model?
- How can the real world impact and corresponding land use changes for a scenario be evaluated?
- How can the land use model be optimized to reduce run time while maintaining model quality?

Integration of LUM and TDM

Questions regarding the integration of a land use model and the travel demand model were:

- How can the separate models best be integrated when they are running on different software platforms?
- What accessibility measures should flow from the TDM to the LUM and how will they account for the various travel modes?
- What demographic measures should flow from the LUM to the TDM?
- How can the integration of the two models be validated / tested?

Recommendations from the Peer Review Panel

Recommendations from the peer review panel are divided into two categories: general comments and response to technical questions. A summary of recommendations from the panelists follows.

General Comments

Members of the panel agreed to several general comments and recommendations that weren't necessarily in response to specific questions. Those comments are summarized in this section.

Resource Management

Overall, the CHCNGA-TPO has done a good job in expanding its resources and building a solid foundation for meeting short, medium, and long term goals. This is particularly impressive given the relatively modest size of the region.

Data Collection Activities

The CHCNGA-TPO has done a good job in data collection and development of data sources; however, it is important to realize that model development efforts shouldn't be driven by the availability of data. Similarly, when considering model development, it is important to match the expectations of the development task with the commitment of resources.

Modeling Non-Motorized Travel

Being regional in nature, the travel demand model is probably not the best tool for modeling non-motorized travel. Instead,

specific non-motorized modeling tasks should be performed at a corridor / sub-area level using a tool designed for such a use. As the CHCNGA-TPO considers adding a transit mode choice component to the travel model, a relatively simple multi-nomial logit model is recommended. This type of model should meet the needs of the CHCNGA-TPO without being too difficult or time consuming to develop.

Land Use Model Development Sequence

In developing a land use model, it is recommended that the CHCNGA-TPO move forward with the CommunityViz model. CommunityViz can be developed more quickly than UrbanSim, which will make it easier for the CHCNGA-TPO to maintain their overall modeling schedule. However, this doesn't mean that consideration of UrbanSim needs to be abandoned. It is recommended that UrbanSim be the subject of further research and possible future implementation. This research should include talking with current UrbanSim users to learn about their experience. Additionally, the CHCNGA-TPO may consider partnering with a university to share the development load.

Regarding CommunityViz, it is important to remember that it is a land use allocation model that requires control total information as an input. The CHCNGA-TPO should investigate if there is a regional or statewide REMI or other economic model that can provide assistance in developing these control totals.

Highway Network

On the subject of the highway network, the CHCNGA-TPO explained that the model network was originally based on TIGER files and has subsequently been cleaned and is compatible with the region's GIS street centerline file. The panel felt that the CHCNGA-TPO should consider refreshing the network and utilizing a NAVTEQ or other similar street centerline file.

Development Schedule

The CHCNGA-TPO stated that they would like to commence with modeling to support the next Long Range Transportation Plan in 2012. With this deadline in mind, it is essential that work begin as soon as possible on the model update tasks (including the land use model) so that they are ready for use in time.

Staff Resources

On the subject of balancing the model development workload between CHCNGA-TPO staff and consultants, the panel felt that staff's involvement with a land use model is more important than with the travel model. This is because of the need for local knowledge and relationships in developing a land use model. Nevertheless, it is important for staff to stay involved with the travel model development process to ensure ownership of the process and the results.

In managing staff resources, the panel thought that workload be considered as part of the "production track" or the "research track." The production track would focus on the tasks necessary to producing the CHCNGA-TPO deliverables, which could include short-term model development efforts. The research track would focus on medium- and long-term projects. Adequate time would need to be given to each track for the CHCNGA-TPO to achieve its goals.

Peer Review Panel Response to Technical Questions

This section describes the peer review panel's response to specific technical questions.

Data Collection

With our limited resources and equipment, how can we improve our non-motorized data collection process in a manner that will support travel demand modeling?

As mentioned in the Recommendations section, the panel felt that the CHCNGA-TPO should consider off-model tools to analyze non-motorized travel for specific corridors or study areas. It was felt that the near and medium term benefits associated with modeling non-motorized travel would not be commensurate with the effort necessary to achieve such a goal. It was suggested that non-motorized trips could be removed from the model after trip generation so that they would still be included in the total trips in the region. It was also suggested that non-motorized travel after trip generation could focus on transit access modes rather than as a stand-alone mode.

Based on the various data sources available, what is the best source and the best methodology for estimating and forecasting employment?

The panel felt the best employment data source to be the Quarterly Census of Employment and Wages. This data could be cross referenced with field surveys, the phone book, and commercial data. The CHCNGA-TPO should consider use of a REMI or other economic model to provide control total information (probably in coordination with the state or other MPOs). An expert panel could also be used to validate employment data.

In developing employment data, it is important to consider how the data will be used in developing employment categories. There is no need to develop data for numerous categories if they are simply going to be aggregated before use in the model. This approach will enable the CHCNGA-TPO to focus their data collection on what will actually be used by the travel demand and land use models.

What is the best methodology to expand the on-board transit survey results to facilitate route level analysis and forecasting?

Expanding transit on-board survey data is a complex procedure that should be done by experienced professionals in conjunction with the Federal Transit Administration. The task could include time-of-day and direction expansion as well. The data could also be cross referenced with income / auto ownership data.

Further manipulation of the data should focus on transit corridors rather than individual routes. On-board transit data can also be cross referenced with household survey data to identify possible new routes or other transit enhancements.

The panel felt that the CHCNGA-TPO should consider collecting on-board survey data for the free downtown shuttle route that was previously excluded from data collection activities.

If transit is incorporated into the mode choice model, it should include a transit network that can have trips assigned to it. This will allow for detailed transit analyses, including by route and stop.

Updating the Highway Component of the Travel Demand Model

Should the highway re-validation process (only highway component) delay the development of the transit and non-motorized components?

The panel felt that with only a year or so before the model needed to be ready for LRTP modeling that it would be best to focus first on updating the highway component of the model. However, as previously mentioned, all trips should be included in trip generation with the non-motorized trips then being removed.

TDOT is thinking of building a toll bridge under Public Private Partnership: Is it costly that the model reflect this purpose? How difficult is it to incorporate cost into specific analyses

(e.g. analyze gas prices affect on transit ridership)?

Before any type of pricing data can be evaluated the travel demand model needs to be updated to include cost factors, such as auto operating costs, parking costs, and value of time. Incorporating these factors is a fairly intense effort; however, the effort required can be reduced by borrowing factors / values from other travel models in the region. These types of model enhancements also serve as a good precursor to implementing a full mode choice model.

If the CHCNGA-TPO considered transitioning to an activity-based model, should parallel tracks of modeling be simultaneously considered? Would it be better to start with an UrbanSim land use model, knowing that it will better integrate with TransCAD and will require developing synthetic populations which will be needed for a future activity-based model?

The panel did not believe that the CHCNGA-TPO should consider transitioning to an activity-based model in the short term, although it may be applicable in the long term. Instead near and medium term model development efforts should focus on enhancing the existing four-step model. When the CHCNGA-TPO does begin to move towards an activity-based model, a hybrid approach such as that used by the Knoxville Regional TPO may be applicable.

Adding Transit / Non-motorized Components to the TDM

Should assessments of the reasonableness of transit and non-motorized traffic modeling be by route, stop, and time of day for transit? How would similar assessments be performed for the non-motorized component?

The panel felt that transit reasonableness should be evaluated at the route level, but not necessarily at the stop level. They also didn't see a need for time of day transit modeling, but did suggest considering peak / non-peak modeling.

For non-motorized travel modeling, the panel recommended that an off-model sketch planning tool be used on a sub-area / corridor basis.

Some Transportation Demand Management strategies are supposed to be part of the evaluation process; How can they be evaluated?

These types of strategies are difficult to model with a regional travel model and are probably best left to off-model sketch planning tools.

Land Use Model

How can the decisions of the various stakeholders that influence land use development be modeled without relying on a micro-simulation discrete choice model?

In the short term, consider forming one or more focus groups consisting of business and development interests, economic development groups, chief planning officials, utility service providers, etc. Use these focus groups to develop a list of growth drivers, their priority, and relative importance among each other, which can be used in the land suitability analysis of CommunityViz.

Considering the current data available, staffing, and timetables, what are the major barriers to development of a detailed (micro-simulation) regional land use model?

As mentioned in the panels' general comments, it is felt that a micro-simulation land use model (e.g. UrbanSim) should not be considered in the short- term, but should

be the subject of further research for possible long-term implementation. This recommendation is based on the effort that is necessary to get a properly functioning simulation-based land use model up and running. Some MPOs have spent years on this process. Given the need to begin producing forecasts for the next LRTP in 2012 it is not feasible to implement UrbanSim before then.

How can the land use model be optimized to reduce run time while also maintaining the quality of the modeling?

The panel felt that run time could be a metric used by the CHCNGA-TPO in comparing the type of land use and / or modules to be utilized. If the CHCNGA-TPO proceeds with using CommunityViz, they could consider varying the unit of analysis (i.e. parcel of grid cell) or size of units in some modules in of the model to increase efficiency. For example, large recreation or otherwise development-constrained homogeneous areas could be represented as a single large cell rather than multiple small cells, which would reduce the internal model calculations necessary and speed run time.

Integration of Land Use and Transportation Models

How can the travel demand model and land use model best be integrated when they are running on two different software systems?

The panel did not feel that software differences would be barrier to model development and application. It is a fairly simple exercise to export a DBF, CSV, or other file from one model and import it into another.

What accessibility measures should flow from the TDM to the LUM? How can intrazonal travel, transit, pedestrian, and bicycle accessibility be measured and fed into the LUM?

In the short-term, performance measures and/or assumptions embedded in the CommunityViz land use model will provide some answers, but without a mode choice component to the travel demand model, the best accessibility measure for the suitability analysis is probably the roadway volume-to-capacity ratio. Over time as the LUM and TDM models become more complex, measures such as the presence or absence of a travel mode, congested travel time, cost, and logsums could also be utilized.

What demographic measures can flow from the LUM to the TDM? Are there other measures from the LUM that could be utilized as inputs to the TDM?

The demographic measures that can be expected to move from the LUM to the TDM are the standard socioeconomic data inputs: households, population, household size, employment by category, etc. As cost factors are introduced to the TDM, income will also need to become an input. The key is to match the level of detail coming out of the LUM to the data requirements of the TDM. As mentioned previously, there is little value in building great complexity and detail into the LUM only to aggregate the results to simplified values for use in the TDM.

Other possibilities with the CommunityViz framework are tying TDM inputs to the form and pattern table for each place type.

How can the integration between the LUM & TDM be validated / tested? How does the CHCNGA-TPO know the integrated model is "working properly"?

The key, as with any model calibration / validation exercise, is to ensure that the models accurately represent base year conditions. "Stress testing" can be utilized to test sensitivity to certain changes, which results can be compared to expected values to help judge the reasonableness of the model results. Another factor to be

considered is the adequacy of the convergence of the feedback loop between models.

Appendix A

List of Peer Review Panel Participants

Peer Review Panel Members:

Chandra Bhat	University of Texas
Mei Chen	University of Kentucky
Jerry Everett	University of Tennessee
Brian H. Y. Lee	University of Vermont
Matt Noonkester	Seven Hills Town Planning Group
Guy Rousseau	Atlanta Regional Commission

Local Agency and Partner Agency Staff:

John Bridger	Chattanooga-Hamilton County RPA
Nelson Galeano	Chattanooga-Hamilton County RPA
Yuen Lee	Chattanooga-Hamilton County RPA
Sue Knapp	Chattanooga-Hamilton County RPA
Tim Moreland	Chattanooga-Hamilton County RPA
Karen Rennich	Chattanooga-Hamilton County RPA
Melissa Taylor	Chattanooga-Hamilton County RPA
Aleeta Zeller	Chattanooga-Hamilton County RPA
Valerie Moye	City of Chattanooga Office of Sustainability
Drew Cutright	City of Chattanooga Office of Sustainability
Philip Pugliese	Outdoor Chattanooga
Jenny Park	Outdoor Chattanooga
Susan Paredes	Greater Dalton MPO
Matt Meservy	Nashville MPO
Chin-Cheng Chen	Nashville MPO
Max Baker	Nashville MPO
Bob Rock	TDOT – Long Range Planning

Consultant Staff:

Robert Schiffer	Cambridge Systematics

Supporting Staff to Peer Review Panel Members:

Ivan Hooper (Peer Documenter)	Resource Systems Group, Inc.

Appendix B

Peer Review Panel Meeting Agenda

Chattanooga – North Georgia TPO
Development Resource Center
1250 Market Street
Chattanooga, TN 37402

May 23, 2011

09:00 - 09:15	Welcome, Introduction and Purpose
	Background and Overview
09:15 - 09:45	Travel Demand Model
09:45 - 10:15	Land Use Model
10:15 - 10:45	Data Collection Efforts and Q&A
10:45 - 11:00	Break
	Desired Features (Plans for Model Development)
11:00 - 11:15	Travel Demand Model
11:15 - 11:30	Land Use Model
11:30 - 11:45	Integration
11:45 - 03:15	Panel Discussion, Clarification and Lunch
03:15 - 04:15	Panel Recommendations
04:15 - 04:30	Closing Remarks

Appendix C

Peer Review Panel Biographies

Chandra Bhat, University of Texas
Dr. Chandra Bhat is an international expert in the area of travel demand modeling and travel behavior analysis. His substantive research interests include land-use and travel demand modeling, activity-based travel modeling, policy evaluation of the effect of transportation control and congestion pricing measures on traffic congestion and mobile-source emissions, marketing research of competitive positioning strategies for transportation services, use of non-motorized modes of travel, and physical health and transportation. He serves or has served on the peer review panels for examining the models of the Metropolitan Washington Council of Governments (MWCOG) in the Washington D.C. area, the Metropolitan Transportation Commission (MTC) in the San Francisco Bay Area, the Southern California Association of Governments (SCAG) in the Los Angeles area, the San Diego Association of Governments (SANDAG), the North Jersey Regional Transportation Model Enhancement Project (NJRTME), and the East-West Gateway Council of Government in the St. Louis area.

Mei Chen, University of Kentucky
Mei Chen is an Associate Professor in the Department of Civil Engineering at University of Kentucky. Her research interests include transportation systems analysis, network modeling, integrated land use and transportation planning, simulation and forecasting. She has served on the panels of two TCRP Synthesis, and is currently a member of the TRB Committee on New Transportation Systems and Technology and Committee on Transportation in the Developing Countries.

Jerry Everett, University of Tennessee
Jerry Everett is a Research Director at the University of Tennessee Center for Transportation Research located in Knoxville, TN. In his current position Jerry serves as the Program manager, for the Tennessee Governor's Highway Safety Office, he performs research and provides management oversight for NHI training course development in the areas of highway safety, traffic operations and planning/environment. He has worked professionally in transportation and air quality planning for 18 years. Prior to returning to UT, he served as a community planner in the Metropolitan Planning Division of the Federal Highway Administration (FHWA) in Washington, D.C.

Brian H. Y. Lee, University of Vermont
Dr. Brian H. Y. Lee is an Assistant Professor in Transportation Systems at the University of Vermont; his primary appointment is in the School of Engineering, Civil and Environmental Engineering Program, and his secondary appointment is in the Transportation Research Center. He received his Doctorate degree from the University of Washington in the Interdisciplinary Ph.D. Program in Urban Design and Planning in 2009, his M.S. degree from Northwestern University in Civil and Environmental Engineering in 2003, and his Bachelor of Applied Science degree from the University of British Columbia in Civil Engineering in 2001. He is an applied researcher with expertise in transportation and land use analysis and empirical modeling. He has keen interests in multimodal transport and a record of interdisciplinary collaborations on policy-relevant projects.

Matt Noonkester, Seven Hills Town Planning Group
Matt Noonkester has 14 years of progressive planning experience managing projects that help local, regional, and state government officials tackle difficult public policy planning issues. He has extensive experience using geographic information system (GIS) software to measure the built environment and leading community groups through a scenario planning process. Mr. Noonkester is certified by the software developer for CommunityViz® as a classroom instructor, and routinely speaks at professional conferences, expert panel sessions, and technical user group meetings on the topic of scenario planning and CommunityViz software. He has also partnered with staff and elected officials throughout the United States to prepare regional growth studies, comprehensive plans, small area plans, corridor studies, capital improvements plans, land development regulations, urban design guidelines, development impact fee ordinances, and other special studies consistent with state law and community context.

Guy Rousseau, Atlanta Regional Commission
Guy Rousseau is the Surveys & Transportation Model Development Manager for the Atlanta Regional Commission (ARC), the MPO for Atlanta, Georgia, which he joined in 1998. He is responsible for model development activities for the 4-step trip-based model, the activity-based model and the population synthesizer, for modeling the impact of Regional Transportation Plans and Transportation Improvement Programs, coordinating the travel model with the land use model, providing model results for air quality emissions for conformity and attainment of clean air goals, and obtaining data for the modeling process through household travel surveys, transit on-board surveys and other surveys. He is extensively involved with the Transportation Research Board and TMIP, and is a member of the NYMTC Technical Advisory Committee (TAC) for their recent household travel survey.