



The **Travel** Model
Improvement
Program

TMIP Peer Review Program June 2004 – May 2005
Synthesis Report 2

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Prepared by Texas Transportation Institute
For Federal Highway Administration

Helping Agencies Improve Their Planning Analysis Techniques

TMIP
Travel Model Improvement Program

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I. Introduction

This report provides a synthesis of the six Travel Model Improvement Program (TMIP) Peer Review Panel meetings held between June 2004 and May 2005. Section I provides a brief overview of TMIP and the Peer Review Program. Section II provides a summary of each of the six Peer Review Program Panels. Section III highlights common issues and recommendations identified among the six Peer Review Panels and a comparison to the previous year's issues and recommendations.

This peer review synthesis is intended for technical modelers at state and local agencies who wish to know more about individual travel model peer reviews, travel model improvement and the peer review program. The full documentation for all travel model peer reviews conducted by this program, and relevant peer reviews from other programs as well, is available online at: http://tmip.fhwa.dot.gov/services/#peer_review_program.

A. TMIP Program Overview

The TMIP program provides a wide range of services to help planning agencies improve their travel analysis techniques. The program has three specific goals:

1. To help planning agencies build their institutional capacity to develop and deliver travel related information to support transportation and planning decisions;
2. To develop and improve analytical methods that respond to the needs of planning and environmental decision making processes; and
3. To develop mechanisms to ensure the quality of technical analysis used to support decision-making and to meet local, state, and federal program requirements.

B. TMIP Peer Review Program

As an integral part of the overall program, the Peer Review Program provides state and local planning agencies the opportunity to solicit input from experts in the field of travel demand modeling. The purpose of the Peer Reviews is to have a process whereby experts in the field of modeling can provide guidance to ensure that agencies are developing technical products, procedures, and processes that meet an agency's needs along with state, federal, and local planning requirements. In April 2003, the program began soliciting Peer Review applications from regional and state planning agencies.

II. Summary of the Six Peer Review Panels: June 2004 - May 2005

Between June 2004 and May 2005, TMIP sponsored six Peer Review Panels. These Panels were held at the following MPOs:

- Baltimore Metropolitan Council (BMC) (2 peer reviews held), Baltimore, MD
- Memphis MPO, Memphis, TN
- Metropolitan Transportation Commission (MTC), San Francisco, CA
- Pikes Peak Area Council of Governments (PPACG), Colorado Springs, CO
- Southeast Michigan Council of Governments (SEMCOG), Detroit, MI

The six Panels used a total of 28 Panel experts from a variety of backgrounds and areas of the country. The 28 Panel members included representatives from MPOs, Federal agencies, private consulting firms and educational institutions. Of the 28 Peer Review Panel members, there were:

- 8 MPO representatives
- 6 federal agency representatives
- 9 private consulting firm representatives
- 5 academic institution representatives

The Peer Review Panels took place at various stages of model development. Baltimore Metropolitan Council was further along in their model development, and utilized the two Peer Review Panel meetings to adjust their model developments against the suggestions of the Panel Experts. The remaining four Peer Review Panels were convened in the early stages of model development or update, where the requesting agencies sought consultation on anticipated or early developments of their model improvement work. Table 1 below gives an overview of the focus of each of the Peer Review Panels and the modeling stage at which the Peer Review was held.

	Self Identified Peer Review Focus	Modeling Stage
BMC	Review status of travel model improvement process, provide guidance on development issues	Ascertaining how model can be improved to meet future policy needs/issues.
BMC 2	Evaluate model, make enhancement recommendations, and review model improvement process	Has a well developed 4-step model but policy makers want improvements for performance enhancement and to model new transportation options.
Memphis	Ensure successful implementation of an updated travel demand model	Developing new tools/model
MTC	To review plans and desires for building the next generation of travel behavior model systems for the SF Bay Area	Beginning to consider model redevelopment with an eye on moving to tour-based models
PPACG	Provide suggestions on short- and long-term model enhancements, analyze existing model and comment on its ability to forecast conditions based on comparisons with field data, and recommend possibilities of incorporating new functionalities in methodology	Beginning model update
SEMCOG	Provide assessment of existing model and help prioritize near- and long-term model enhancements. Also, recommend possible applications of more advanced methodologies.	Has model development plan

A. MPO Peer Review Panels

The following section provides a brief summary of each of the Peer Reviews

Baltimore

The Baltimore Metropolitan Council is in the process of enhancing its modeling capabilities by adding new functionalities in the face of new modeling techniques, new modeling requirements (especially FTA New Starts), and demographic changes in the area. Its current four-step model runs on TP+ software version 3.0, except for its transit path-building, which runs on TRNBUILD version 3.0.6. The BMC asked the panel to specifically address demographic forecasting, the incorporation of new model functions such as managed lanes and truck traffic, and its proposed new mode choice model. The peer panel made the following suggestions:

- Make planned revisions to the number and structure of TAZs early in the process so that the new zone structure can be used in other model revisions.
- Coordinate socio-economic forecasting with the Washington, DC metropolitan area to avoid double counting growth estimates.
- Collect data on external trips to account for traffic between the Baltimore and Washington, DC planning regions, and on truck traffic (especially from the Port of Baltimore) as a first step to developing a truck model.
- Before borrowing a mode choice model from another region, make sure it is compliant with FTA rules. Carefully consider what changes will be necessary to make the model appropriate for the Baltimore area.
- Incorporate more socio-economic variables to improve the model's explanatory power.
- Experiment with the number iterations in the trip generation model to achieve tight convergence.

Memphis

The Memphis MPO is in the second phase of a two-phase process to create a new travel demand model. The new model, a four-step model running on TransCAD, will expand the modeling area, better link travel demand modeling and land use, develop a truck model, and provide for modeling multiple time-of-day periods. The MPO has contracted with a consultant for model development, and is in the process of finalizing the specific tasks and timeline. The peer panel's primary charge was to examine and comment on the planned changes. Specifically, the panel was asked to address the proposed timeline, network and TAZ development, and model validation. The panel felt that the Memphis area had good stakeholder participation in the model development process, and that the MPO and consultant had a good working relationship. In addition, it made the following recommendations:

- Determine approximate number of TAZs by comparing average square miles or persons per TAZ with those of other metropolitan areas to get an idea of how many zones may be required.
- Reconcile data issues related to using data from various years as the "base" data.
- Collect more and better travel time and speed data for model calibration and validation.
- Re-examine socio-economic and land use forecasts to better reflect regional trends and to obtain agreement on forecasts from important stakeholders.

- Develop a model prototype early in the process to anticipate problems and possibly identify activities that can be done earlier in the process if problems arise that delay other model development actions.

San Francisco Bay Area

The Metropolitan Transportation Commission (MTC), the MPO for the San Francisco metropolitan area, is at a turning point in its travel demand modeling process; it is considering how much to invest in improving the existing four-step model versus creating a new tour-based model. An activity-based travel survey was conducted in 2000, opening up the possibility of using this data for a tour-based model. Further, MTC staff feel that they have exhausted the possibilities of the existing advanced four-step model. The MTC asked the peer review panel to make recommendations on how to best proceed with its modeling enhancements. Some of the primary recommendations are listed below:

- Develop a tour-based model; MTC has highly trained staff that would be capable of being an early adopter of this technique.
- Learn from tour-based modeling efforts in other areas.
- Take advantage of academic research on the topic; consider hiring a doctoral student from an area university to help develop the model.
- Take advantage of the expertise of consultants working on the project by enlisting them to educate MTC staff about the model development.
- Consider adopting and expanding the first generation tour-based model used by the San Francisco County Transit Authority.
- Be sure to include local jurisdictions in decision-making process.
- Take advantage of GIS capabilities to relate the built environment to trip making behavior.

Colorado Springs

The Pikes Peak Area Council of Governments (PPACG), the MPO for Colorado Springs, Colorado, is poised to make major revisions to its travel demand model. Before hiring a model development contractor, PPACG convened a peer review panel to evaluate the current model structure and make recommendations for short- and long-term improvements, especially relating to truck traffic, FTA New Starts criteria, and land use and demographic forecasting. One of PPACG's most significant modeling challenges is that it does not have a modeling specialist on staff. The panel's primary recommendations were:

- Obtain in-house staff skills (through hiring or training) sufficient to understand the travel demand model and its assumptions, oversee the work of the model development consultant, and properly interpret model results. The panel felt that addressing this deficiency should be a top priority.
- Increase the number of TAZs, and design them so that they generally match the highway and transit networks.
- Revise the mode choice model, which is probably not consistent with FTA New Starts criteria.
- Concentrate on improving the fundamental elements of the model rather than adding new functionalities.
- Develop a more formal process for data collection and inventory.

Detroit

The Southeast Michigan Council of Governments (SEMCOG), the MPO for the seven-county Detroit region, is updating its travel model improvement plan. It requested that the peer review panel provide suggestions for short and long-term model enhancements. SEMCOG also wanted recommendations for possible applications of more advanced travel demand modeling methodologies. The peer review panel felt that the current model represents the “state of the practice” and addresses time-of-day, commercial vehicle, and external trips particularly well. The panel’s general recommendation was that SEMCOG concentrate on improving the model’s core capabilities by, for example, enhancing the data collection and highway and transit networks, rather than expanding into complicated new modeling capabilities. For future model enhancements, the panel’s primary recommendations are listed below. Several of these topics are included in SEMCOG’s existing model improvement plan.

- Develop an integrated, multi-year network/database structure.
- Incorporate new data on vehicle classification, travel times, transit ridership, and trip purpose, length, rate and frequency.
- Make better use of recent empirical data to validate and calibrate the model.
- Revise the traffic analysis zones based on 2000 census data.
- Revise the functional classification system based on definitions in the Highway Capacity Manual.
- In the long term, considering implementing an activity-based model.

III. Panel Recommendations

While the composition and discussion of the Panel Reviews was unique to the individual region, several common issues were addressed during the course of the six Peer Review meetings. These common issues were identified within Peer Panel discussion sessions and in many instances the issues were directly included within the list of recommendations prepared by the Peer Review Panel. The following two sections provide highlights of common issues and recommendations. The first section compares recommendations and issues to similar issues from the previous year, the second is a smaller set of emergent issues from the 2004 – 2005 peer reviews not mentioned in the previous synthesis.

Technical Recommendations for Ongoing Issues

The following issues were raised in peer reviews in previous years. For more technical recommendations on these issues see the previous synthesis available at: http://tmip.fhwa.dot.gov/services/peer_review_program/documents/synthesis_report/.

Land use: In these Peer Reviews, land use issues centered on land use allocation procedures. It was recommended that Memphis reach consensus on land use allocation using a Delphi process and that Pikes Peak formalize their land use forecast process including obtaining an inventory. At Baltimore there is an acknowledged lack of resources to implement the integration of land use and travel demand models, whereas Detroit, who are testing the URBANSIM software, needs mindfulness of resource allocation for full land use travel model integration.

Freight-based activities

Freight activities are important to include within transportation demand models because the total impact of freight vehicles on the operations of the network can be significant.

The panelists recommended that:

- SEMCOG should integrate its truck model with the Michigan DOT statewide model. Although not under the control of SEMCOG, the panelists noted that the Michigan statewide model would be more useful for freight modeling if it included commodity flows for all modes of travel (e.g., truck and rail).
- MTC should examine alternative data sources, including commodity flow surveys. At MTC, the panel recognized the difficulties and costs associated with truck survey data and models.
- As Baltimore is a major port, BMC should coordinate with Maryland DOT on their port study to ensure data collection needs for the travel demand model.

Migration to activity-based or tour-based modeling. Only two Panels addressed migration to activity or tour-based modeling, SEMCOG Panelists agree with panels from the previous year that agencies with limited resources should concentrate on improving their current 4-step model rather than switching to a new model type at this time. For MTC, however migration is encouraged, but again, at a steady rate and with plentiful documentation and discussion with partner and client agencies.

Data collection, coordination, standardization and improvement.

Data issues continue to abound in the current round of Peer Reviews.

- At Baltimore, the Panel recommends coordination with Metropolitan Washington Council of Governments for more accurate employment control totals. Baltimore also has data issues regarding external trips being too high, airport trips needing to be counted as person trips and having transit options together with accurate traffic counts.
- In Memphis, the Panel recommended revisiting economic and demographic forecasting procedures, strengthening them to reflect unique regional trends. Memphis also has data reconciliation issues, multiple sources of data must be made consistent with a model calibration year or a justification developed why not. Memphis can also conceivably better integrate with the Tennessee statewide model.
- Detroit faces a data issue similar to many MPOs; the need to perform an existing data inventory.
- Colorado Springs should coordinate data sharing with neighboring MPOs, particularly Denver Regional Council of Governments (DRCOG), and transit data collection must comply with FTA requirements. As for borrowing data, it must be done carefully, logically and from comparable regions.
- For San Francisco, the Panel recommends a detailed analysis of household survey data and encourages the use of GIS to add value to the data.

Transit and alternative mode modeling

Baltimore is implementing a new mode choice model. The Panel suggests that Baltimore should carefully consider the ramifications of gentrification of the urban core as it relates to trip generation, distribution and mode choice. In Memphis, the Panel suggests making the model more sensitive to environmental justice issues as this may be affecting the quality of transit model validation results. While Panelists at Detroit felt that including a non-motorized mode is the right thing to do in good model practice, it is still not a high

priority for a near-term model update. Detroit can use their recent household travel survey to re-estimate and re-calibrate their mode choice models but other tasks should be completed first. At Colorado Springs, non-motorized trips are underrepresented in the model, and so factors such as density and urban design characteristics should be considered.

Modeling a variety of toll and HOV policies

Almost all Peer Review Panels recommended that agencies develop a method for modeling pricing policies and begin the necessary data collection to support the model. At a small MPO, complicated pricing aspects should be kept simple, accounting only for tolls and including feedback to the trip distribution phase.

Re-evaluating modeling zone sizes whenever opportunity allows.

Peer Panels again overwhelmingly recommended that agencies begin to investigate opportunities for smaller zone sizes. The choice of zone sizes depends on the available data, data quality, and use of results. The ability to use smaller zone sizes will allow more detailed modeling of areas which need special attention, such as those areas which display unusual characteristics or are highly diverse and require finer grained modeling.

Consideration of time-of-day variables in models. The Peer Review Panels recommended including or improving time-of-day modeling, since the transportation system varies widely during peak and non-peak hours and in light of different peaking characteristics for transit and auto riders.

Technical Recommendations for Emergent Issues

The following issues were raised for the first time in these six peer reviews.

Air Quality

- At Baltimore, it was noted that engine technology seems to be “solving” air quality problems. Despite projected growth, projected emissions seem to be decreasing.
- In Memphis, air quality modeling methodology must be prepared.
- To complete the air quality model integration at Detroit, the panel felt that the class-specific TOD traffic volumes and speeds used in subsequent air quality analyses should be derived from the class-specific TOD traffic volumes from the traffic assignments.

Trip Generation and Distribution

More segmentation greatly enhances the forecasting accuracy of a gravity model. Increased socio-economic data inputs can add explanatory power and accuracy. Cross-classification schemes should be sensitive to market characteristics that are likely to change over time. Trip rates should be validated, trip purposes should be clear. It is easier to draw linkages between workers and specific job types in destination choice than in gravity models. There is concern that gravity models are inadequate in modeling travel patterns for distribution, however, a destination choice formulation should be developed and sensitivity tested.

Traffic Assignment

MPOs would be best served to compare free flow speeds with mid-day speeds to make sure the model speeds are realistic. One panel recommended that the MPO use actual free flow speeds that were higher than posted speeds as a start for their model.

Traffic Operations Tools/ITS

There is a need for a bridge between regional modeling and detailed traffic operations analysis. Furthermore, the effects of ITS, travel demand management, and transportation system management techniques are very difficult to predict on a large scale. They are usually better handled through microsimulation.

B. Managing the Modeling Process and Results

The Peer Review meetings covered topics beyond the technical details of the model itself. The following are highlights of recommendations made by the Peer Panels on ways to better manage the modeling process and optimize the use of the model results. Again, these issues and recommendations echo issues addressed in the last synthesis.

Building expertise

Training and retaining staff is an issue faced by all agencies. Panels recommend that MPOs create a core team of modeling specialists, and/or consultants. Consultants can be used for educating, tutoring, training, coaching, mentoring, computer programming, debugging, reasonableness checking, brainstorming, second-guessing, collaborating, problem-solving, etc. Sometimes an agency does not need a model developer on staff but still will need staff who can understand the fundamental theory behind the model. PhD candidates can be a useful resource.

Early dialogs between modelers and policy makers should be conducted to ensure model sensitivity to policy initiatives that might be used in the future. At the Memphis Peer Review the need to better understand the needs of policy makers was raised, and also the need to articulate the models' abilities and limitations in evaluating particular policies and sensitivities.

IV. Agency Feedback from Previous Peer Reviews

To understand the medium-term impacts (one to two years) of peer reviews, representatives from five MPOs that conducted peer reviews during 2003 and 2004 were interviewed. Overall, the respondents were very satisfied with the results of their agency's peer review. They felt that the peer reviews met or exceeded their expectations. Further, they thought that the panelists were easy to work with, technically skilled, and interested in helping the host agencies improve its model. They also felt that the application process was straightforward and simple.

Respondents mentioned two significant outcomes of the peer reviews: model improvements based on panel recommendations, and increased model credibility. Every respondent said that their agency has used the peer panel recommendations to guide travel model enhancements. Specific actions that resulted from the peer reviews included re-evaluating travel times, adjusting the k-factor in the logit model, and adding staff at the state department of transportation to provide more technical assistance to MPOs. Two respondents said that their agencies have implemented almost all of the peer panel recommendations.

Of course, there have been recommendations that agencies have not implemented. In a few cases, this was because the agency simply disagreed with the recommendation. More often, however, this was because the recommendation requires more time and money than the agency can dedicate to the model. For example, recommendations that involve

significant new data collection or creating a new activity based model are difficult to implement in the short- or medium-term. Nonetheless, respondents said that these longer-term recommendations are shaping their ideas for the future of their travel modeling.

Respondents were pleased that the peer review process imparted added credibility to their models. One of the primary benefits of this was that the forecasts had more legitimacy in the eyes of external stakeholder groups. For example, one interviewee said that local jurisdictions that rely on the MPO's travel forecasts had more confidence when applying the forecasts to their own planning efforts. Another respondent said that the peer review improved agency forecasts in the eyes of special interest groups.

Among the interviewees, there were two respondents who had also served as panelists for other agencies' peer reviews. They felt that serving as a panelist was very educational, and that they were able to draw on panel experience when analyzing their own model.

One area for improvement is in helping host agencies choose peer panelists. Two respondents felt that they did not know enough modeling experts, or know enough about the experts they were familiar with, to be confident in their choices of panelists. The host agencies relied on information from sources such as TRB committee rosters, the FHWA division office, and the state DOT. However, the respondents would have liked more information on the specific modeling expertise of potential panelists, and on how effective the experts would be in a critical evaluation of their agencies' models. Despite this uncertainty, these respondents felt that they chose very good people to be on their peer review panels

Appendix A: Acronyms

The following is a list of acronyms used in this report:

BMC Baltimore Metropolitan Council
DOT Department of Transportation
EPA Environmental Protection Agency
FHWA Federal Highway Administration
FTA Federal Transit Administration
GIS Geographic Information System
HOV High Occupancy Vehicle
ITS Intelligent Transportation System
MPO Metropolitan Planning Organization
MTC Metropolitan Transportation Commission
PPACG Pikes Peak Area Council of Governments
SEMCOG South Eastern Michigan Council of Governments
TAZ Traffic Analysis Zone
TMIP Travel Model Improvement Program
TOD Time of Day
TRB Transportation Research Board

Appendix B: Index of Peer Review Panel Meetings

The following is a list of TMIP Peer Review Panel Meetings held between June 1, 2004 and May 30, 2005. Information includes the host agency, city location, date of the Peer Review Panel meeting, and a link to the meeting report contained on the TMIP website.

Baltimore Metropolitan Council (BMC) (1)

Baltimore, Maryland

September 23 – 24, 2004

http://tmip.fhwa.dot.gov/services/peer_review_program/documents/bmc/report1/

Baltimore Metropolitan Council (BMC) (2)

Baltimore, Maryland

February 28, 2005

http://tmip.fhwa.dot.gov/services/peer_review_program/documents/bmc/report2/

Memphis MPO

Memphis, Tennessee

October 27 – 28, 2004

http://tmip.fhwa.dot.gov/services/peer_review_program/documents/memphis/

Metropolitan Transportation Commission (MTC)

Oakland, California

December 2 – 3, 2004

http://tmip.fhwa.dot.gov/services/peer_review_program/documents/mtc/

Pikes Peak Area Council of Governments (PPACG)

Colorado Springs, Colorado

April 12 – 13, 2005

http://tmip.fhwa.dot.gov/services/peer_review_program/documents/ppacg/report1/

Southeast Michigan Council of Governments (SEMCOG)

Detroit, Michigan

December 6 – 7, 2004

http://tmip.fhwa.dot.gov/services/peer_review_program/documents/semcog/

Appendix C Peer Reviewers and their Affiliations

Bhat, Chandra - University of Texas
Castiglione, Joe - PBconsult,
Cervenka, Ken – North Central Texas Council of Governments
Cooney, Tom – Pima Association of Governments
Davidson, Bill - PBconsult
Eash, Ron - Northwestern University
Forinash, Chris - EPA
Goulias, Kostas - University of California Santa Barbara
Granzow, Edward - CH2M Hill
Killough, Keith - KLK Consulting
Koppelman, Frank - Northwestern University
Lawton, Keith - Portland METRO
Matley, Ted - FTA
May, Jeff – Denver Regional Council of Governments
McFarlane, Bill – San Diego Association of Governments
Miller, Eric - University of Toronto
Outwater, Maren - Cambridge Systematics
Pihl, Eric - FTA
Rossi, Thomas - Cambridge Systematics,
Rousseau, Guy – Atlanta Regional Commission
Sabina, Erik – Denver Regional Council of Governments
Schlappi, Mark – Maricopa Association of Governments
Slavin, Howard - Caliper
Sosa, Mayela - FHWA
Spear, Bruce - FHWA
Spielberg, Frank - BMI-SG
Walker, Dick - Portland METRO
Yoder, Supin - FHWA