# Summary Report of the Peer Review Panel for the Southeast Michigan Council of Governments Travel Model Improvement Effort

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**Travel Model Improvement Program (TMIP)**
***Report on the Findings of the Peer Review Panel***
***for the Southeast Michigan Council of Governments***
***Location: Detroit, Michigan***

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| **Date:** | December 6-7, 2004 |
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## EXECUTIVE SUMMARY

This report summarizes the results of the two-day peer review meeting conducted at the request of the Southeast Michigan Council of Governments (SEMCOG) through the Travel Model Improvement Program (TMIP) sponsored by the Federal Highway Administration (FHWA). SEMCOG requested that the panelists assess the current travel demand model and recommend both near-term and long-term model enhancements.

SEMCOG has a relatively new TransCAD-based four-step travel demand model. The model includes consideration of external, commercial vehicle, and transit trips. It relies on a variety of data sources including census information, a SEMCOG household travel survey, traffic counts, and a transit-on-board survey. After a day of SEMCOG presentations on the current travel demand model and plans for model improvements, the peer review panel met in private to discuss the model and make recommendations for model enhancements.

The peer review panel felt that the current model represents the "state of the practice." The panel felt that the model addresses time-of-day, commercial vehicle, and external trips particularly well.

For future model enhancements, the panel's recommendations include:

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

Several of these recommendations are included in SEMCOG's existing plans for improving its travel demand modeling.

# I. BACKGROUND

The Southeast Michigan Council of Governments (SEMCOG) is the metropolitan planning organization (MPO) for the seven-county southeast Michigan region, encompassing the Detroit metropolitan area. The agency is responsible for developing the federally mandated long-range regional transportation plan (RTP) and the transportation improvement program (TIP) for the region. SEMCOG is also responsible for measuring and documenting on-road mobile source air pollutant emissions for both the air quality state implementation plan (SIP) and the regional air quality conformity analysis. The travel demand forecast model (TDFM) and its underlying theory is a key support tool for this core work.

Travel model operation and maintenance is critical to the quantitative forecasting methods that form the sound technical base for SEMCOG planning and policy decisions. Engineers and planners use the model results for traffic studies, master plan updates, and major transportation projects. The model is also important to local transit operators as it allows them to forecast the potential demand for various transit alternatives.

Over the past two years, SEMCOG has transformed its travel model from a DOS-based TRANPLAN platform to a Windows-based TransCAD® platform. The new model includes a transit model, a time-of-day (TOD) process, a multi-class highway assignment, and a feedback loop. The model was updated using 2000 as the base year. SEMCOG is currently using model Edition 3. The TransCAD highway network is essentially a translated TRANPLAN file with limited geo-location corrections. The new network development activities are based on the Michigan Geographic Framework (MGF). At this time, SEMCOG is updating its multi-year TDFM improvement plan and requested this peer review to assist them in this process.

A major challenge for the model is handling the movement of people and goods across jurisdictional boundaries. SEMCOG works with other transportation and planning agencies in the region to ensure that a truly regional planning process is always maintained. SEMCOG continues to look for ways to maintain an interface with the two regional sub-area models, Washtenaw Area Transportation Study and the St. Clair County Transportation Study, as well as the Michigan Department of Transportation's (MDOT) statewide travel demand forecast model.

SEMCOG's data collection efforts include several surveys conducted over the years with the assistance of various agencies: a 1994 household survey, a 1996 external survey, a 1998 Detroit DOT (DDOT) transit on-board survey, a 1999 commercial vehicle survey, and a 2002 regional transit on-board survey.

Having both roadway and transit forecasting capabilities allows for a comprehensive analysis of transportation alternatives, both in corridor-level studies and in the development of the RTP. Since the inception of the TransCAD model in 2002, SEMCOG has started several projects to further improve its travel model, including:

- A traffic counts database for model calibration and validation
- A 2004-2005 household survey
- A traffic analysis zone (TAZ) revision
- A long-range model development plan

Over the long term, SEMCOG might consider advanced modeling techniques such as tour- or activity-based modeling.

SEMCOG requested that the peer review panelists examine its existing model and the agency's plans for future model improvement and enhancements, as recommended by its consultant (Cambridge Systematics, Inc.). SEMCOG asked the panel to assess their existing model and to help them prioritize near-term and long-term model enhancements. They also wanted recommendations for possible applications of more advanced travel demand modeling methodologies.

## II. PRESENTATIONS AND DISCUSSION

### *A. SEMCOG Travel Demand Model*

#### 1. SEMCOG and the Region

The SEMCOG planning region includes the following seven counties: Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne. In the year 2000, the region had 4.83 million people, 1.85 million households, and 2.16 million employees.

#### 2. Modeling Objectives

In designing their new travel demand model, SEMCOG's objectives were to:

- Have a sound and defensible model design
- Be as consistent as possible with the "state-of-the-practice" in travel modeling
- Meet the project schedule and budget
- Include tools that support all decision-making requirements
- Tie model analysis and data to geographic information systems (GIS)
- Achieve balance between model structure sophistication and available resources
- Have a high level of usability
- Provide accurate representations of:
  - major roadways
  - major transit facilities
  - traffic volumes
  - operating speeds
  - vehicle and transit trips
  - information required to estimate vehicle emissions

#### 3. Data Used in the Model

The model uses three types of data:

- *Survey data*: These data are used for the estimation of the mode choice, time-of-day (TOD), and trip distribution models. These data come from four surveys:

  - 1994 SEMCOG household travel activity survey
  - 1995 DDOT
  - 1995 Suburban Mobility Authority for Regional Transportation (SMART) transit onboard survey
  - 1996 Ann Arbor Transportation Authority (AATA) transit onboard survey
- *Socioeconomic data*: These make up inputs for the trip generation and mode choice models. Households are cross-classified into categories that vary by trip purpose (e.g., workers per household by autos per household for home-based work trips, persons per household by autos per household for home-based shopping trips, and persons per household by children per household for home-based school trips). Employment is categorized into basic, retail, and service.
- *Traffic count data*: These are used during model calibration and validation, and serve as a benchmark for examination of base year model volumes.

## 4. Description of the Model

The new SEMCOG TransCAD model system is a traditional four-step, person trip-based model. The model was calibrated for a base year of 2000. Figure 1 shows the structure for the new SEMCOG travel model system. A description of the individual components follows.

Zone System

The model area consists of the entire SEMCOG planning region. The model's zone system includes 1,442 internal zones and 63 external stations. The external stations are used to reflect trips that have at least one trip end outside the modeled area. This is the same zone system used with the original TRANPLAN model.

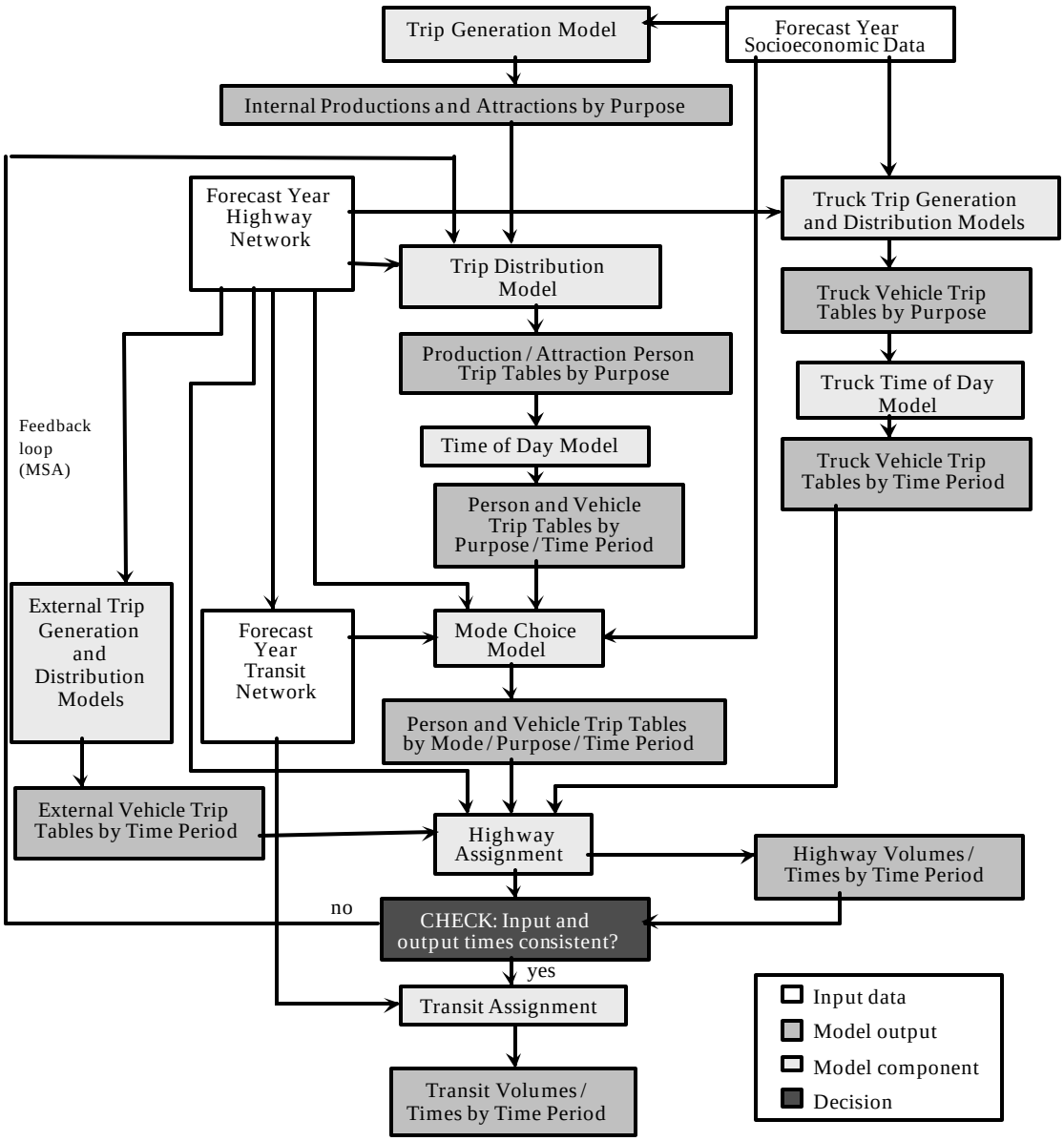
Networks

The model consists of a highway and transit network. When the previous TRANPLAN highway network was converted to a TransCAD network, the following changes were made:

- File formats were converted to TransCAD
- Major highways were conflated to match more closely with the MGF geographic information system
- Additional centroid connectors were added
- Free flow speeds and capacities were revised

The new TransCAD transit network is based on the highway network. It considers the maximum walk distances to and from transit stops. The transit network also considers transit park-and-ride lot nodes that serve as intermediate destinations for automobiles to park prior to the drivers and passengers boarding a transit line. The bus speeds used in the transit network are related to the highway network.

## Fig. 1: Structure of the SEMCOG Model



## 5. Model Components

Four Steps of the Travel Model

The trip generation and distribution models of the new TransCAD model remain unchanged from the previous TRANPLAN model. The four steps are consistent with the traditional standard practice urban transportation planning system model. All the model steps have been validated, although the highway assignment will be subject to additional comparison checks as more traffic counts become available. The documentation for the model has been completed. The model has the following components:

- *Trip generation model:* The trip generation model is based on recent survey data and has been validated.
- *Trip distribution model:* The trip distribution model uses a highway impedance function applied to a gravity model formulation. The trip distribution is applied separately to each trip purpose.
- *Trip generation and distribution for external travel models*: Trip generation is based on zone size and distance from the regional boundary, while trip distribution is obtained from the gravity model. The models are based on the 1995 external survey data. External stations are classified by the following roadway types:
    - expressway
    - arterial near expressway
    - arterial not near expressway
    - collector/local
    - bridge/tunnel to Canada
- *Mode choice model:* SEMCOG tested both multinomial and nested logit models for work and non-work trips that were estimated using data from the 1994 household survey, the 1995 DDOT survey, and the 1996 AATA survey. Although a nested logit model formulation is more detailed, SEMCOG's model estimations did not support a nested formulation. Ultimately, the multinomial models were selected.

Trip assignment*:*

The SEMCOG highway assignment uses a multi-class user equilibrium process. Trip tables are assigned for each time period for six vehicle types:

- single occupant auto
- two-person carpool
- three-or-more-person carpool
- light truck
- medium truck
- heavy truck

Speed flow curves were derived from a modified BPR approach. The highway assignment was validated using traffic counts.

The transit passenger trip tables are assigned using the TransCAD Pathfinder procedure. Walk access trips are subject to a maximum walk time of 18 minutes and auto access trips must go through a park-and-ride lot node.

Truck Travel Model

The truck modeling process creates trip tables for light, medium, and heavy trucks. It also creates TOD trip tables for external-internal and external-external truck trips. The data sources for the truck model development are Michigan's statewide travel model for external trips and the SEMCOG commercial vehicle survey (CVS) for internal trips. The internal trip generation is based on the CVS-developed trip rates applied to the socioeconomic data. The internal trip distribution is based on a gravity model formulation. External trips are obtained from the Michigan statewide travel model trip tables.

Time-of-Day

The TOD factors are derived from the household survey and applied after trip distribution. Time of day is modeled using four time periods:

- Morning peak—7 a.m. to 9 a.m. (AM)
- Mid-day—9 a.m. to 3 p.m. (MD)
- Afternoon peak—3 p.m. to 6 p.m. (PM)
- Evening or off-peak—6 p.m. to 7 a.m. (OP)

Feedback Process

The model feeds the highway assignment travel times back to the trip distribution module. The travel time skims are weighted for each purpose. The model uses the method of successive averages for feedback. Determination of convergence is based on changes in link volumes from run to run.

## 6. Travel Model Update

Since the first version of the TransCAD model, SEMCOG has updated the various model components. This update model is named SEMCOG Model E3. Most notably, the highway network was changed so that it is now fully compatible with MGF version 2.0. The network development is based on the MGF, which is the highway network translated from TRANPLAN. The consolidated highway network improved communication between databases and increased the number of centroid connectors from 1.6 to 1.8 per TAZ. Another improvement was the complete re-coding and re-development of the transit network based on the year 2000 published schedules from local transit providers.

The updated model also considered TOD calibration, mode choice model adjustment, external model adjustment, truck model adjustment, and highway assignment validation. It adopted the SEMCOG 2030 regional development forecast and used a zone system with 1442 internal TAZs and 63 external stations based on 1990 census zonal definitions. The individual calibrations of the updated model are:

- *Time-of-day calibration*: The initial TOD factors for each of six internal trip purposes were derived primarily from the 1994 household survey. It also incorporated data from the MDOT's hourly traffic counts and SEMCOG's own regional traffic count database.
- *Mode choice model revision:* This revision introduced dummy variables to address over-estimation of suburban transit trips by adjusting the constants. In addition, the revised mode choice model eliminated midday and off-peak auto access to the transit mode to reflect the actual transit operation schedules.

- *External travel model adjustment:* This revision used SEMCOG's latest external traffic counts to adjust the base year trips. The revised total external trip ends increased from 199,200 to 651,300 (which corrected a previous error).
- *Commercial vehicle model adjustment:* The updated commercial vehicle model adjusted the base year vehicle trips according to the 1999 CVS expansion factors. The adjustments will be re-evaluated using 2002 vehicle classification counts. The passenger car equivalents are 1.1 for light trucks, 1.5 for medium trucks, and 2.5 for heavy trucks.
- *Highway assignment calibration:* The model uses the SEMCOG regional traffic count database, MDOT traffic counts, screenline counts, and highway performance monitoring system (HPMS) counts as benchmarks for the highway assignment calibration database. The comparison showed that the overall modeled vehicle miles traveled (VMT) is 6.6 percent above the HPMS and 5.3 percent below the other traffic count databases.

### 7. Model Statistics for Year 2000 Edition 3

For the SEMCOG planning region, the base year 2000 model run indicated approximately 133.3 million vehicle miles of weekday travel. The total number of weekday internal trips is 15.83 million and the total number of weekday linked transit trips is 182.8 thousand. The overall transit mode share is 1.1 percent.

## *B. SEMCOG Model Improvement Plan*

The model improvement plan aims to evaluate SEMCOG's modeling needs and develop a list of necessary model improvements. The scope includes developing a multi-year model improvement plan and identification of data needs.

### 1. Plan Scope

The model improvement plan includes a review of a number of issues relating to data collection, travel demand forecast modeling, and policy considerations.

Data collection is necessary for input and adjustment to the steps in the TDFM. One major data collection effort, the 2004-2005 Michigan statewide household survey, is near completion. In addition, SEMCOG collects data every year for its regional traffic count database. Once gaps in these databases are filled, model validation capabilities will improve. New census data will also be examined, as will information on performance measures and cross border travel.

The identification of short- and long-term needs is also a key priority. By identifying these needs, the improvement plan can help SEMCOG determine the appropriate balance between implementation of advanced techniques and the improvement of the basic model components.

On the policy side, changes in air quality conformity standards require that additional counties be included in SEMCOG's air quality conformity analysis. This requires a review of SEMCOG's air quality modeling-TDFM interface. Consequently, SEMCOG continues to maintain coordination with MDOT statewide modeling efforts. Additionally, SEMCOG is considering

how to manage modeling issues such as high occupancy vehicle modeling and toll modeling. Other issues include development of the SEMCOG Year 2035 Regional Transportation Plan in 2009; project planning; microsimulation of households, trips, and traffic; intelligent transportation system applications; and staffing and resource availability.

## 2. Modeling Needs

The model improvement plan can be divided into short-term and medium-term modeling needs and long-term modeling possibilities.

Short-Term Modeling Needs

- TransCAD upgrade to version 4.7
- GISDK code revision to increase efficiency
- Simplified model development
- Base year update to 2002
- Data and scenario management
- Area type model evaluation
- Two-way-left-turn lane capacity definition
- Generalized impedance-based highway assignment
- Transit network issues and speed function development

Medium-Term Modeling Needs

- TAZ revision and network redevelopment using 2000 census definitions
- Functional class and capacity definition study based on the Highway Capacity Manual
- Consideration of additional trip purposes
- Inclusion of non-motorized modes
- Segmentation in trip distribution and mode choice models
- Conformity with Federal Transit Administration guidelines
- Vehicle availability
- Parking cost modeling
- Update of external trips, which may require new survey data
- A new study of traffic going to and coming from the Detroit Metropolitan Airport (DTW)

Long-Term Modeling Possibilities

- Tour- or activity-based modeling
- Microsimulation of households and trips
- Traffic microsimulation
- Land use modeling
- Enhanced freight modeling

## 3. Progress to Date and Next Steps

As part of its continuing effort to update and improve its travel demand forecasting capabilities, SEMCOG has undertaken the following tasks:

- Conducting (as part of the MDOT statewide survey effort) a 2004-2005 regional household survey of 6,040 households
- Developing the traffic count file for model calibration and validation
- Establishing a travel model development plan
- Refining a multi-year highway network database system

The improvement plan has identified peer MPOs for SEMCOG and obtained documentation on their models. SEMCOG and its consultant have reviewed and documented the existing SEMCOG model and prepared a technical memo on modeling needs. SEMCOG and its consultants intend to complete the comparisons with peer MPOs and develop recommendations and a multi-year model refinement plan that incorporates the comments of the peer review panel.

### *C. SEMCOG Air Quality Status*

Currently, the SEMCOG region and the contiguous county of Lenawee are in marginal nonattainment status for eight-hour ozone levels. Two of the seven counties in the SEMCOG region are in preliminary non-attainment status for fine particulate matter. SEMCOG is awaiting a final determination from the Environmental Protection Agency on these counties. Other air quality concerns exist in Wayne, Oakland and Macomb, which are in "maintenance" status for carbon monoxide.

The travel model inputs to the air quality model include all link-level data. The inputs are:

- daily VMT (by direction)
- daily capacity (by direction)
- link length
- total lanes (both directions)
- functional class
- county code

The local inputs to the EPA MOBILE6 model include age distribution of the light-duty vehicle fleet, local fuel sulfur data (gas and diesel), reid vapor pressure, and minimum and maximum temperatures. The model calculates emission factors for every two mile per hour (mph) speed increment from 5-65 mph. It calculates separate factors for freeways, arterials, and local roads. The air quality model post-processor calculates the seasonal VMT adjustment, temporal VMT distribution, vehicle type mix by hour and functional class, and the link-specific speed by hour and direction.

# III. Peer Review Panel Recommendations

The panel was charged with two primary tasks:

- Assessing the current model status—outlining the strengths and weaknesses of the travel demand model and its application to the transportation planning efforts it supports
- Prioritizing both near-term and long-term model enhancements

On the first day of the meeting, SEMCOG and its consultants presented the status of the model and the model development plans. Following the presentation and subsequent discussions, the panelists convened in private to discuss the SEMCOG's model and identify recommendations for model development. The second day of the meeting was devoted to presenting and discussing these recommendations. The remainder of this section summarizes the panel's findings and recommendations presented to SEMCOG staff and representatives from other agencies (listed in Appendix II).

## *A. SEMCOG Model Strengths and Weaknesses*

The panelists agreed that a four-step TransCAD-based "state-of-the-practice" model is now in place and ready for use on many transportation planning applications projects. The panel felt that the model addresses time-of-day, commercial vehicle, and external trips particularly well.

The panelists also agreed that there is room for improvement in the existing four-step model, and endorsed SEMCOG's desires to move forward with a multi-year travel demand forecast model improvement plan. Three areas for improvement were specifically noted:

- The current mode choice model implementation and transit data validation results need more investigation.
- Traffic assignment validations need to be reviewed in the context of new traffic count data files.
- The traffic assignment speeds for TOD and air quality modeling need to be compared to real-world observed data.

The panel recognized that SEMCOG is already making progress on several data improvements. The 2004-2005 household survey data will be useful in improving the trip generation, trip distribution, mode choice, and TOD components of the model. SEMCOG must use this data to replace the 1994 household survey data carried over during the model translation. Census data will be updated from the 1990 data currently in use to data from the 2000 census. Maintaining and updating the agency's extensive traffic count database will provide a sound baseline for comparison against the travel model volumes and improve TDFM calibration and validation.

The transit mode choice model will be enhanced by incorporating data from the comprehensive 2002 transit on-board survey. Recent revisions to the transit network have improved network connectivity and representation of more of the local streets used by transit providers. Additional network editing will further enhance transit networks to reflect actual route configurations in model simulation.

By using a subset of the MGF base map to create the modeling network, the network geo-location and positional accuracy has already been improved. As refined versions of MGF become available, SEMCOG anticipates maintaining this compatibility through incremental updates. SEMCOG's GIS, planning applications, and alternatives analysis require this compatibility for data sharing. With a commitment toward integrated networks, SEMCOG is poised to make highway and transit networks fully integrated to allow more advanced planning analysis.

### *B. Overview of Recommended Strategy*

The panel's general recommendation is for SEMCOG to keep its near-term focus on important four-step model improvements and network and data enhancement activities that will keep the model's capability consistent with the model's primary purposes. However, SEMCOG must also recognize that the state of the practice for travel demand modeling is moving towards activity-based microsimulation modeling, and SEMCOG may eventually want to consider this type of modeling. Most of the panel's recommendations are useful for the current four-step model, but also provide a solid foundation for a future activity-based model implementation.

### *C. Panel Recommendations*

The following section summarizes the enhancements recommended by the panel. Unless otherwise stated, the panel was unanimous on its recommendations.

Although the original intent was to prioritize all recommendations, the panel felt SEMCOG staff could better perform this task since they have a better sense of their resource constraints. SEMCOG must now determine how to incorporate the following 20 recommendations into its multi-year travel demand forecast model improvement plan. The recommendations are organized under five categories: data collection/networks; model improvements; model validation and verification; model operations; and policy issues.

#### 1. Data Collection and Networks

**Recommendation 1. Existing Data Inventory**
A data collection inventory will support efforts to make the most effective use of all traffic and transit data that already exists (e.g., for sub-area and screenline validations), and help determine what additional data are needed. The traffic count database must be updated. Also, the latest 2005 digital-ortho aerial photos must be reviewed to verify accuracy of current road alignments and existing number of lanes.

**Recommendation 2. Vehicle Classification Counts**
Additional vehicle classification counts are needed. Once these have been collected and analyzed, it may be necessary to update the existing commercial vehicle model. The classification counts will also be useful for air quality conformity analyses.

**Recommendation 3. Network Coding and TAZ Structure**
The panel endorsed SEMCOG's desires for an integrated multi-year network/database management structure. As SEMCOG considers a more refined zone structure, the level of roadway type coded in the database management structure needs to be kept consistent with current classifications. Transit access/egress coding should be considered in the TAZ development, along with the number of trip ends in a zone. Since interactions with Windsor, Canada are important for good regional modeling, the panel suggested consideration of a skeleton network/TAZ structure for Windsor rather than simple treatment of the bridges and tunnel to and from Windsor as external stations.

## 2. Model Improvements

**Recommendation 4. Land Use Modeling**
The panel agreed on the importance of land use modeling and integration with travel demand modeling. The panel is aware that SEMCOG is completing some initial Washtenaw County tests using the URBANSIM software, and reminded SEMCOG that it must be mindful of the significant resources and multi-year time frame that will be needed for a full regional implementation of URBANSIM.

**Recommendation 5. Additional Trip Purposes**
Another consideration during the model updates is the additional market segmentation of home-based work trips for purposes of trip generation, distribution, and mode choice. Although the number of university trips represents a very small portion of all regional trips, they are nevertheless very important to some areas within the region (like Washtenaw County) and should be considered as a separate trip purpose.

**Recommendation 6. Trip Generation and Distribution Review**
The current model's purpose-specific trip rates, average trip lengths, and trip length frequency distributions need to be compared against the 2004-2005 household survey data. The home-based work trip patterns should also be compared against the year 2000 patterns from the 2000 Census Transportation Planning Package.

**Recommendation 7. Non-Motorized Modes**
When comparing SEMCOG's model to those in other areas, the panel supports the inclusion of the non-motorized mode as the "right thing to do" in good model practice, and noted the need to summarize the data from the 2004-2005 household survey. However, three of the five panel members felt that a full implementation is perhaps not the highest priority for the next near-term model update.

**Recommendation 8. Trip Distribution**
Two of the five panelists were concerned that gravity models are inadequate in modeling travel patterns for the trip distribution step. However, all five panelists agreed that a destination choice formulation should be developed and sensitivity-tested. The results should be compared against the current gravity model implementation to determine which of the techniques should be incorporated in a future updated model.

**Recommendation 9. Mode Choice**
SEMCOG can take advantage of the recent 2002 transit onboard survey data as well as the anticipated data from the 2004-2005 household survey to re-estimate and re-calibrate the mode choice models. However, the following tasks should be done in advance of the model re-estimation effort:

- Examine the current model re-estimation/calibration work performed by Parsons Brinckerhoff (PB) and compare it against the existing SEMCOG model implementation
- Identify an approach for market segmentation of home-based work trips in both trip generation and distribution
- Identify an approach for the development of parking cost and auto availability models.

**Recommendation 10. Traffic Assignment**
The panel endorsed a time- and distance-based generalized cost traffic assignment as a good modeling approach. The panel also suggested that some of SEMCOG's reported validation results undergo a re-examination of the BPR-format volume-delay factors, especially for freeways. At a minimum, there should be some additional validation checks with updated traffic count data.

**Recommendation 11. Air Quality Model Integration**
To complete the air quality model integration, 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.

**Recommendation 12. Airport Modeling**
SEMCOG should take advantage of the airport analysis in the model re-estimation work performed by PB (see Recommendation #9). Four of the five panelists felt that a special air passenger survey is probably not necessary.

**Recommendation 13. Enhanced Freight Modeling**
The panelists recommended that SEMCOG better 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).

**Recommendation 14. External Trips**
SEMCOG's external trip modeling should be coordinated with the Michigan DOT statewide model to the greatest extent possible.

**Recommendation 15. Uncertain Model Improvement Items**
The panel identified three other model improvement areas that require further investigation:

- Modifications to how area types are calculated
- A determination of whether modeling of HOV lanes is necessary
- Documentation of the different peaking characteristics for autos and transit riders, as well as ideas about how this should be modeled

**Recommendation 16. Activity-Based Modeling**
The panel recommended that a full activity-based model implementation be considered as a long-term model improvement goal. They felt that the best strategy for SEMCOG is to continue its pursuit of four-step model improvements, and await the results of rigorous activity-based model sensitivity tests performed in other regions.

## 3. Model Validation/Verification

**Recommendation 17. Validations**
The panelists felt that the year 2000 model results need to be examined in more detail. The high root mean square error for freeways may indicate a count problem, a volume-delay problem and/or upper-level model errors. The panel also supported the development of a year 2002 (or later) model validation that will provide further useful information on the quality of the current model (as well as any future model update).

**Recommendation 18. Travel Speed Verification**
The panel recommended additional highway speed (travel time) studies. These can be used to compare TOD assignment speeds against observed TOD speeds. The panelists discussed the related need to see how the average TOD modeled bus speeds compare to average TOD observed bus speeds.

## 4. Model Operations

**Recommendation 19. Traffic Operation Tools**
Overall, the panel recognized SEMCOG's interest in traffic operations tools for use with short-range traffic operations analysis (e.g., traffic signal improvements and/or changes to intersection geometries). The panel pointed out that the limiting constraint in pursuing traffic operations tools may be the resources available for both the four-step travel modeling and detailed traffic microsimulation (or dynamic traffic assignment). The panel agreed that there is a need for a bridge between regional modeling and detailed traffic operations analysis.

## 5. Policy Issues

**Recommendation 20. Travel Model Sharing**
During the peer review, the panel was asked to consider how SEMCOG can share their travel model with other agencies. Workable options for travel model sharing include:

- Perform all model runs in the region and make only the final model forecast results available to others
- Provide agencies and consultants with only portions of the model (e.g., the roadway networks and TOD vehicle trip origin-destination tables)
- Provide agencies and consultants with a simplified model system
- Make all model inputs and procedures available to "certified" agencies and consultants who have received proper training and agree to follow guidelines established by SEMCOG
- Make all model inputs and procedures available "as is" to agencies and consultants

## Appendix I: SEMCOG Travel Model Improvement Plan Peer Review Agenda

**Day One: December 6, 2004, Monday**

| | |
|---|---|
| 8:30 a.m. | Welcome and introductions - Carmine Palombo, Director, SEMCOG Transportation Programs |
| 8:45 a.m. | Overview of the peer review process and charge to the peer review panel - Ken Cervenka, NCTCOG |
| 9:00 a.m. | Overall schedule for the model and planning process - SEMCOG, Michigan Department of Transportation, Washtenaw Area Transportation Study, and St. Clair County Transportation Study |
| 9:30 a.m. | Presentation on current travel model - Li yang Feng, SEMCOG |
| 10:00 a.m. | Break |
| 10:15 a.m. | Presentation on current travel models - (continued) |
| 12:00 | Lunch |
| 1:00 p.m. | Air Quality Conformity modeling - Joan Weidner, SEMCOG |
| 1:15 p.m. | Presentation of the model improvement plan - Tom Rossi, Cambridge Systematics |
| 1:45 p.m. | Questions and answers |
| 3:00 p.m. | Break |
| 3:15 p.m. | Panel deliberation (panel members only) |
| 4:30 p.m. | Adjourn |

**Day Two: December 7, 2004, Tuesday**

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|---|---|
| 8:30 a.m. | Panel deliberation (panel members only) |
| 10:15 a.m. | Break |
| 10:30 a.m. | Presentation of findings and recommendations - panel |
| 11:00 a.m. | Discussion of panel findings and next steps |
| 12:00 | Adjourn |

## Appendix II: List of Attendees

Terri Blackmore, WATS
Alex Bourgeau, SEMCOG
Tom Bruff, SEMCOG
Ken Cervenka, NCTCOG
Jim Cramer, FHWA
William Davidson, PB
Tiffany Draper, SEMCOG
Jennifer Evans, SEMCOG
Li-yang Feng, SEMCOG
Christopher Forinash, EPA
Jay Gardiner, SMART
Qiang Hong, SEMCOG
Tiffany Julien, SEMCOG
Shruti Mahajan, Volpe Center USDOT
Sayeed Mallick, SEMCOG
Chris Mann, SEMCOG
William McFarlane, SANDAG
Carmine Palombo, SEMCOG
Tim Roseboom, DDOT
Tom Rossi, Cambridge Systematics, Inc.
Jerry Rowe, SEMCOG
Mark Schlappi, MAG
Stephanie Taylor, SEMCOG
Joan Weidner, SEMCOG
Brad Winkler, MDOT
Supin Yoder, FHWA