Transportation Model Improvement Program (TMIP)
Report on Findings of the Third Peer Review Panel for the Atlanta Regional Commission (ARC)

Location: Atlanta, Georgia
Date: February 3-5, 2004
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Executive Summary

The following report summarizes the results of a Peer Review Panel held through the Travel Model Improvement Program (TMIP), which is sponsored by the Federal Highway Administration (FHWA). The Atlanta Regional Commission (ARC) hosted the 2.5-day peer review composed of Metropolitan Planning Organizations (MPO), private consultants, and Federal and local transportation and resource agencies. The primary aim of the peer review was to provide ARC with an independent assessment of its travel demand modeling system and to compare the model with industry standards.

ARC's current travel model, which is used to develop travel forecasts, was implemented using input received in a previous peer review on modeling in June 2000.

As a result of the 2000 review, ARC's modeling structure evolved, taking advantage of previous panel comments. The model enhancements led to analyses and results included in the regional transportation plan. Through the Peer Review, the progress and performance of ARC's most current travel model update were assessed. Areas in which ARC might improve its modeling procedures were also identified. Specific subjects considered and evaluated include:

- Recent modifications to ARC's Transportation Planning Plus (TP+) input assumptions,
- The future direction of ARC's land use forecasting and modeling process, and
- The suitability of emerging tour-based modeling platforms to meet Atlanta's future modeling needs.

Initially, ARC staff and the consultants under contract to ARC, Parsons Brinkerhoff, gave presentations on the existing state of the ARC modeling practice, including descriptions of collected data, assumptions, and objectives for modeling procedures. ARC's planning partners, a group that included local transportation and resource agencies, also provided succinct lists of recent ARC modeling successes and areas for improvement.

Participants in the peer review included transportation and land use model experts from the Denver Regional Council of Governments (DRCOG), Sacramento Area Council of Governments (SACOG), Portland Metro Planning Department, North Central Texas Council of Governments, Maricopa Association of Governments (MAG), Parsons Brinkerhoff, PB Consult, Georgia Department of Transportation (GDOT), Georgia Regional Transportation Authority (GRTA), Metropolitan Atlanta Rapid Transit Authority (MARTA), Georgia Department of Natural Resources Environmental Protection Division (EPD), Environmental Protection Agency (EPA), FHWA Atlanta Resource Center, FHWA GA Division, and the Volpe Center. The peer review was held February 3 through February 5, 2004 at the ARC offices in Atlanta, Georgia.

Background

The Atlanta Regional Commission (ARC) functions as the Metropolitan Planning Organization (MPO) for 10 Georgia counties: Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, and Rockdale. Each of these counties pays dues to be an ARC member. ARC's transportation planning and modeling area encompasses 13 counties, an area likely to be expanded to 18 counties in the future.

The region's prevalent transportation planning challenge is extensive growth. Currently, over 3,500,000 people live in an area of more than 2,981 square miles, and since the Atlanta region is not located at a seaport, the city relies heavily on its rail and highway networks. The area supports 16,500 roadway miles, 300 rail cars on 46 one-way rail miles, 850 buses and vans serving 5,600 miles. These networks are expected to continue experiencing both occupancy and mileage growth.

The number of total workers in the Atlanta region is also expected to continue expanding. Over the last 10 years, the Atlanta region workforce increased by 33.6%, representing an increase nearly three times higher than the national average (11.5%). Average travel time to work in the region increased 20.2% during this same time period, from 26 minutes in 1990 to 31.2 minutes in 2000, the fourth highest percent change in the nation. More recently, in 2002, people averaged 31.8 daily vehicle miles traveled (VMT), while transit ridership was over 560,000 people per weekday.

The regional growth and extensive roadway network has contributed to the designation of the 13 Atlanta region modeling counties as non-attainment areas under the 1990 Clean Air Act Amendment's (CAAA) National Ambient Air Quality Standards (NAAQS). Twenty counties have been proposed for the 8-Hour Ozone Standards non-attainment.

ARC's transportation demand model, which predicts the impact of travel growth, also helps ARC and its partners assess how potential transportation improvements might affect air quality conformity. The model also supports the federally required long-range Regional Transportation Plan (RTP), the basis upon which an annual short-range Transportation Improvement Plan (TIP) is developed. The current ARC travel simulation model follows the traditional four-step modeling structure: generation, distribution, mode choice, and network assignment.

In previous peer reviews, modeling experts suggested that there were several areas ARC might investigate for model improvements. ARC acknowledged these recommendations and has made efforts to significantly refine and enhance its travel simulation and forecasting capabilities. Improvements to the model as identified by ARC include:

- Reroute model loop to Trip Generation from Trip Distribution
- Conversion of the modeling platform from TRANPLAN to TP+ (have been in TP+ environment for 2 years and will be moving to CUBE platform)
- Enhanced coding procedures for both the Highway and Transit networks
- Updated trip generation models
- Revised Volume-Delay Curves, Capacities and Free Flow Speeds
- Enhanced Time-of-Day Modeling Procedures
- Updated External Travel Parameters
- Updated the Mode Choice model based on the year 2000 Transit On-board Survey
- Updated the Airport Model using the year 2000 Airport Interview Survey
- Updated Emissions Model

An evaluation of both these current model improvement efforts and long-term goals, such as the development of a tour-based approach to trip generation and trip distribution, were the subjects of the February 3-5, 2004 Peer Review Panel.

Presentation and Discussion

Introduction and Four Step Modeling Process
Jane Hayse, Guy Rousseau

A peer review of ARC's travel demand modeling process was held in June 2000. Based on recommendations from the panel of modeling experts, ARC made many improvements to its travel demand model. New data, assumptions, and model structure were used to create a mechanism by which more accurate and reliable transportation forecasts can be made.

The first model enhancement consisted of converting from a TRANPLAN platform to a TP+ platform. The TP+ platform is based on the established four-step transportation model – trip generation, trip distribution, mode split, and traffic assignment. These steps are combined to allow modelers to estimate vehicle trip counts and distribution based on household level information.

In order to determine at the household level vital information for generating estimates of home-based and non-home-based trips, ARC used a Household Travel Survey (HTS). In the survey, ARC asked all members of a household five years old and older to document all of their travel information for a 48-hour period. This level of information constituted "full participation." Once data were collected, it was determined that 8,069 households had fully participated. In total, the demographic data collected reflected 20,472 persons, 14,371 vehicles, and 131,323 trips made during the two-day travel periods.

ARC's model also takes advantage of recent data updates. Census datasets and college/university enrollment numbers from 2000 are now included in model runs. Data improvements have necessitated revisions to the parameters utilized in the Disaggregated Residential Allocation Model and Employment Allocation Model (DRAM/EMPAL). Here, ARC disaggregates 589 census tracts into 1683 internal traffic analysis zones (TAZ). Before the June 2000 peer review, ARC used 948 TAZs. In order to accommodate the internal TAZ geometric configuration, ARC revisited how it defined and treated centroid connectors. ARC maintained the same number (57)of external stations.

Other areas of model improvement are as follows:
- Facility type definitions and free-flow speed data were expanded.
- A bus speed model was developed.
- Transit service access was defined. Walk-to-local-service and Walk-to-premium service were differentiated and automated in the model.
- Park-and-Ride lots were separated by type.
- Mode-to-mode transfer prohibitions were refined.
- Bus Rapid Transit coding methods were refined.
- Coding was updated in order that features such as Intelligent Transportation Systems (ITS) features could be included and carried through the model's four steps.

These improvements were integral to the creation of the 2030 Aspirations Plan, a plan that is the first phase in the process to create the 2030 RTP ("Mobility 2030"). The 2030 Aspirations Plan is intended to provide planners with the information necessary to understand the range of transportation solutions required to reduce congestion and improve mobility.

Population and Employment Forecasts
Bart Lewis

To appraise future transportation requirements based on economic and population (births and immigration) growth, ARC uses the DRAM/EMPAL model. The model combines demographic and econometric data for forecasts. DRAM/EMPAL produces forecasts at the census-tract level that must be disaggregated to the TAZ level. The disaggregated information feeds into the TP+ platform, which operates at the TAZ level. The model provides a method by which localized forecasts can be made.

These small-area forecasts are produced using a two-step procedure. First, control forecasts for the entire region are made using the Interactive Population and Econometric Forecast (IPEF Model). This cohort component model, which separates the population into 18, 5-year age groups, econometrically forecasts future jobs, then estimates the population required to fill those jobs. In ARC's view, this method is appropriate because the job market created by an expanding economy is the driving force attracting new residents to the Atlanta region. For the second step, the IPEF created control forecasts are disaggregated into more localized estimates using 5-year iterative cycles of DRAM/EMPAL.

The DRAM component of the model forecasts household location based on prior employment location, prior population location, land use, household-income distribution, and travel cost. Similarly, the EMPAL component forecasts employment location based on prior employment location, prior population location, employment attractiveness, and travel cost.

As new data become available, ARC updates the DRAM/EMPAL model. The Atlanta region's Livable Centers Initiative, a program that funds 42 towns and activity centers to collect demographic and economic data, has been a productive source of information helping to give ARC a level of community understanding it did not have previously. ARC attempts to receive input on these and other new data as well as on new DRAM/EMPAL assumptions and results by sharing the information with partnering agencies. Opportunities for active involvement, such as local meetings, are held, and reports requesting local government comments are drafted. By providing intermediate model data and results, ownership among local governments is fostered. Local governments are able to compare more easily their own local forecasts to ARC's regional forecasts. The challenge for ARC is that local governments have different ambitions and ideas about future growth.

Mobile Source Emissions Modeling Process
Tracy Clymer

ARC seeks to continue providing consistency and credibility to various reviewers within the context of air quality and conformity determination in Atlanta. To do so, ARC utilizes a traditional link-based procedure to estimate mobile source emissions. This process satisfies Federal transportation conformity regulations that direct regional emissions analyses. It is also consistent with methodology used to develop emissions inventories needed to establish the Motor Vehicle Emissions Budget (MVEB) as part of the SIP.

ARC's mobile source emissions model calculates levels of NOx and VOC emissions (precursors to formation of the criteria pollutant ozone) that the regional highway and transit networks produce. The emissions model has undergone significant enhancement since the June 2000 Peer Review, including updates to reflect the recalibration of the travel demand model after the release of the 2000 Census data and expansion to four time-of-day periods. In the model, daily vehicle trips are broken down into four time periods – the morning peak from 6:00 a.m. to 10:00 a.m., the mid-day peak from 10:00 a.m. to 3:00 p.m., the evening peak from 3:00 p.m. to 7:00 p.m., and the night hours from 7:00 p.m. to 6:00 a.m. This extension is important because output received from the time-of-day periods can be used to more accurately determine temporal emissions levels and impacts.

The mobile source emissions model, like the overall transportation demand model, has been converted to the TP+ platform. Within ARC's TP+ emissions interface, two primary variables affect mobile source emissions estimates: vehicle miles traveled (VMT) and speed estimates. The model interprets loaded networks for each time-of-day period then post-processes speeds and VMT. Emissions model output are listed below:

- Link VMT (post-processed)
- Link free-flow speeds and congested speeds (post-processed)
- Link Federal Information Processing Code Standard (FIPS)
- Link ARC facility type code and HPMS functional class code
- Link VOC and NOx emissions

Environmental Protection Agency (EPA) guidance recommends HPMS based forecasts for conformity analyses. ARC currently compares average daily, summer-adjusted HPMS VMT estimates for 2000 to average daily, summer-adjusted travel model VMT for 2000. The adjustment factors are applied at the link level using HPMS functional class codes.

$$\text{HPMS Adj. Factor}_i = \text{2000 HMPS VMT}_i/\text{2000 Model VMT}_i$$
where, i = HPMS functional class

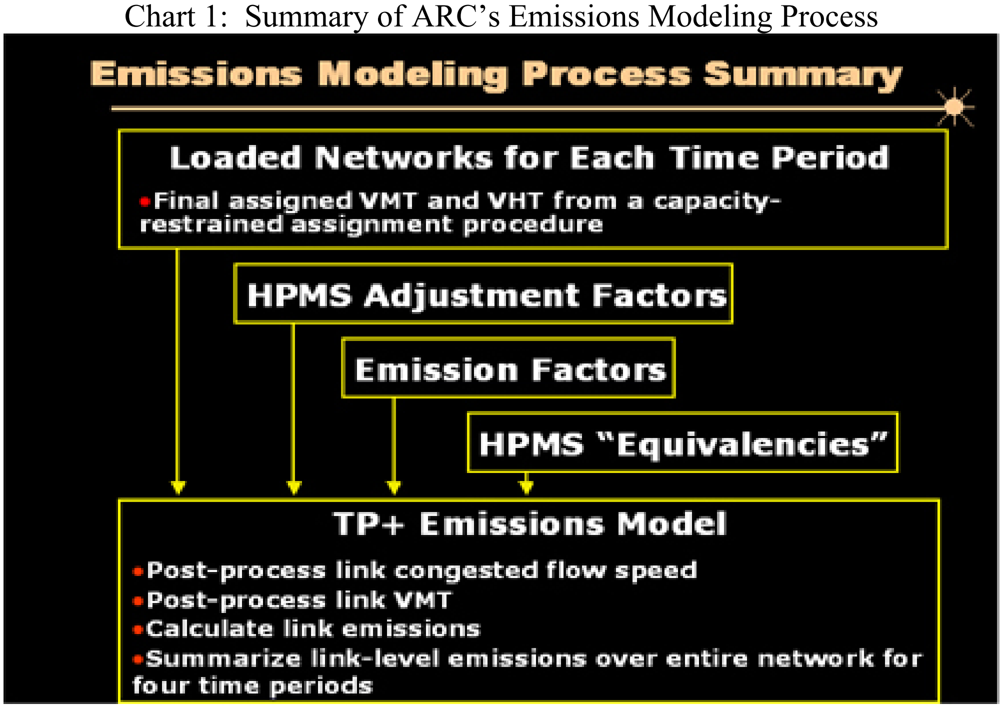
The adjustment factors generated by the model ranged from 0.69 for "rural interstates" to 2.76 for the "urban other freeways" classification. The panel commented that this range (and potential error) might have resulted from inconsistencies between ARC and HPMS classification systems and roadway type definitions.

Along with HPMS adjusted VMT, speed affects mobile source emissions estimates. Currently, ARC applies speed post-processors based on volume-delay functions to congested-flow speed estimates. The volume-delay functions are applied for each time of day period for individual road classes. The post-processed congested speed is calculated by multiplying the free flow speed on a link by an appropriate speed function, a function of facility type and the volume/capacity ratio as determined by a built-in look-up table. The panel recommended that ARC revisit the reasoning behind including these speed post-processors (See Summary of Panel Recommendations).

ARC's emissions model has also now been converted to integrate MOBILE6.2 emissions factors model. ARC uses the MOBILE6.2 model to predict gram per mile emissions of volatile organic compounds (VOC) and nitrous oxides (NOx) under various conditions by drive cycle. The Georgia Environmental Protection Division (EPD) collaborates with ARC to generate MOBILE6.2 model input data. Emissions factors are produced for 2.5 mph and 3 mph to 65 mph in one mph increments.

ARC plans to continue to update its current emissions model and process, which is summarized in Chart 1 below. In the future, ARC anticipates incorporating PM2.5 emission factors and making model modifications as necessary based on the 8-HR Ozone and NAAQS requirements. ARC's air quality modelers also look forward to updating the emissions model according to the peer panel's recommendations.

Chart 1: Summary of ARC's Emissions Modeling Process



Source: Tracy Clymer, ARC

Multi-year Activity-Tour Based Model
Bob Donnelly, Peter Vovsha, Mark Bradley, John Bowman

ARC consultants, Parsons Brinkerhoff, gave presentations on the status of the development of a tour-based transportation demand model for the Atlanta region. Tour-based models differ from traditional models in that they predict “tours” rather than “trips,” while simultaneously calculating the main components of a person’s travel during a day. Tour-based models are based on actual data and can capture the interdependence of different activities in a trip chain and provide better understanding of non-home-based travel and travelers’ responses to transportation policies. These models can also explicitly model intra-household interactions, providing enhanced temporal resolution to transportation demand. Through log-sum calculations, this makes clear estimations of the time structure of transportation use possible. Each of these advantages of a tour-based model would allow ARC to develop transportation demand analyses, which include many added variables, more quickly, without losing detail or increasing computational complexity.

In 2003, the Atlanta region’s tour-based model design was completed. Development of the model structure and subsequent refinements were fashioned from lessons learned by other metropolitan areas studying tour-based models. As a part of this progress, a Population Synthesizer component was created, programmed, and put through initial testing. The Population Synthesizer creates synthetic populations of households and their members, two characteristics that affect travel activity and choices. The Synthesizer creates household populations through two basic steps, the Balancer step and the Drawer/Validator step. The Balancer determines initial estimates of the number of households in each zone then adjusts these estimates by iterative proportional fitting, a mathematical procedure that combines information from two or more datasets. The Drawer/Validator uses the Balancer’s simulated household population data to back-cast population estimates for comparison to actual data.

Other aspects of tour-based model development that have been completed include model estimation of household car ownership, household daily activity patterns (DAP) by eight person types, tour mode choice, tour time of day/duration, household joint tour generation, household allocated maintenance tour generation, and individual discretionary tour generation. Consultants have also incorporated grid cell data into the model, better allowing for the modeling of pedestrian activity.

The Atlanta region tour-based model has produced some initial empirical results. These results, some summarize in Table 1 below, are similar to results generated from other tour-based models.

Table 1. Summary of Initial results of Atlanta Region tour-based model.

Occurrence	Trend
Duration Effect	Longer travel times extend the duration of a tour and shift work tours earlier in the day (constrained arrival time).
Congestion	Higher travel impedance in peak period shifts outbound and return

Effect	trips to other times of day.

ARC consultants intend to finalize the first tour-based model for the Atlanta region during FY04. In order to do this, the following model refinements are scheduled:

- Addition of a primary destination choice
- Addition of trip mode choice
- Calibration and validation of the Population Synthesizer
- Development of a dual-approach for cross-testing the tour-based model with the current model, as well as a strategy and schedule for model conversion.

Questions regarding the model's ability to estimate air quality, for example, still remain. ARC is reluctant to be the first MPO in the country to try to attain air quality conformity determination with a tour-based model. To date, the tour-based model weaknesses are not well documented, nor has there been explicit enumeration of the model's benefits. Over the next two to three years as ways to illustrate how a tour-based model adds value to a project – perhaps through exploration of "What If" scenarios, ARC hopes also to observe the benefits of parallel model development.

Stakeholder Comments

ARC and the panel provided ARC's partners the opportunity to comment on ARC's model enhancements. Major challenges to future model improvements were also addressed. The Georgia Department of Transportation, Georgia Regional Transportation Authority, and Metropolitan Atlanta Rapid Transit Authority each provided remarks about the current state of ARC's transportation model. Stakeholder feedback is summarized below.

Georgia Department of Transportation

The Georgia Department of Transportation (GDOT) and ARC have generally maintained an amicable relationship. Each agency has regarded open and clear communication as an asset towards the improvement of transportation planning strategies. GDOT has been particularly satisfied by ARC's conversion from TRANPLAN to TP+, its refinement of the TAZ structure, and its transportation surveys. It was noted that these surveys and surveying techniques might be exportable to other parts of the state.

GDOT also commented on the challenges that, in its view, ARC faces. Concern was expressed as to whether ARC could continue increasing the size of its modeling area for air quality attainment. In order to increase the model area and carry along the detail required for reliable planning, ARC may have to determine how the boundaries of an urban model that continues to reach into rural areas are drawn. GDOT acknowledged that sharing the interstate system plan might help ARC in the determination of external stations. GDOT also expressed how difficult finding freight movement data and incorporating it into the process might continue to be.

Georgia Regional Transportation Authority

The Georgia Regional Transportation Authority (GRTA), an agency that works to improve Georgia's mobility, air quality, and land use practices, is responsible for advocating and implementing a transportation system that is multi-modal and accessible to all citizens. Representatives from GRTA outlined what GRTA viewed as ARC's modeling successes and challenges. Noteworthy achievements included:

- Development of an online model stream
- Extensive documentation of model stream and analysis, allowing for open communication during conformity determination
- Inclusion of GRTA's 2000 speed data in transportation demand model, increasing model fidelity
- Automated process for walk to transit – formerly a tedious process

GRTA noted that the challenge of incorporating heavy-duty truck data, including inventory and volume information, would be difficult. With limited data on freight movement, accurate calculation and calibration of emissions shares in the air chemistry model may be compromised. The mode choice model may also be affected by incomplete heavy truck data, as the public's desire to use roads may be affected by the amount of truck congestion at a given time. In order to avoid these areas of potential model error, GRTA suggested that ARC continue to explore and develop methods to survey and appraise freight figures for the region.

GRTA also recommended that ARC consider bringing all partnering agencies "up to speed" together during the creation of 4-5 year plans. By doing so, more useful input concerning model assumptions, modifications, and results might be garnered. Continued stakeholder participation could potentially strengthen support for TIP funding requests, while helping ARC to determine meaningful measures of model reliability and cost-effectiveness. ARC might also consider incorporating signal timing into the regional model.

Metropolitan Atlanta Rapid Transit Authority

The Metropolitan Atlanta Rapid Transit Authority (MARTA) agreed with GDOT and GRTA on ARC's notable enrichment of their transportation demand model. MARTA noted the following three specific successes of the model:

- Inclusion of bus speeds into the model – This information has made emissions estimates in the model more reliable.
- Refinement of the TAZ structure – With ARC's updates to the transportation model, a TAZ was created for each MARTA station.
- Creation of walk access trips

These successes do not come without accompanying challenges. MARTA questions the transit friendliness of TP+. With the new platform, it has been difficult to determine station access, time of day for transit use, and the overall dependability of station-to-station analyses. Trust and confidence in the new platform must be rebuilt through development and presentation of performance measures.

MARTA requested that ARC provide more explanation of and training in how the model treats transit and the associated assumptions within model runs. New technologies in the future should be implemented at times when partnering agency staff has time to learn alongside ARC staff, ensuring that the entire process and quality control elements are understood. The greater the involvement of collaborating agencies throughout the model development process, the easier buy-in becomes later on.

Summary of Panel Recommendations

The peer review panel provided an overview of model improvement accomplishments that ARC had made since the previous peer reviews. Each modeling expert on the panel also presented to ARC a list of successes and recommendations on how the various models currently used might be improved further. To conclude, the panelists offered a summary of "10 Next Steps" that ARC might consider during future model development and implementation. All of the comments and recommendations presented were results of panel consensus.

Overview of Accomplishments

Michael Morris

The panel commented that over the last eight years, ARC had made numerous positive steps and, in general, remarkable progress in the improvement of the Atlanta region's transportation demand model. The 10 most significant successes include:

- Use of two track program implementation
- Increased stakeholder and partner involvement
- Development and use of survey data
- Major software upgrade and the concurrent documentation of the upgrade
- Improved mode choice model
- Use of speed data in the model
- Continued commitment to improvement of air quality analysis methods
- Increased zone detail, which has helped to improve the explanatory nature of the model (The zone detail has also improved transit accessibility estimation.)
- Introduction of auto ownership into the model
- Attention to network quality detail

Demographic Forecast Models

Rita Walton

Demographic Forecast Model Successes:

- Utilization of a technical advisory group of local experts in economic and demographic theory and solicitation of stakeholder involvement in order to strengthen existing partnerships and build new ones.
- Use of local governments to provide data and insight into their community activities
- Development of an Atlanta region labor market in order to balance population and employment as much as possible
- Implementation of the Interactive Population and Econometric Forecasting model (IPEF) calibrated against historical growth patterns in the Atlanta region
- Development and use of a Population Synthesizer
- Stratification of household/employment data in DRAM/EMPAL

Demographic Forecast Model Recommendations

- Consider increasing the model size, because the economic unit (and labor market) of the model has become larger than model area unit itself and likely will continue to expand outside the current modeling area.
- Augment documentation of DRAM/EMPAL so that it keeps up with advances of transportation model. Evaluate tour-based model and related economic features to perhaps replace DRAM/EMPAL.
- Deliberate on reducing the number of zones in the second tier (DRAM/EMPAL) and creating a third tier that would utilize GIS data at the parcel level of local geography. A third tier could feed into the second tier, allowing for easier association of socio-economic data to other levels of geography.
- Evaluate the socio-economic data needs of the tour-based transportation model through use of new socio-economic model.

Travel Demand Models – Trip Generation, Trip Distribution, Mode Choice
Gordon Garry

Trip Generation Successes:

- Addition of accessibility measures, density functions, composite time, and non-motorized trips

Trip Generation Recommendations:

- Non-motorized trips should be carried further through the model chain, into and through mode choice model.

Trip Distribution Successes

- Use of composite time to feed DRAM/EMPAL

Trip Distribution Recommendations:

- Composite impedance should include time and cost. If ARC decides to keep time and cost out of composite impedance variable, document the rationale for this decision.
- Trip distribution is driven by both peak and non-peak speeds. Use midday or blended speeds instead of free-flow speed in the non-work trip distribution models.
- Consider using midday speed skims instead of free flow speeds.

Mode Choice Successes

- The nested structure and overall assumptions in the model are improved.

Mode Choice Recommendations

- Look into alternate structures, particularly if non-motorized modes are added to the model. Adding non-motorized modes should help model performance in areas of the region with no or little transit service.
- Determine the discrepancies between observed MARTA data and model output data. Attempt to clarify and rectify any differences that may exist. Refine the mode choice

model as necessary. Try to determine to what inter-station ridership differences might be attributed.
- Provide more transparent documentation describing what characteristics determine “premium transit” and “local transit.” The current classification gives the model a rail bias at the baseline because the only premium service is rail. It is important to add Bus Rapid Transit (BRT) in documentation as a potential premium service.
- Make clear how the modeling software differentiates between premium and local transit.
- Investigate additional software improvements.
- Consider including Park-and-Ride lot skims in the network skim.
- Examine further the station loadings via model output versus observed numbers.

Travel Demand Models Part 2 – Mode Assignments, Air Quality Interface, HPMS Adjustments

Jeff May

Mode Assignments Successes:
- New functional classification system, including ramp definitions.
- Twenty-six functional classification types will help planners evaluate policy decisions.
- The eleven ITS function classes that affect both highway and transit share are model improvements.
- ARC is planning to reflect regional traffic signals plan into model.

Mode Assignments Recommendations:
- Addition of traffic signals per mile measures may help in assigning modes.
- Improve the HOV designation of persons per car. Currently, there is no way to include a differentiation between varying 2-people and 3-people HOV lanes. ARC can only change the HOV definition at regional level. ARC should introduce a way to allow HOV designation to be changed, because all HOV lanes may not have the same occupancy definition.
- Better documentation of how and why the volume-delay curves vary by time of day.
- Check future year model results for rationality. The current fiscally unconstrained model forecasts that in 2030 vehicle hours traveled will be 1.3 hours per person, a level similar to Boston. If this estimate significantly increases in the fiscally constrained plan, investigate trip distribution or generation process to ensure that the travel time budget concept is maintained.
- Consider reassessing closure criteria. In the past, ARC has reached model closure before 25 iterations. More statistical measures should be shown (including future runs) in order to help validate current closure standards.

Air Quality Interface Recommendations:
- Work with EPA to show that the speed post-processor in the emissions model is unnecessary, as it does not produce congested flow speeds that are noticeably different produced by the travel demand model.
- Continue to develop truck/freight models. Consider conducting location specific surveys to obtain more detailed information about the on-street fleet composition.

- Increase the model boundary. With a larger model boundary, issues regarding 8-Hour Ozone Standards will be more easily addressed.
- Consider adding more zones to increase the fidelity of the assignment process.

HPMS Adjustment Recommendations

- The current use of HPMS adjustment factors is taking well-calibrated travel model roadway link volume estimates and downgrading their accuracy before inputting the results into the air pollution model. The transportation model results appear more rational than the HPMS estimates. This is because the HPMS was never designed to give detailed metro area estimates. As such, HPMS adjustment factors are being misapplied at the level of detail being used. ARC and its partners should work with EPA to develop a more rational correction process to implement in parallel with the State Implementation Plan process over the next few years. This process would perhaps involve two correction factors, one for classified and modeled roadways, and the other for local street traffic. In both cases, it is anticipated the correction factors should be no more than a few percent.
- Because ARC's roadway type definitions do not correspond to HPMS functional class definitions, it is difficult to calculate accurate HPMS adjustment factors, in particular for local roads. Rather than calculating 12 unique HPMS adjustment factors, ARC may want to consider calculating a "network VMT" adjustment factor and a "non-network VMT" adjustment factor. The "network VMT" factor would reflect all coded links (facility types greater than local roads) and should correspond fairly well with HPMS VMT for HPMS facility types greater than local roads. The "non-network" factor would be used to adjust ARC local road VMT to HPMS VMT for local roads and would be expected to be somewhat larger considering the inherent difference in how this facility type is defined by ARC and by the HPMS system. The panel stated that non-network VMT should be approximately 8-9% of total VMT.
- Work with State government to determine how local streets and network/non-network streets are defined.
- Check to see if any links defined as HPMS urban/rural local have been coded. If these links exist, they should not be considered as a local road in calculating the non-network VMT adjustment factor because, by definition, a local road should not be coded. On the other hand, roads that are actually collectors may be misunderstood in the HPMS system as being local roads. Either way, the discrepancies between the ARC and HPMS definition of local roads needs to be considered.
- The HPMS factors of 2.76 for non-interstate freeways should be used with care as it may be biasing corridor level air quality analysis. In combination with the correction factor on principal arterial roads, it could bias the analysis away from freeway facilities and toward arterial solutions.
- Consider boundary expansion with Phase I models and examine the associated cost within the framework of the new model system.

Activity/Tour-Based Models

Keith Lawton

Tour-based Model Successes**:**

- ARC has made a significant investment into developing a tour-based model, which has corresponded to significant progress.

- The tour-based application software is well developed and built upon knowledge, findings, and data sets from other models.

Tour-based Model Recommendations

- Continue current project momentum towards implementing a tour-based model by deciding the amount of effort and resource investment that will be made.
- Produce real-world, undeniable examples of the utility of a tour-based model. This would help gain funding.
- Validate the estimations provided by the Population Synthesizer.
- Compare trip-based and tour-based models from MPOs or DOTS who have already implemented a tour-based model (Columbus).
- Run current model and tour-based model in parallel before switching models.
- Expand model boundaries.
- Check model for responsiveness to variable change; ARC should test the sensitivity of travelers to the introduction of new transportation elements.
- Be clear that air quality conformity analysis can be performed with the tour-based model.

Next Steps and Summary

Michael Morris

This TMIP Peer Review was intended to provide feedback from a panel of experts to ARC and its consultants on enhancements made to the ARC travel demand model, which were based, in part, on prior peer review comments. ARC also sought review and recommendations from the panel regarding the development of an activity/tour-based model.

The panel presented ARC a summary of its 10 chief recommendations steps to take in the future. These next steps are listed below:

1. Determine whether the work plan will continue to include development of an activity/tour-based model.
2. The model's current boundary should be increased. ARC would benefit from collecting more clear data on external people, because these people's trips into the region are included in the model.
3. Performance measures should be emphasized, especially reliability and accessibility measures.
4. Continue to place attention on freight modeling.
5. Continue to work with transit agencies to clarify and correct any data discrepancies.
6. Develop an interim approach to 8-Hr Ozone Standards. Begin planning on a critical path on how to reach conformity within the allotted time frame. The panel suggests a Three Agenda Interagency Meeting to discuss 8-Hr Ozone Standards, the activity-based model, and HPMS Standards.
7. Consider a three-tiered approach for demographic models.
8. Increase zone detail. The panel recommends investigating how other metropolitan areas determine people per zone.

9. Interface Population Synthesizer with DRAM/EMPAL as a way to begin integrating activity-based features into current modeling strategies.
10. Maintain a strong technical foundation to continue becoming a leader in the field.

Appendix

Agenda

TRANSPORTATION AND LAND USE MODELING PEER REVIEW
A Peer Review of the Atlanta Regional Commission's
Travel Demand Model and Land Use Model
February 3 – February 5, 2004

Tuesday February 3
ARC Offices, C Level Amphitheater

<u>Morning Session – Overview of Current Practice</u>

8:30 – 8:45	Welcome and Introductions – Jane Hayse
8:45 – 9:00	Overview/Background – Jane Hayse
	Synopsis of 2000 Peer Review – Jane Hayse
9:00 – 10:00	Current Modeling Practice
	Travel Demand Model – Guy Rousseau
10:00 – 10:15	Break
10:15 – 11:15	Current Modeling Practice, Part 2
	Emissions Model – Tracy Clymer
	Travel Demand Model – Guy Rousseau
11:15 – 11:45	Questions from Panel
11:45 – 1:00	Lunch

<u>Afternoon Session – Continuation of Presentations on Current Practice</u>

1:00 – 2:00	Land Use Model
	DRAM/EMPAL and IPEF – Bart Lewis
2:00 – 2:30	Questions from Panel
2:30 – 2:45	Break
2:45 – 4:00	Tour-Based and Activity-Based Model in Development
	Consultants
4:00 – 4:45	Questions / Answers Session – Working Session

Wednesday February 4
ARC Offices, Harry West Room

8:30 – 9:30	Presentations by Other Government Officials
	GRTA, GDOT, MARTA, EPA, EPD, FTA, USDOT
	Land Use Modeling in Phoenix and Sacramento
9:30 – 10:00	Questions/Answers Session
10:00 – 10:15	Break
10:15 – 12:15	Panel convenes in closed session to prepare recommendations
12:15 – 1:30	Lunch
1:30 – 4:45	Interactive Dialogue and Questions/Answers Session
	Conversations between the Panel and ARC

Thursday February 5
ARC Offices, Harry West Room
9:00 – 10:30 Panelists present findings/recommendations
10:30 – 10:45 Break
10:45 – 12:00 Questions / Answers Session

Partial List of Participants

- Dale Aspy, Environmental Protection Agency
- John Bowman, Parsons Brinkerhoff
- Mark Bradley, Parsons Brinkerhoff
- Cora Cook, GDOT
- Tracy Clymer, ARC
- Curt Davis, ARC
- Claudette Dillard, ARC
- Bob Donnelly, Parsons Brinkerhoff
- Judy Dovers, ARC
- Johnny Dunning, Jr., MARTA
- Gordon Garry, Sacramento Area Council of Governments
- Rob Goodwin, GRTA
- David Haynes, ARC
- Jane Hayse, ARC
- Latoya Jones, FHWA Georgia Division
- Art Kalinski, ARC
- Keith Lawton, Portland Metro Planning Department
- Bart Lewis, ARC
- Kandace Lewis, ARC
- Jeff May, Denver Regional Council of Governments
- John Morton, Environmental Protection Division, Georgia Department of Natural Resources
- Michael Morris, North Central Texas Council of Governments
- John Orr, ARC
- Jean Hee Park, ARC
- Carson Poe, USDOT Volpe Center
- Robert Radics, FHWA Resource Center
- Guy Rousseau, ARC
- David Schilling, ARC
- Patti Schropp, PBS&J
- Gordon Schultz, Parsons Brinkerfhoff
- Chris Simons, PBS&J
- Jim Skinner, ARC
- Emily Tate, FHWA Georgia Division
- Peter Vovsha, Parsons Brinkerhoff
- Rita Walton, Maricopa Association of Governments
- Tom Weyandt, ARC
- Ying Zhu, Parsons Brinkerhoff