Summer 2004

TMIP Connection

The Travel Model Improvement Program Newsletter







After Hard Work, DRCOG Finalizes Design Concept for New Model—More Hard Work Anticipated

By Erik Sabina, P.E. *Travel Forecasting Group Leader, Denver Regional Council of Governments*

The Denver Regional Council of Governments (DRCOG) conducted a data acquisition and model upgrade project in the late 1980s, which resulted in the respecification of key four-step model elements, and a shift of the model from UTPS to the MinUTP software platform. Having learned the hard way how much time is required to complete a project of that magnitude (as much as ten years, including the time required to persuade policy-makers to give us the money!), DRCOG modelers almost immediately began planning for the next round of data acquisition and model upgrade projects.

As DRCOG was planning the Travel Behavior Inventory (TBI) project (the regional survey ultimately conducted in 1996-98), developments in two areas were powerfully affecting both the design of that survey project, and early thoughts on the models that would be developed using the data acquired in it:

- Significant advances in travel modeling were occurring in the academic community (such as tour-based model structures), and initial steps were being taken to implement them in a few MPOs; and
- The Denver region was emerging from the recession of the 1980s, with an accompanying resumption of the rapid growth in the region that has been the typical pattern of the past 50 years. The DRCOG regional population grew from 1.83 million to 2.45 million between 1990 and 2000.

The DRCOG Board of Directors' response to the second of these trends, with its accompanying rapid increases in traffic congestion and suburban development, was to initiate the MetroVision planning process. MetroVision has been, in many respects, a landmark in planning in the Denver area, as it identified specific core elements to be forwarded in an attempt to rationalize and limit the geographic spread of development. Concrete measures included the adoption of an urban growth boundary, and the identification and development of higher-density urban centers in a variety of locations throughout the region, among others (see Figure 1 on page 3).

One side-effect of the MetroVision process was the focusing of much greater attention on regional planning tools used to evaluate the effectiveness of the wide range of planning initiatives expected to support MetroVision's goals. This examination made plain the inability of those tools to fully evaluate some of those initiatives. However, progress in travel modeling, the first of the two trends above, offered some hope that newer modeling tools could permit much more effective response to these planning needs.

The voluntary character of participation in the regional planning process in the Denver region meant that DRCOG member governments had to feel a strong sense of "ownership" in the MetroVision process if its goals were to be realized. DRCOG management's response to this reality was to make the MetroVision planning process as open and member-driven as possible, and this atmosphere extended throughout the planning process, including the travel and land use modeling processes. Many participants in the regional planning process, however, viewed the model as a "black box", and placed little faith in its results.

DRCOG's on-going Integrated Regional Model Project was developed in this planning context, and was structured to respond to it. The project's initial stage, the Refresh Phase, involved retaining the existing model's basic four-step structure, but updating its parameters based on the TBI data, and transferring the model from MinUTP to TransCAD, permitting short-run regional modeling to be conducted on a more solid basis. The second phase of the IRM project, the Vision Phase (recently completed), was structured to accomplish two goals:

- To develop sufficient understanding of the current and near-future state of advanced practice in travel and land use modeling to support development of a next-generation model for the Denver Region; and
- To develop a clear understanding of regional technical staff and policy-maker views of the planning process, and their goals for the region, through their direct participation in the planning work of the Vision Phase.

Understanding the perceptions and prior-

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U.S. Department of Transportation
Federal Highway Administration

Walker Joins Panel

Richard Walker
Travel Forecasting Manager
Portland, Oregon Metro

While we are very sad to say goodbye to Keith Lawton, who is stepping down from the TMIP review panel after years of excellent and well appreciated work, we are delighted to welcome Richard Walker of Portland Metro as our newest panel member.

Richard Walker is the Travel Forecasting Manager at Metro — the Portland, Oregon MPO. He directs all the travel forecasting related programs — including data collection, model development, and model application. His areas of expertise include multi-modal models, freight models, emission modeling, and transit "New Start" projects. A graduate of Montana State University (B.S.C.E), he has been involved in the discipline of transportation modeling since 1974.

Mr. Walker is active in the professional community. He currently serves on the Transportation Planning Applications Committee (ADB50) and the TRB Task Force on Innovations in Freight Transportation Modeling (AT016T). In addition, he has had the pleasure to serve on numerous peer panels charged with the review of modeling tools. Locally, he is the chair of the Oregon Modeling Steering Committee.

One of the projects of significance currently underway at Metro is the TRANSIMS model development and case study application. Metro is working with the FHWA and the project consulting team to bring this innovative tool to the marketplace. ■

Model Citizen

Arash Mirzaei

Model Citizen is a new column in TMIPConnection. The column features a practitioner from the community. Our inaugural "model citizen" is Arash Mirzaei. He wrote for us about activity and tour based modeling.

Arash Mirzaei is a Principal Transportation Planner for the North Central Texas Council of Governments, which serves as the Dallas–Fort Worth MPO. His current emphasis is in integration of travel demand model and traffic micro-simulation. He has nine years of experience in transportation engineering and planning. He has developed and implemented travel demand models, performed traffic studies, conducted travel survey projects, and built

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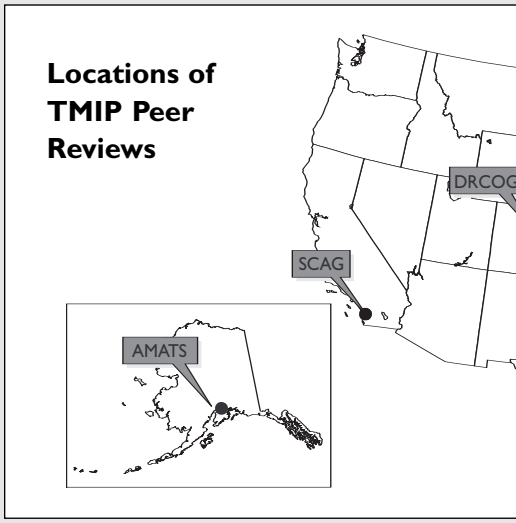
The State-of-the-Art—The State-of-the-Prac
A Peek at the TMIP Peer Review Program Synthesis I

By Esther Lee, *Policy Analyst, USDOT John A. Volpe National Transportation Systems Center*, with assistance fro

Whether an agency seeks the state of the art or state of the practice in modeling, practitioners agree that the TMIP Peer Review Program provides an opportune forum to share "war stories" with fellow modelers and solicit technical guidance from expert peer consultants.

Since its inception in Fall 2003, the TMIP Peer Review Program has sponsored nine Peer Reviews hosted by seven different agencies across the country. Five were local metropolitan planning organizations (MPO) [Ohio-Kentucky-Indiana Regional Council of Governments (OKI), Denver Regional Council of Governments (DRCOG), Southern California Association of Governments (SCAG), Atlanta Regional Commission (ARC), Anchorage Metropolitan Area Transportation Study (AMATS)], and two were state agencies [North Carolina Department of Transportation (NCDOT), Iowa Department of Transportation (IaDOT)]. While the composition and discussion at each of the Peer Reviews was unique to the needs of each region, several common themes emerged during the course of the nine Peer Reviews.



Improving Modeling Techniques

Comprised of various federal, state, local and private sector representatives, Peer Review Panels have reviewed modeling projects ranging from the development of a state-of-the-art, fully-integrated land use and travel model system to the update of a 4-step model with state-of-the-practice techniques. Peer Reviews were convened to either assist in the model development phase or to solicit feedback on recent model improvements. Typically, Peer Reviews addressed a variety of agency-specific technical challenges that arose during trip generation, trip distribution, mode choice, assignment, output or model development calibration and validation.

Trip generation and distribution issues included travel impedance, travel time, friction factors, special generators and trip purposes. On the topic of a gravity model versus a destination choice model, one Peer Panel supported continued use of a gravity model for trip distribution contingent upon good calibration and friction factors, while another Panel strongly recommended a transition to a destination choice model.

Topics of discussion on trip assignment and mode choice also varied, ranging from peak spreading, pre- and post-processors, and adjustment factors, to the number of iterations needed for a "complete" model run. For smaller agencies interested in estimating baseline transit service, a couple of Panels recommended borrowing coefficients or estimates from cities with comparable characteristics and adjusting for local conditions.

Many regions are exploring the option of activity or tour-based modeling. While most Peer Panelists agreed that the modeling industry is headed towards tour-based modeling in the long term, whether or not tour-based models are currently appropriate for

"DRCOG" continued from page 1.

ities of technical staff and policy-makers is of critical importance in two respects: to ensure that the new model meets their needs, and to enhance understanding of and confidence in the technical analysis that supports regional planning. The primary steps taken in the Vision Phase to support these priorities were:

The establishment of Technical and Policy advisory panels. The Technical panel was composed of planning, modeling, and engineering staff from member governments. The Policy Panel was composed of the highest-level policy-makers that could be persuaded to participate, including the Deputy Director of the Colorado Department of Transportation, the Mayor of the City of Boulder, the President of the Denver Metro Network (the regional economic development organization), a member of the Regional Transportation District (RTD) Board of Directors (the Denver region transit agency), as well as prominent representatives of the development community, the environmental community, and many others. Working with these panels, the project team developed a list of critical planning initiatives that the modeling system should better support, and a priority ranking of those initiatives. This list and ranking will be a key input in the development of new model design during the Update Phase, which is about to begin, including the development of RFPs for consultant services.

The evaluation of other advanced models in North America and Europe. Project staff wanted to develop a clear understanding of the state of the art in advanced modeling in applied settings, again to support development of model design during the Update Phase, and especially to permit a more informed calculation of the risks associated with various possible approaches. Summaries of all or portions of eight advanced models were prepared during the Vision Phase, and these descriptions also helped the project

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Report

n Terry Regan, *Senior Associate, Planners Collaborative, Inc.*

all agencies is not definitive. Peer Panelists suggested that while some MPOs are pioneering the use of tour-based microsimulation models, agencies with limited resources should wait until other agencies' tour-based models are complete and able to be modified.

The quality of data used as model inputs and as a check against model output, emerged as a major issue for most agencies. The question of the quality of 2000 US Census data and appropriate survey techniques were among the data quality issues raised.

Peer Panelists cited good documentation of the various components of the model update process as essential for practitioners to understand the intricacies of models and for policymakers to interpret the model results.

Leveraging Organizational Resources

Several Peer Reviews identified the limitation of organizational resources and rapid turnover of expert staff as a major challenge to model improvements. One Peer Panel suggested that skilled experts be better leveraged by sharing their expertise. The NCDOT Peer Panel recommended that a core team of modeling specialists be maintained at the central office and dispatched to assist generalists in local agencies when necessary.

Other Peer Panels agreed that coordination with regional agencies is crucial to addressing the shortfall of modeling resources. Particularly in light of the rapid growth and resultant reconfiguration of urbanized areas, greater coordination with agencies within and outside a region is also a critical data collection strategy.

Identifying Policy Issues

Many modelers at the Peer Reviews shared the challenge of responding to proposed policy initiatives and their network impacts in a reasonable amount of time. Panelists noted that early dialog between policy makers and modelers should occur to adapt the model and produce results in a timely manner.

Pricing is a major policy issue faced by some of the MPOs. For example, the SCAG Panel recommended that SCAG include the ability to examine high occupancy toll facilities as well as high speed rail within its model output.

Another major policy issue faced by modelers was the integration of land use models with travel demand models. Although data on the effects of development patterns on travel behavior and vice versa remains limited, all the Peer Reviews suggested that integration of land use and travel demand models is a necessary trend to pursue.

An additional policy issue that arose from the Peer Review Panels was the need to address freight issues and the increasing trend towards the development of freight models. Some agencies, like ARC, are poised to develop a freight model while other agencies, such as OKI and SCAG, are already in the process.

Reports of the completed Peer Review Panels and the forthcoming TMIP Peer Review Program Synthesis Report are available at http://tmip.fhwa.dot.gov/services/peer_review_program/status.stm. ■

team identify specific advanced modeling elements that would permit enhanced support of the policy initiatives identified by the technical and policy panels.

The establishment of a modeling expert panel. Supported in part by TMIP funding, the project team conducted two one-day meetings of a panel of prominent modeling experts from across North America. During the first meeting, the panel discussed the list of policy initiatives developed by the local panels, and modeling approaches that might be used to address them. During the second meeting, the expert panel discussed the Vision Phase consultant and project team suggestions for model design, and produced a list of recommendations for model development during the upcoming Update Phase.

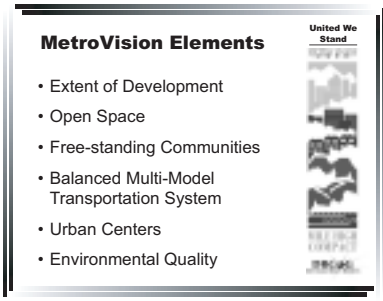

Figure 1.

Having concluded the core work of the Vision Phase, the DRCOG project team is now finalizing design concepts for the new model, and working on an RFP for consultant services. Efforts such the IRM Project must ultimately be designed with the customer in mind, and as the popular phrase puts it, "failure is not an option" when project schedules are long and costs high. Project staff feel that the Vision Phase has provided us with a clear understanding of our customers' expectations and requirements, as well as the state of the "leading edge" and "bleeding edge" in applied, advanced travel and socio-economic modeling today. In the end, the project team feels that the insights gained in the Vision Phase are of critical value to bringing the IRM Project to a successful conclusion. ■

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transportation information systems. He holds a bachelor's and a master's degree in civil engineering and is working towards a second master's in computer science in the University of Texas at Arlington.

On March 24, 2004 TMIP sponsored a one-day seminar in Boston on activity- and tour-based modeling. The seminar covered the limitations of traditional trip-based models and provided information on the concepts, estimation methods, and data requirements for the activity-based modeling.

Limitations of traditional trip-based models have been widely recognized in the industry for a long time, and activity-based modeling appears to provide a reasonable and feasible substitute. Activity-based modeling has a very strong conceptual foundation: it treats travel as a demand derived from the desire to participate in other activities; it considers sequences of behaviors versus disconnected trips; it considers individual households as the decision-making unit in the generation and timing of activities as opposed to aggregated households with assigned time-of-day trips; and it incorporates spatial, temporal and interpersonal constraints as compared to largely aggregated trip consistencies. Activity-based modeling appears feasible for many regions because of advances in the development of theories toward practical implementation and the availability of ever-faster computers at reasonable prices.

As much as the conceptual advantages of activity-based modeling are promising, they are useful to real-world transportation planners only if fully-implemented models are successfully completed, tested, and documented. The development process for an activity-based model is inherently long and complex, and MPOs choosing this path will face a long-term commitment for sustaining sufficient expertise to run the model in applications environment, as well as for ongoing maintenance and improvement of the underlying model structure.

The one-day seminar focused on the theoretical advantages of activity-based models, but fell short in providing clear examples of successful implementations. A well-built trip-based model can still answer many questions with enough apparent accuracy for planning decisions, so additional effort is needed to compare and contrast activity-based results with trip-based results. The needs for the more robust and detailed output offered by an activity-based model framework must be strong enough to support the significantly increased level of effort for a full implementation. To help build a more positive picture in support of activity-based models, more work is needed in the preparation and full documentation of sensitivity tests applied to both the calibrated model parameters and to the forecast year network and demographic inputs. ■

Editor's note

In addition to developing and presenting the Activity and Tour Based Modeling Seminar, FHWA has undertaken a number of activities in to help further the state of the art and the state of the practice of activity and tour based modeling. We have developed and are currently demonstrating and disseminating the activity based model TRANSIMS. Panelists on peer reviews frequently encourage and advocate that agencies adopt a tour and activity based model for their own modeling purposes. TMIP maintains a body of literature in our clearinghouse and we continue to collect, promote and post documentation on tour and activity based modeling as it becomes available.

Hot Topics: To Cap or Not to Cap
Initial Wait Time Calculation in Transit Skimming and Path Building

By Hua Tan, *Transportation Engineer, Capitol Region Council of Governments, Hartford, CT*

Transit initial wait time is one of the important factors calculated in transit skimming and path building. The most common practice of determining the initial wait time is to use half of the transit service headway value. For example, if the headway is 60-minutes, the initial wait time will be 30-minutes. However, a maximum 15- to 20-minute initial wait time is often applied to simulate that a transit user is less likely to wait for half an hour if the bus headway is 60-minutes and that the maximum time a person is willing to wait is 15- or 20-minutes. This practice might be insensitive to headway changes because if a service frequency is improved from 60-minutes to 45-minutes, the initial wait time will still be 15-minutes, even though in real life, the 45-minute headway will be more attractive to the users.

Below is a summary of the recent TMIP email list discussion among private consultants, state DOTs, MPOs, and modeling software developers.

No Capping on Initial Wait Time

One agency responded that after trying both with and without the maximum initial wait time, not capping the wait time generated better results. Others provided more detailed inputs on the no capping method.

Using Linear Equation

Average wait = 10 min. + 0.2 x (Headway - 20 min.)

Using the example listed above, a headway of 60-minutes results in an average wait of 18-minutes; a headway of 45-minutes results in an average wait of 15-minutes.

No Linear Equation

Some commercial software programs such as CUBE provide the ability to specify wait curves which are based on surveys of how long people actually wait as a function of service headway. Other commercial software programs such as ESTRAUS consider the fixed wait time (usually half of the headway), but also add a variable wait time that reflects the level of congestion on the transit service. The second practice is geared more towards a heavily used transit system because it considers the extra wait time when the transit vehicle's passenger capacity is reached.

Capping on Initial Wait Time

The common practice of capping on initial wait time is to apply a "1/2 the headway" wait time function and a maximum headway (i.e., a 15- or 20-minute maximum initial wait time). Some agencies such as Connecticut's Capitol Region Council of Governments (CRCOG) use a "1/2 the headway" wait time function and a 30-minute maximum headway (i.e. a 15-minute maximum initial wait time.) This is the industry standard, but it also means a 30-minute-headway route will have the same supply attraction as a 60-minute-headway or 90-minute headway route. Currently CRCOG is working on replacing the capping method with a no capping approach.

General Discussion

Reliability of Transit Service

One modeler argues that demand aggregation can cause a problem when modeling transit lines with high headways. Demand aggregation relates to the reliability of transit service. Regular riders boarding at or near the beginning of a route always have some reasonable estimate about the arrival time, regardless of the headway. Riders who board the bus mid-way through the route are less sure of the bus arrival time. The demand aggregation limits the modeling ability to provide a more realistic estimate for the initial wait time for low service lines. Although excluding very low service lines or aggregating the low service lines with other lines might solve the problem, it is still very difficult to model the demand aggregation.

Initial Wait Time Calculation of Combined Routes

There is an inconsistency among commercial modeling software in terms of calculating initial wait time for a path with combined services, whether the maximum wait time is applied before or after combining routes.

Consideration of the Inconvenience Factor

There is a concern about the lack of an inconvenience factor in modeling initial wait time. This concern comes from the observation that people who use transit services with long headways tend to adjust their activity departure time so that they will arrive a few minutes before the bus or train. Those people who must conform their activity schedule to the transit service schedule are to some degree being inconvenienced. And, this inconvenience factor is not reflected in the wait time versus headway function that is developed from the observed average wait times.

To see the full discussion, look at other discussions, or start your own Hot Topic, go to http://tmip.fhwa.dot.gov/email_list/ ■

Upcoming Events

Conferences

Association of Metropolitan Planning Organizations Conference
October 12-15, 2004
San Antonio, TX • www.ampo.org

Courses

Estimating Regional Mobile Source Emissions
September 14-17, 2004 – Austin, TX
Cost: $545

Additional offerings may become available. For the latest training information, consult the TMIP website
http://tmip.fhwa.dot.gov/conf_courses

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