A White Paper on Metropolitan Planning Organization (MPO) Land Use, Transportation, and Air Quality Modeling Needs in the New Federal Transportation Bill

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EXECUTIVE SUMMARY

The National Association of Regional Councils (NARC), in conjunction with the Delaware Valley Regional Planning Commission (DVRPC), conducted a national survey of Regional Councils and MPOs to ascertain current modeling practices, planned upgrades, and the related costs for model enhancement, maintenance, and validation. The survey included three aspects of modeling required by the ISTEA and CAAA legislation: socioeconomic and land use projection, travel demand forecasting, and mobile source emissions calculation.

The response to the survey was very good, including 31 planning organizations. It includes almost all of the large MPOs and a good cross section of medium and smaller regional agencies. The survey results, together with emerging planning needs and advances in the information science and modeling methodology, have been used to develop recommendations for inclusion in the next transportation bill now under consideration by the Congress.

Most urban regions of the United States face relentless continuing growth in highway travel volumes as a result of population and employment growth. Decentralization of land use patterns into auto-oriented suburban and rural areas also plays a role, as do demographic shifts, increases in auto ownership, and other causes. The urban travel demand forecasting models are, and will continue to be, an integral part of the planning establishment in all urban regions in the US. As the urban fabric of the US matures into an auto-oriented development pattern, transportation infrastructure capacity expansion is increasingly difficult from the financial, legal, and environmental impact standpoints. The models are very important in optimizing and legitimizing planning efforts and resolving related disputes. Lawsuits related to proposed transportation projects are very common. Issues related to the adequacy of the travel forecasting models used in planning stages are central to the legal arguments and often pivotal in the decision. Projected uses of the models can be categorized into five interrelated areas:

- New transportation facility construction and the expansion of existing facilities
- Land use planning and growth management
- Travel demand management
- Economic and environmental justice
- Environmental concerns and air quality planning

It is very clear that the travel demand models and related land use and emissions estimation procedures will continue to be most important elements in regional transportation and environmental planning activities. The new transportation bill should make explicit provisions for the validation and maintenance of regional models and for required upgrades. These enhancements are needed to remain consistent with acceptable modeling practice and to address emerging transportation planning issues. Suggested guidelines for this legislation follow:

1. *Adequate funding for routine model validation, maintenance, and enhancement should be provided.* There is a very large difference between smaller (populations less than 500,000) and large MPO's planned expenditures. On average, smaller MPOs plan to spend $220,000 per year on land use, transportation, and mobile source emissions models models and large MPOs plan to spend $780,000. One should remember, when interpreting these cost figures, that these are rough estimates that can vary significantly from one MPO to another, depending on the local situation and the character of upgrades that are planned. In aggregate, these planned expenses are comparable to historical spending rates over the last 10 years. These expenditures are necessary to sustain MPO modeling capabilities at the current level. There is variation in planned expenditures between large and very large MPOs. The average transportation model expenditures for MPOs with regional populations over four million is about 25 percent higher than the average for all large MPOs. This planned spending, for the most part, reflects required model validations and incremental improvements to the models and related software.

2. *MPOs should be given flexibility to tailor their modeling processes to local planning issues and requirements.* Land use and transportation modeling requirements should reflect the local planning culture in terms of transportation issues, data availability, and the current specification of the models.

3. *Detailed model specification issues should not be addressed in the legislation.* The travel modeling community is served by an active academic and professional community that can assist in the determination of acceptable practice.

4. *If new transportation planning initiatives not adequately addressed by regional models are included in the bill, funding for the required model upgrades should be provided.* Modeling of congestion pricing and other aggressive demand management policies, TRANSIMS and so forth may require extensive and expensive upgrades to the existing MPO models. Specific funding must be provided in the bill, if extensive model upgrades are mandated.

5. *Model requirements, such as validations, should be coordinated with the availability of Census and other survey data*. This will improve the efficiency of the conformity process and improve the quality of the results by eliminating the need for interim year validation forecasts.

6. *Specific provisions should be made in the bill to provide technical resources for MPO's who are placed in a non-attainment status as a result of the 8-hour air quality standards*. For smaller MPOs, this conformity demonstration support, in many cases, may be provided by state environmental protection and transportation departments as an adjunct to the SIP development process. Special situations may also exist where individual large MPOs might need to upgrade their technical process or MPOs might form consortiums to acquire and apply the technical expertise needed to conduct conformity analyses.

I. INTRODUCTION

Urban travel demand modeling has its origins in the mid-1960s through Federal Highway Administration (FHWA) sponsored travel demand studies focused on several large urban areas, including Chicago, Philadelphia, Pittsburgh, and others. The models produced by these studies and their successors were used to design the Interstate Highway System throughout the US, which was then in the planning stage. The models that evolved during this era were intended to answer the following question – given the anticipated level and pattern of travel for the region – how much additional freeway and major arterial capacity is needed and where should it be located?

In the 1970s and early 1980s, the recommendations of the initial highway studies were widely questioned because of large scale disruption and destruction of urban neighborhoods and landmark historical/cultural institutions. In addition, public transit proponents questioned the efficacy and efficiency of freeway solutions in high travel demand corridors and dense urban areas. As a result of this scrutiny and the accompanying federal highway planning regulations, freeway plans of most large urban regions were scaled back and replaced by expanded proposals for passenger rail and other transit service options. This change in policy emphasis had a significant effect on the specification of most urban travel demand models. Model components related to transit/highway modal split and transit facility assignment were upgraded and improved.

Following the completion of the Interstate Highway System and the first generation of new transit facilities in the 1980s (Washington, DC, San Francisco, Atlanta, Miami, etc.), urban travel demand modeling fell into a period of stagnation. In some urban areas, data sets and models were evaluated and updated regularly and used innovatively, but in other regions funding and staff levels were insufficient to carry out data collection and model updates. These regions were left with sparse and aging databases and models that had not kept up with advances in the profession.

The passage of the Clean Air Act Amendments of 1990 (CAAA) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) drastically changed how Metropolitan Planning Organizations (MPOs) conduct urban transportation planning. Prior to ISTEA, MPOs conducted a continuing, cooperative, and comprehensive (3-Cs) transportation planning process. This process was intended to develop plans that addressed transportation needs and were consistent with overall planned development. ISTEA and CAAA expected MPOs to provide leadership in defining a regional vision through a long-range transportation plan, and produce a Transportation Improvement Program (TIP) that functioned as a strategic management tool to accomplish the objectives of the plan. Major objectives of the transportation plan were to improve the air quality, promote the efficiency and performance of the overall system, and consider a broad range of transportation modes and their inter-connectivity. These regulations were particularly stringent in regions with moderate or worse air pollution problems. Many of the mandated data collection programs and transportation/air quality model upgrades were focused on the estimation, tracking, and prediction of mobile source emissions. These mobile source emissions were part of a larger State Implementation Plan (SIP) that was designed to achieve ambient air quality standards within a specified time limit.

Now, some ten years after the CAAA and ISTEA legislation, many of the traditional uses for travel demand models remain. Highway and public transit systems are still being improved through new facility construction, albeit at a slower rate. Substantial progress has been made towards improving overall air quality, although mandated air pollutant reductions will not be achieved in all regions and the pending introduction of the more stringent 8-hour air quality standard will necessitate redoubled efforts towards mobile source emissions control.

New uses for travel demand simulation and forecasting are also beginning to emerge. The Interstate Highway System and its supporting regional highway network are for the most part more than twenty years old; approaching their design limit both in traffic/volume capacity and pavement life. Because of financial and infrastructure constraints, it will not be possible to accommodate much of the future growth in travel demand through the expansion of the transportation networks. Intelligent Transportation System (ITS) technology can maximize the use of existing capacity, but more aggressive travel demand management policies may also be needed.

Traditionally, spontaneous traveler behavior has utilized all available highway system capacity through alternate routings, peak spreading, trip reduction, and congestion-related traveler responses. But, there are limits to the use of traveler behavior. Congestion dampens economic activity and promotes loss or decentralization of residential, and employment land uses. This is particularly true if congestion levels grow to the point that is difficult or impossible to predict when a given trip will be completed. Work, school, and business travel are predicated on predetermined starting/meeting times. In this environment, aggressive travel demand management (TDM) and ITS options such as high occupancy vehicle (HOV) lanes, single occupancy vehicle (SOV) restrictions, congestion pricing, and ramp metering may be more politically acceptable. In the planning and evaluation stages of these options, there are significant questions about plan/option effectiveness and related traveler and environmental impact issues. These questions can be answered by appropriately designed forecasting models.

The National Association of Regional Councils (NARC), in conjunction with the Delaware Valley Regional Planning Commission (DVRPC), conducted a national survey of Regional Councils and MPOs to ascertain current modeling practices, the costs of model maintenance, and validation. The survey also collected information about plans for model enhancements and the projected costs associated with these improvements. Modeling practices included three aspects of modeling required by the ISTEA and CAAA legislation: socioeconomic and land use projection, travel demand forecasting, and mobile source emissions calculation. The response to the survey was very good, including over thirty planning organizations. It includes almost all of the large MPOs and a good cross section of medium and smaller regional agencies.

The purpose of this paper is to review the progress of MPOs towards updating and maintaining their models and related travel survey, transportation network, and land use data files, and report on their plans for model enhancement. The survey results, together with emerging planning needs and advances in the information science and modeling methodology, has been used to develop recommendations for inclusion in the next transportation bill now under consideration by the Congress.

Section II presents a non-technical introduction to land use, travel demand, and air quality modeling theory and practice. Section III reviews current MPO modeling practice in terms of model content, uses of model outputs, and the costs associated with ongoing model maintenance and validation activities. This section also provides an assessment of the degree of conformance of prevailing model practice with existing federal requirements.

Section IV presents an analysis of MPO plans for model enhancements and related expenditures. It also includes a discussion of NARC's role in lobbying for modeling issues and for providing technical guidance. Emerging transportation and land use forecasting requirements are discussed in Section V, and NARC's recommendations for the modeling provisions to be included in the transportation bill are presented in Section VI.

II. INTRODUCTION OF LAND USE, TRAVEL DEMAND, AND AIR QUALITY MODELING

Travel demand modeling follows a straightforward behavioral paradigm in which travel demand is derived from the mobility needs of individuals carrying on their daily personal, social, school, and business activities. In the analysis, the amount of travel, type, origin/destination, and specific transportation facilities used is inferred from the spacial distribution of these activities and facilities. This paradigm requires:

- Gathering a large number of data inputs and specifying transportation networks at an appropriately fine level of spacial aggregation called Traffic Analysis Zones (TAZ).
- Preparing traffic zone level forecasts of these such as population, households, auto ownership, and employment; specifying the proposed transportation facilities to be tested; and assuming plausible settings of other model inputs such as auto operating costs, transit fares, personal income and so forth.
- Developing models that accurately represent the travel behavior patterns implied by these forecasts and assumptions.
- Applying these models to the forecasted and assumed data to prepare plausible travel forecasts that are useful in the overall planning process.

The above process involves large data collection and preparation efforts, extensive complicated computer manipulations with semi-custom software, and large amounts of analyst time to design and calibrate the models and to validate the outputs. Model enhancements tend to be both time-consuming and expensive. For this reason most model enhancement efforts are incremental, making the maximum theoretically correct use of the existing modeling system and its database.

A. Socioeconomic Data and Land Use

Good results are obtained only if the input data, forecasts, assumptions, and models are adequate. Travel demand analysis requires detailed knowledge of where existing and projected households, businesses, professional and government offices, and other activity generators are located, or are likely to be located. Projection of these variables is typically done in several steps - regional totals of primary variables such as total population and employment are estimated by econometric methods using national, state, and local data and trends. Then, the regional projections are allocated to smaller, intermediate aerial units, such as counties or smaller forecasting districts. These allocations are prepared using a variety of modeling and trending methods and often make heavy use of local knowledge available in county and local planning departments. Formal land use models such as DRAM-EMPAL, and its successors, POLIS, MEPLAN, and others are sometimes used for this intermediate allocation. Finally, the county/forecasting district totals are sub-allocated to traffic zones, and other related variables required by the transportation models are estimated. This is often done by ad hoc techniques that make use of estimates of available land and local knowledge of development plans and proposals, although some variables such as vehicle ownership may be estimated by a formal model.

Travel demand analysis also requires detailed knowledge of the transportation infrastructure available to each traveler. This infrastructure in described through the use of computerized networks made up of nodes and links. These networks accurately describe the service levels provided by highway and public transit facilities through the travel times, distances, capacities, and costs included on the links. Separate networks are almost always developed to represent highway and public transit services, sometimes depicting peak and off-peak congestion levels and service patterns. Provision in the network structure is sometimes made for HOV lanes and rarely for walking and bicycle facilities.

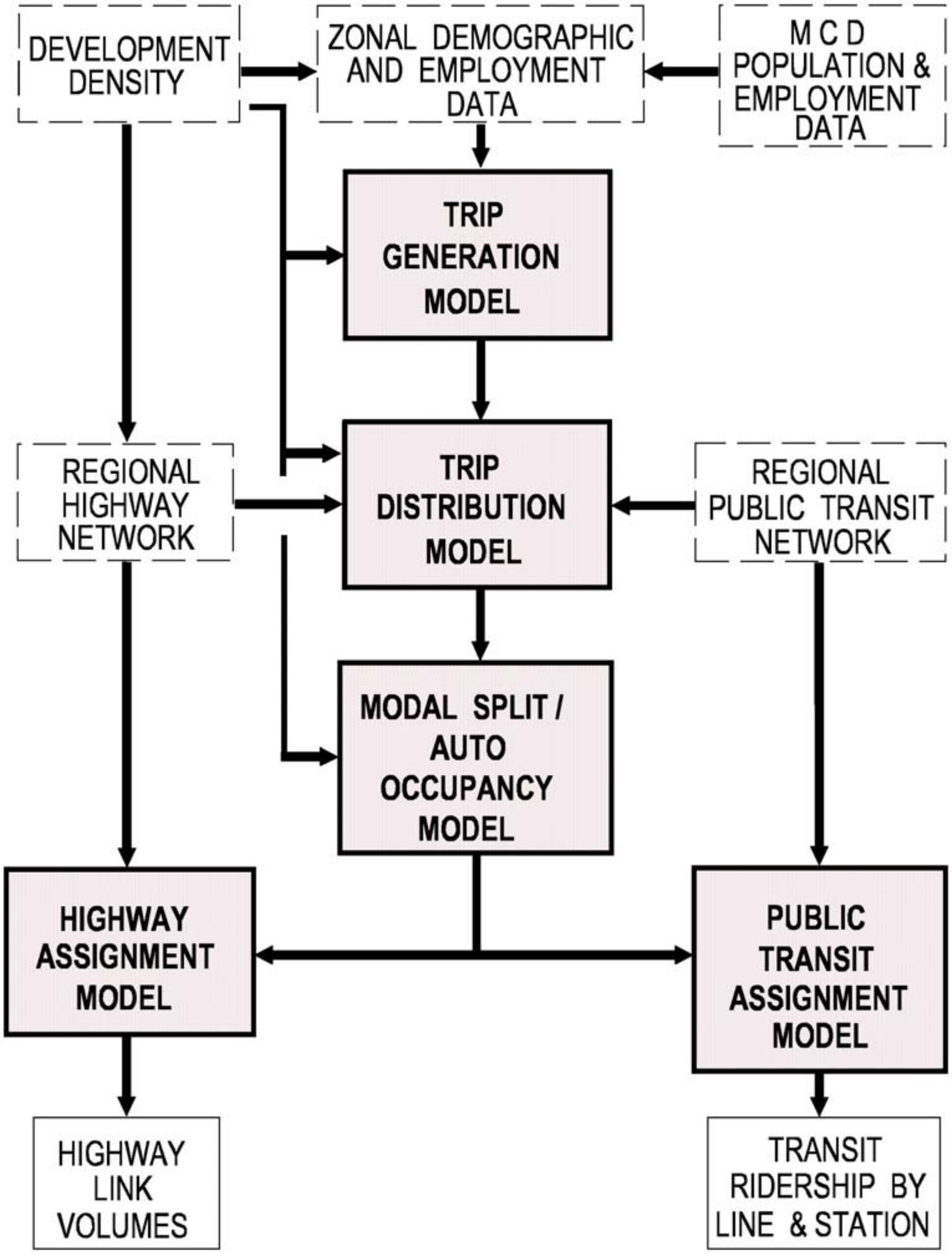
In almost every application, surveys of individual and household behavior are used to provide the empirical travel data needed to develop the model structure and statistical coefficient estimates. The overall performance of the models is then validated by measuring their ability to replicate counted highway link volumes and transit line ridership. These model validation runs typically use Census-derived estimates of the socioeconomic model inputs and transportation networks representative of the facilities opened to traffic during the validation year. These validation exercises are central to the credibility of the models and are performed at regular intervals (ten years or less) to insure that travel volume trends are incorporated into the models and their parameter structures.

B. The Four Step Travel Simulation Process

Travel demand models are partitioned into stylized hierarchical elements of the traveler's decision making process commonly called "steps" (see Figure 1). Most modeling chains utilize either three or four steps. The difference in the number of steps results from whether highway only or highway and transit travel is being estimated. Four-step processes also include transit travel by generating person travel, which could use either highway or transit modes. An additional model step (Modal Split) is required to separate highway from transit travel. Three-step models generate highway travel directly and do not consider public transit.

In the first step in the four-step process, commonly called "*Trip Generation,*" the number of trips likely to be produced by or attracted to the households, businesses, and other activities located in an appropriately small geographical area or TAZ is estimated. Generally, trip productions are made by persons living in households located in the zone, and trips are attracted to persons employed in commercial, institutional, office, and other activities. In theory, the degree of accessibility provided to the TAZ by the transit system should also play a role, but this effect is difficult to identify in survey data. The most common form of trip generation model is cross classification, where average trip rates per person/household or employee are calculated from stratifications of the home interview survey based on household, industrial, or other activity characteristics. These are then applied to the appropriate zonal data to estimate travel. Some trip production models (especially attraction models) employ regression equations based on home interview survey data for the same purpose.

Figure 1
Four-Step Travel Modeling Process



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"*Trip Distribution,*" step two in the process, matches zonal productions with attractions to produce a spacial pattern of trip making. The typical trip distribution model uses a "gravity formulation" where the zone I to j volume of travel is directly proportional to the number of trips produced in the origin zone, attracted to the destination zone, and inversely proportional to the cost of travel between the zones. The cost of travel between zones is primarily travel time, either by highway, or in some models, a combination of highway and transit times. The monetary cost of travel (auto operating and transit fare) may play a role in the model. Common functional forms include the gravity model and the logit model which are similar in functional form, and calibrated to survey data.

Auto trips are separated from transit trips and, in some cases, from non-motorized trips in the "*Modal Split*"or third step of the model chain. Modal split (sometimes called modal choice) models estimate the percentage shares of the travel modes competing for trips in a given zonal interchange as a function of the relative travel time and cost between modes. Other modal characteristics (comfort, convenience, etc.) are implied in the model's coefficients which are calibrated from survey data. The modal split step is the most econometrically sophisticated element of the travel modeling chain. The most commonly used functional form is the nested logit, although some regions use simple logit or other function forms, and a few regions employ the so-called probit form. Both logit and probit can be thought of as a system of simultaneous equations, with an equation included for each mode being considered. The primary difference between logit and probit is in the statistical treatment of the error term included in each equation. Probit models require explicate a priori knowledge of the error structure in the model calibration, which is difficult to obtain. Nested logit models assume that all equations are independent, but control sub-mode interactions by segregating them into hierarchical levels of the nesting structure. This nesting structure treats interdependent sub-modes as a group for modal split purposes. Because of the inherent tractability of this error structure, nested logit is almost universally used in new modal split models.

The fourth and final step of the travel demand model structure is the association of estimated trips with specific transportation facilities. This "*Traffic Assignment*" step is accomplished by assigning mode and time-specific trip tables to paths within their respective infrastructure networks. Travel assignment to public transit facilities in done primarily on the basic minimum time paths through published route travel times and service frequencies. Some models recalculate future bus travel times based on projected increases in roadway congestion. Highway assignment models are universally "capacity restrained" in that the minimum time route selected for assignment through the highway network is cognizant of prevailing congestion levels throughout the network. Traffic congestion is a function of the volume of traffic assigned, and of roadway characteristics in terms of capacity (number of lanes, function class, etc.). Most urban models utilize a true equilibrium assignment process where the solution, in terms of congested speeds and traffic volumes, is determined by mathematical programming techniques. At equilibrium, no trip can be reassigned to a different path in such a way as to reduce the trip travel time. It is assumed that actual driver behavior approximates this equilibrium routing paradigm.

C. Time Period of the Day and Congested Speed Feed Back Loops

Congestion plays a part in decisions about when to travel, destination choice, travel mode, and travel route. Older travel models estimate average daily travel or, in some cases, peak hour travel, as the peak volumes are a major factor in facility design decisions. In these models, link volumes were the primary model output and link travel time was often used as a calibration parameter to improve the accuracy of the estimated volumes. With the advent of the CAAA legislation, accurate estimated link speeds, as well as volumes, were required to drive the mobile source emissions models. For this reason, the models were disaggregated into separate peak and off-peak processes to more adequately replicate congested travel speeds.

The travel time/capacity function, usually the Bureau of Public Roads (BPR) curve, is formulated in such a way as to prevent any increase to the initial input travel times. Link speeds can be reduced but not increased during the capacity restraint. Therefore, increases in travel speeds resulting from congestion relief will not be modeled, unless the capacity-restraint process is initiated with free flow highway speeds.

There is an obvious inconsistency issue imbedded in the four step process; the trip distribution and modal split portions of the process depend on travel times that are not known definitively until the entire process comes into equilibrium. Congested travel times produce shorter trip lengths from the gravity model, and from the modal split, more transit ridership on rail and other grade separated right-of-way facilities. This, in turn, reduces highway congestion in the next round of equilibrium assignment, and so forth. Analysts approach this inconsistency in several ways. In older models, the trip distribution and modal split steps are run with preliminary estimates of congested speeds. This reduces, but does not eliminate, the congested time inconsistency.

Another approach is to iterate the travel simulation models by running congested speeds from the highway assignment back through the trip estimation models. Some iterative processes define the feedback loop to include modal split and traffic assignment steps, but as congestion levels also affect trip length and destination choice, it may be more theoretically correct to iterate from trip distribution through traffic assignment.

The iterative model for trip distribution through traffic assignment has a unique equilibrium solution, but most regional models with feedback loops do not iterate the model outputs to convergence. The equilibrium solution requires use of operations research programming algorithms similar to those used to solve the capacity-restrained highway assignment. Currently, there are two methods in use to achieve a near equilibrium solution the Method of Sequential Averages (MSA) and the Evan’s Algorithm. In both methods, the equilibrium solution is built up from a weighted sum of individual model iterations, but the Evan’s Algorithm is more sophisticated mathematically and is thought to achieve a near equilibrium solution with less computational effort.

D. Air Quality Modeling

Mobile source emissions modeling techniques universally involve straightforward summarizations of the highway link volume of the travel simulation model. These summaries are used in combination with emission factors prepared by the EPA's MOBILE series of models, or in California, the EMPFAC/BURDEN models prepared by the California Air Resources Board (CARB). For the most part, these calculations are spreadsheet in nature, where vehicle miles of travel (VMT), cross classified by facility type, type of area, and speed range, are multiplied by the appropriate emissions factor and then summed to regional and sub-regional totals.

The estimation of accurate highway speed distributions is critical to the estimation of mobile source pollutants because the emissions factors vary significantly by speed range. The capacity-restraining functions used in the highway assignment step are generalized and may not be able to produce adequate, detailed speeds for emissions estimation. For this reason, many MPOs employ an emissions postprocessor to re-estimate speeds from the estimated highway volumes and apply these more accurate speeds to the estimation of mobile source emissions. The new MOBILE6 model requires aggregated speed and VMT distributions summarized from the model output. These distributions are then used to calculate an overall emissions factor for use in mobile source pollutant estimation.

There are many other differences between MOBILE5 and MOBILE6 related to vehicle operating regimes, and other assumptions in the design of the post-processor required to summarize the travel demand model outputs. Conversion from MOBILE5 to MOBILE6 requires significant changes to the emissions estimation processes used by MPOs to show conformity and to make other emissions calculations. MOBILE6 also requires re-estimation of the SIP emissions budgets used in conformity analyses.

E. Activity Based Modeling

Activity based travel demand modeling reorganizes the trip generation and distribution phases of the four-step process to consider multi-trip tours (trip chaining) rather than individual trips from a given origin to a single destination. A tour is a series of connected trips made by a single member of the household to accomplish a specific primary activity work, shopping, social recreation, etc.

Much of the motivation for activity-based modeling derives from the need to more accurately estimate the number of and origin and destination of non-home based trips. The information about the trip maker income, auto ownership, employment status, and age is CENSUS-based and, therefore, registered by place of residence. Non-home based trips are difficult to forecast with traditional models because little or nothing is known about the person making the trip. Tours also impart a certain logic to the trip making process. In theory, if the trip maker is known to be at the place of work, it is much easier to forecast his lunch time eat-meal trip than to generate and distribute an equivalent non-home based trip knowing nothing about the trip maker or the purpose of the trip. From a practical point of view, much of the attractiveness of activity based modeling has arisen from the increase in the proportion of and number of non-home based trips in recent home interview surveys. Much of non-home based travel is associated with compound work trips. Modern auto-oriented life styles with both spouses working, promotes multi-purpose work trips such as dropping off the children at day care or school, getting coffee, eating breakfast, or running other errands. From a traditional modeling point of view, this compound work trip would be categorized as a home-based, non-work trip followed by a non-home based trip, blurring the home-work relationship which is relatively easy to forecast.

F. Computer Software

All urban transportation simulation applications require a suite of computer software programs to support the model application and analyses. A few MPOs still make use of mainframe software programs, such as the Urban Transportation Planning Package (UTPS), for part of their travel modeling applications; but almost all current models require PC or UNIX workstation based model packages. All of the PC/workstation packages replicate, and to some degree augment, the functionality of the UTPS system. TRANPLAN and MinUTP are straightforward adaptions of older mainframe software to the PC environment, while EMME/2, TransCAD, and TP+ provide modeling flexibility beyond the UTPS methodology through simplified user-coded programming languages. TransCAD also incorporates major features of Geographical Information System (GIS) technology directly into the modeling package. TRANPLAN and TP+ provide an interface into the ARCVIEW/ARCINFO GIS package. The graphical capabilities of the GIS environment have simplified the problem of network and database maintenance, and have provided powerful mechanisms for communicating the travel simulation results to transportation professionals and decision makers. However, applying all steps of the modeling process and summarizing the results still require substantial analyst time and effort.

As part of the federally administered Transportation Model Improvement Program (TMIP), a fundamentally new form of transportation model, TRANSIMS, has been developed. TRANSIMS operates within the UNIX workstation environment, but requires modeling methodologies and computer software that are very different from the UTPS environment.

G. TRANSIMS

TRANSIMS represents an attempt to completely integrate the travel simulation model into the GIS framework. The most salient aspect of TRANSIMS is the elimination of traffic zones. Travel is simulated for hypothetical, but statistically representative persons traveling from the actual address of origin to the exact destination, over a near literal representation of the transportation infrastructure that includes all local streets, highways, and transit routes. The simulation proceeds, tracking the travel behavior of each individual throughout the day at ten second intervals. As one might expect, TRANSIMS is much more expensive for a region to implement and operate because it requires extreme detail in the land use and transportation network inputs and immense computation and data storage resources. However, the consideration of individual driver behavior allows much more realistic simulation of vehicle operations and delays, and the tracking of individual behavior. This enhanced vehicular detail may improve the ability to evaluate environmental and economic justice issues, model ITS operations, and calculate vehicular emissions.

Traditional trip generation, trip distribution, and modal split models cannot be directly applied in the TRANSIMS framework because they are stochastic in nature, that is, they model the statistical behavior of groups of individuals rather than simulating the behavior of each individual. For this reason, the initial design of TRANSIMS was based on simulations of the travel behavior of synthetic individuals drawn from census demographic profiles, expressing travel characteristics adapted from the trip diaries of persons that responded to the home-interview survey. Initial experiments in Portland, Oregon indicated that this approach was unable to replicate important regional characteristics, such as trip length distributions and modal splits. For this reason, traditional trip distribution and modal split models were used to prepare aggregate travel patterns for control purposes. These data were then disaggregated to individual behavior using monte carlo simulations. As of this writing, the results of the TRANSIMS trials in Portland have not been published and we cannot evaluate the benefits of TRANSIMS vis-a-vis more traditional modeling approaches.

III. CURRENT MPO MODELING PRACTICES

This section presents an analysis of the current modeling practices that were identified in the survey of the NARC membership taken in the fall of 2002. Overall, thirty-one regional planning organizations responded to the survey. The regional agencies included in the survey are listed in the appendix. A breakdown of the responders by regional population is given in Table 1.

TABLE 1 Survey Responses by Region Size

Population	Number of Responses
Less than 200,000	2
200,000 to 500,000	6
500,000 to 1,000,000	6
1,000,000 to 2,000,000	5
2,000,000 to 4,000,000	4
Greater than 4,000,000	8
Total	**31**

This is a reasonably good sample that has adequate representation from small and mid-size MPOs, and includes almost all of the large metropolitan transportation planning organizations in the US. For purposes of tabulating the results, a regional population of 500,000 was taken as the breakpoint between smaller and large MPOs. Although not the median regional population, this value was selected because there are a large number of MPOs in the US with less than 500,000 in population. Also, for regions larger than 500,000 persons, the complexity of the transportation system and overall planning problem requires a higher level of model sophistication and physical size (networks, zones, etc.). This is also a breakpoint in terms of the staffing level and costs associated with model maintenance and upgrade. In the sample, 13 out of 23 large MPOs and 1 out of 8 smaller MPOs were subject to the final conformity rule modeling requirements.

A. MPO Forecasting Responsibilities

Table 2 presents the results of the survey with regard to MPO responsibilities for the socioeconomic/land use, transportation, and mobile source emissions forecasts. Also considered, is whether any other agencies were involved in preparing the forecasts. Land use/socioeconomic forecasts were the primary responsibility of 100 percent of the smaller MPOs and 87 percent of the larger organizations. This lower percentage for large MPOs resulted primarily from the Chicago, San Francisco, and Boston regions where regional agencies separate from the MPO are responsible for the socioeconomic forecasts input to the travel models.

However, there is a heavy, cooperative, non-MPO presence in socioeconomic forecasting methodologies of most regions (63 percent of smaller and 83 percent of larger MPOs). These are primarily member governments (county, city, and local), although Department of Transportation (DOTs) and other state agencies are also involved. The land use/socioeconomic forecasts are reviewed by these other agencies and adopted through a process of cross-acceptance. Also, localized forecasting tasks, such as traffic allocating control totals to traffic zones may be subcontracted by the MPO to member governments.

All of the smaller and large MPOs are responsible for travel forecasts. There is significantly less involvement in travel forecasts by other agencies than in land use. Fifty percent of the smaller agencies rely on outside agencies (state DOTs or member governments) to review travel forecasts and in some cases, assist in preparing the inputs and running the models. The percentage is much less – 30 percent – for large MPOs in this case, consisting primarily of reviews by member governments and transit agencies.

TABLE 2 Land Use, Transportation, and Air Quality Forecasting Responsibilities

Responsibility:	**Smaller MPOs**	**Large MPOs**
MPO prepare Socioeconomic/ Land Use Forecasts	100%	87%
Other agencies or consultants involved in the Socioeconomic/ Land Use Forecasts	63%	83%
MPO prepare Transportation Forecasts	100%	100%
Other agencies or consultants involved in the Transportation Forecasts	50%	30%
MPO prepare Mobile Source Emissions Estimates	25%	70%
Other agencies or consultants involved in the Mobile Source Emissions Estimation	50%	30%

Note: Percentages exclude non-responses.

Smaller MPOs rely heavily on other agencies for emissions estimates. Only about 25 percent of smaller MPOs are primarily responsible for emissions calculation. Fifty percent rely on outside agencies (DOTs and consultants) for this calculation. Also, many smaller agencies are categorized as attainment for air quality purposes and are not required to calculate emissions. Large MPOs are much more likely to be in a non-attainment status. About 70 percent of large MPOs make their own emissions forecasts, and another 30 percent of large MPOs rely on consultants, DOTs, and in California, the CARB.

B. Land Use Forecasting Procedures

Table 3 summarizes the socioeconomic data/land use forecasting procedures that are currently in place to prepare the inputs to the travel simulation models. None of the smaller MPOs and about one-quarter of the large MPOs employ DRAM EMPAL or one of its decedents in their demographic and employment forecasting process. There are widely varying degrees of satisfaction with DRAM EMPAL. A few MPOs are planning to upgrade the model or replace it with another approach. Some 13 percent of smaller and 27 percent of larger MPOs have devised their own socioeconomic forecasting processes that are defined and well documented enough to be considered models. The remainder of MPOs use cooperative processes with their member governments that involve regional total estimation and progressive sub-allocation to smaller and smaller areal units using local knowledge (zoning regulations, development proposals, etc.). Thirteen percent of smaller MPOs and 35 percent of larger MPOs incorporate a feedback loop from planned major transportation facilities into the land use forecasting process.

TABLE 3 Socioeconomic/Land Use Forecasting Procedures

Forecasting Procedure:	Smaller MPOs	Large MPOs
MPO utilizes a standardized Land Use model	0%	23%
MPO uses a locally developed formalized Land Use model	13%	27%
Land use procedures include a Transportation Feedback Loop	13%	35%

Note: Percentages exclude non-responses.

C. Travel Demand Modeling Procedures

Table 4 summarizes the travel simulation/forecasting models currently in use. Smaller MPOs are about equally split between the Three-Step and Four-Step processes. Smaller regions usually lack an extensive public transit system. This greatly reduces the need for the modal split and transit assignment steps of the four-step process. All large MPOs have significant public transit systems and use the Four-Step, or in one case, an activity based model that includes transit. Not all MPOs with a Four-Step process can adequately model public transit. Only 38 percent of the smaller and about 87 percent of the larger MPOs, claim to model public transit. A distinct minority – 25 percent of the smaller and 32 percent of the larger MPOs – also model non-motorized travel (walking, bicycling) as an alternative to auto and transit travel. An even smaller minority (13 percent) of smaller MPOs , and 32 percent of larger MPOs, explicitly model commercial/truck trips.

Some 25 percent of smaller MPOs and 64 percent of the larger MPOs have the congested travel time feedback loop required by the air quality conformity rule. However, many agencies omitting the loop are not required to incorporate this feature into their model because they don't have the population size or air pollution severity stipulated in the rule. All of the smaller and 95 percent of larger MPOs that responded, reported that their travel forecasts had credibility with decision makers and the general public.

TABLE 4 Travel Demand Forecasting Procedures

Type of Model:	Smaller MPOs	Large MPOs
Three-Step Model	50%	0%
Four-Step Model	50%	96%
Activity-Based Model	0%	4%
Model includes Public Transit	38%	87%
Model includes non-motorized travel	25%	32%
Model explicitly estimates truck/commercial vehicle trips	13%	32%
Model has a congested time feedback loop trip distribution/modal split	25%	64%
Forecasts have credibility	100%	95%

Note: Percentages exclude non-responses.

D. Mobile Source Emissions Estimation

The methodologies used by MPOs to convert their travel forecasts into mobile source emissions are summarized in Table 5. Some 37 percent of smaller and 39 percent of larger MPOs still use MOBILE5 to estimate vehicular emissions factors. Nationally, we are now in the process of converting the conformity process from MOBILE5 to the USEPA's new MOBILE6 model. Over the next two years, non-attainment regions are required to switch from MOBILE5 to MOBILE6 in their conformity demonstrations. The totals for smaller MPOs do not add to 100 percent because 63 percent are in air quality attainment and are not required to estimate emissions. The summed percentage for large MPOs using MOBILE5 or MOBILE6 (61 percent) is less than using a postprocessor (81 percent), because three MPOs in the sample use the California emissions model (Burden). Also, 19 percent of the large MPOs do not use a postprocessor because one is in attainment and does not calculate emissions and four MPOs estimate emissions directly from modeled speeds.

TABLE 5 Mobile Source Emissions Estimation Procedures

Type of Model:	Smaller MPOs	Large MPOs
MOBILE5 process	37%	39%
MOBILE6 process	0%	22%
Postprocessor-based travel speeds from assigned volumes	37%	81%

Note: Percentages exclude non-responses.

E. Travel Demand Model Validations

The CAAA and ISTEA legislation, conformity guidance, and good modeling practice all require that travel simulation model output be validated against current highway and transit count data at regular intervals. Census, home interview, and other survey data are also included in the validation process to validate and re-calibrate model parameters as needed. Most MPOs undertake a major validation every ten years based on decennial Census, home interview and special survey data, and at least one minor mid-decade validation, during the interval between the Census, based primarily on traffic and transit counts. Production schedules for Census Journey-to-Work data, and funding, and manpower availability for surveys can shift the model validation year away from the Census cycle. The ten-year validation requirement in the final conformity rule invariably requires validations more often than ten years. This is because timing shifts in Census and survey data availability delays the validation beyond the ten-year

maximum. As a result, expensive interim year forecasts are prepared solely for model validation purposes. The conformity process would be more efficient, and results better, if the conformity rule requirements were benchmarked to coincide with the availability of the Census data.
Table 6 presents the survey results on questions regarding model validation. One-half of the smaller MPOs validated their models at five-year or shorter time intervals and the other 50 percent, every 10 years. Large MPOs validated their models more often, 70 percent every 7 years or sooner, and the other 22 percent within 10-year intervals. About 86 percent of both small and large MPOs use the Census Journey-to-Work data in their model validations, and 63 and 70 percent use home interview or other special survey data. All MPOs base their model validations on transit and/or highway count data. Some 42 percent of smaller and 52 percent of larger MPOs use consultants to conduct model validations.

TABLE 6 Travel Demand Model Validation

	Smaller MPOs	**Large MPOs**
How often do you validate your Travel Demand Model?		
Every 2 to 5 years	50%	61%
Every 5 to 7 years	0%	9%
Every 10 years	50%	22%
Use Census Journey- to-Work data in your model validation	83%	86%
Collect home interview or other survey data for your model validation	63%	70%
Validation based on Transit and Highway count data	100%	100%
Model validation performed by consultants	42%	52%

Note: Percentages exclude non-responses.

F. Uses for Travel Demand Model Outputs

The uses for model output identified in the survey are displayed in Table 7. Three-quarters of smaller MPOs and all larger regional planning commissions use their model’s output for facility design and corridor studies. This also includes Major Investment Studies (MIS) and

Environmental Impact Studies (EIS). More than 80 percent of MPOs use their models to evaluate the long-range transportation plans. These are the original uses for travel demand models. TIP/Plan conformity is another use for the models in non-attainment air quality regions. Some 13 percent of smaller MPOs and 62 percent of larger MPOs are required to show conformity. Other significant uses mentioned in the survey responses include congestion management, land use scenario testing, environmental justice, and ITS planning.

TABLE 7 Uses for Travel Forecasting Model Output

Output Use	Smaller MPOs	Large MPOs
Facility Design, Major Investment/ Environmental Impact Studies	75%	100%
TIP/Plan conformity	13%	62%
Long-range plan evaluation	87%	82%
Congestion/Travel Demand Management	38%	55%
Evaluate Land Use Scenarios	13%	18%
Environmental Justice	13%	36%
ITS Planning	38%	18%

Note: Percentages exclude non-responses.

G. Travel Forecasting Requirements for Conformity Analyses

The modeling guidelines for conformity analyses are generally oriented towards preparing accurate estimates of mobile source emissions. The final joint USEPA/USDOT rule for conformity analysis stipulates six requirements for serious and worse Ozone non-attainment and Carbon Monoxide (CO) non-attainment areas with populations above 200,000:

- Network-based models must be validated against observed counts (peak and off-peak, if possible) for a base year that is not more than ten years prior to the date of conformity determination.
- Model forecasts must be analyzed for reasonableness and compared to historical trends and other factors, and the results documented.
- Land use, population, employment, and other network model assumptions must be

documented and based on the best available information. Scenarios of land development and use must be consistent with future transportation alternatives for which emissions are being estimated. The distribution of employment and residents for different transportation options must be reasonable.

- A capacity-restrained traffic assignment methodology must be used, and emissions estimates must be based on a methodology that differentiates between peak and off-peak speeds.
- Zone-to-zone travel times used to distribute trips must be in reasonable agreement with the travel times that are used in the final assigned traffic volumes. Where transit is anticipated to be a significant factor in satisfying travel demand, these final travel times should also be used to estimate modal splits.
- Finally, network-based models must be reasonably sensitive to changes in the time(s), cost(s), and other factors affecting travel choices.

In the mid-to-late 1990s most MPOs undertook major model enhancement programs to satisfy these requirements, although those regions with enforceable requirements (severe or greater non-attainment and populations over 200,000) undertook the greatest effort. The quality of the models used to show conformity have become a major focus of legal challenges to regional plans and programs by environmental groups. There is considerable variation from region to region in how models were upgraded and how they are utilized in the overall planning process. Much of the variation reflects localized issues and the local planning culture. In the sample, 13 out of 23 large MPOs and one out of 8 smaller MPOs fell within the final conformity rule modeling requirements.

Table 8 shows the degree of MPO compliance with conformity rule mandated model characteristics for two categories of MPOs: those covered by the rule and those exempt from the rule. As discussed in the section above, validation every ten years might not be frequent enough to insure that all conformity analyses are based on current models. Although the results appear to be the same for covered and exempt MPOs, as discussed previously, all MPOs covered by the rule validate their models more frequently than ten years in order to meet the requirement. All MPOs have a cooperative land use/socioeconomic data forecasting process with member governments and, in some cases, even utility company reviews and cross acceptance. Three of the large MPOs rely on sister regional agencies for forecasts of the socioeconomic inputs to the models. All regional models include a capacity-restrained highway assignment and have some sensitivity to time and cost factors.

The model requirements that are unique to the conformity rule clearly show the effect of the requirements on modeling practices. Covered agencies are more than twice as likely to have a congested time feedback loop within their model structure as are exempt organizations (85 percent versus 33 percent for large and 100 percent versus 14 percent for small). Similar differences (92 percent versus 50 percent) exist among large MPOs for peak and off-peak speeds and volumes. However, smaller exempt MPOs are more likely (29 percent versus 0 percent) to separate peak and off-peak model runs than covered agencies.

TABLE 8 Compliance with Conformity Rule Mandated Modeling Procedures

MPOs Covered by Conformity Rule:	**Smaller MPOs****	**Large MPOs**
Validate Every 10 Years*	100%	100%
Land use/socioeconomic requirements	100%	77%***
Capacity-restrained assignment	100%	100%
Peak and off-peak speeds and volumes	0%	92%
Congested travel time feedback loop	100%	85%
Models sensitive to time and cost factors	100%	100%
Expect change in attainment status as a result of the 8-hour standard	0%	50%

MPOs Exempt from Conformity Rule:	**Smaller MPOs**	**Large MPOs**
Validate Every 10 Years	100%	100%
Land use/socioeconomic requirements	100%	100%
Capacity-restrained assignment	100%	100%
Peak and off-peak speeds and volumes	29%	50%
Congested travel time feedback loop	14%	33%
Models sensitive to time and cost factors	100%	100%
Expect change in attainment status as a result of the 8-hour standard	57%	75%

Notes: Percentages exclude non-responses.

* All MPOs covered by the conformity rule validate every 7 years or less.

** Only one MPO in this category.

*** Three large MPOs have land use/socioeconomic forecasts made by a sister agency.

Some 50 percent of large covered MPOs expect their attainment status to change as a result of the pending 8-hour air quality standard. All smaller covered MPOs expect their attainment classification to remain the same under the 8-hour standard. For exempt large agencies, the percentage expected to be reclassified as non-attainment increases to 75 percent. The corresponding percentage for exempt smaller MPOs is 57 percent, reflecting the fact that air pollution problems are often not as severe in smaller regions.

IV. PLANNED IMPROVEMENTS IN TRAVEL FORECASTING MODELS

One of the questions in the transportation modeling section of the survey asked if the MPO planners were happy with their transportation model. The response to the question indicates that 63 percent of the smaller and 87 percent of large MPO professionals were happy with their models. Clearly, there are no current plans for massive alterations or extensions to the models. Although planners are not as happy with land use as with the transportation model, most MPOs want to continue to maintain and validate their models and to correct selected deficiencies. The most frequent planned change is to update the model software. Enhancements are also planned to correct deficiencies, keep models consistent with current practice, and include Conformity Rule mandates that have not yet been implemented.

A. Planned Land Use Model Enhancements

Table 9 lists the planned model enhancements that were identified from the survey. Only about 13 percent of the smaller MPOs and 9 percent of the of the larger MPOs are contemplating implementing a new standardized land use model. Standardized model refers to a clearly defined, published model such as DRAM EMPAL or METROPOLIS. One-third of the larger MPOs are planning to upgrade their existing land use model or forecasting procedures. About one-quarter of the smaller and large MPOs are planning to implement a feedback loop between published model such as DRAM EMPAL or METROPOLIS. One-third of the larger MPOs are

TABLE 9 Planned Land Use Model Improvements

	Smaller MPOs	**Large MPOs**
Enhancement:		
Implement new Standard Land Use Model	13%	9%
Upgrade existing Land Use Model/process	0%	36%
Implement transportation/ land use feedback loop	25%	23%
Enhance GIS aspects of Land Use forecasting	0%	27%

Note: Percentages exclude non-responses.

planning to upgrade their existing land use model or forecasting procedures. About one-quarter of the smaller and large MPOs are planning to implement a feedback loop between transportation and land use and about 27 percent of the large MPOs are planning to enhance their land use processes through GIS techniques. All of the smaller MPOs intend to enhance their land use procedures through consultants, but the larger MPOs have a tendency to do this work in-house. About 36 percent of large MPOs intend to involve consultants in their land use model upgrade.

B. Planned Transportation Model Enhancements

On the transportation side (see Table 10), 63 percent of smaller MPOs and 59 percent of large MPOs intend to upgrade their computer software. Much of this upgrade involves switching to

TABLE 10 Planned Transportation Models Improvements

Enhancement:	Smaller MPOs	Large MPOs
Upgrade/replace software	63%	59%
Implement Activity Based model	0%	27%
Implement Separate Peak and Off-peak model	13%	5%
Implement congested times feedback loop	0%	9%
Enhanced GIS/Transportation interface	50%	45%
Non-motorized travel	0%	14%
Transit modeling	13%	18%
Truck/commercial modeling	13%	18%
TRANSIMS	0%	9%
Use consultants in model upgrade activities	72%	89%

Note: Percentages exclude non-responses.

the TransCAD package. A lot of the appeal of TransCAD emanates from its integrated GIS capabilities. Overall, 50 percent of smaller and 45 percent of large MPOs intend to upgrade their transportation GIS capabilities.

Twenty-seven percent of large MPOs plan to upgrade the trip generation/distribution phases of their models to activity based designs. A few MPOs plan to implement separate peak and off-peak models and implement congested travel time feedback loops in order to achieve compliance with the Conformity Rule. Other planned model upgrades include improved transit and commercial/truck models, and implementing non-motorized travel models. Transit model upgrades are intended to upgrade from Three-Step to Four-Step processes or to improve transit forecasts from an existing Four-Step model. Some 72 percent of the smaller MPOs and 89 percent of the large agencies plan to involve consultants in their model upgrade projects.

Two large MPOs (9 percent) intend to implement TRANSIMS. Both of these have already been involved in the TRANSIMS model demonstration program.

C. Planned Expenditures for Model Maintenance and Enhancement

The survey also asked the respondent about planned expenditures for model validations with 2000 Census and Survey data and planned model and software upgrades. These upgrades for the most part reflect incremental improvements to the existing models.   The resulting annual average planned expenditures are given in Table 11. There is a very large difference between smaller and large MPO’s planned expenditures. This, in part, reflects model complexity and funding availability. On average, smaller MPOs plan to spend $40,000 per year on land use models and large MPOs plan to spend $180,000. Much larger expenditures are planned for transportation models – $130,000 per year for smaller and $500,000 for larger MPOs. This cost difference, in part reflects expensive home interview survey and model enhancement projects spread over several years. MPOs plan to spend $50,000 and $100,000 per year for emissions model upgrades. This cost reflects the transition from MOBILE5 to MOBILE6 and related conformity budget expenses.

TABLE 11 Planned Average Annual Model Maintenance and Upgrade Expenditures

Category	Smaller MPOs	Large MPOs
Socioeconomic/land use models	$40,000	$180,000
Travel demand models	$130,000	$500,000
Mobile source emissions models	$50,000	$100,000
Total	**$220,000**	**$780,000**

One should remember, when interpreting these cost figures, that these are rough estimates that can vary significantly from one MPO to another, depending on the local situation and the character of upgrade that is planned. In aggregate, these planned expenses are comparable to historical spending rates over the last 10 years. These expenditures are necessary to sustain MPO modeling capabilities at the current level. There is variation between large and very large MPOs. The average transportation model expenditures for MPOs with regional populations over 4,000,000 is $780,000, compared to the $500,000 average for all large MPOs.

D. NARC's Role in Promoting MPO Modeling

The survey questionnaire also asked if NARC should take a proactive role in providing modeling guidance, updating the best practices manual,[1] and lobbying for MPO interests in the transportation legislation now before the Congress. Overall, Table 12 shows that there is overwhelming support for continuing NARC involvement in all three areas. Almost all of the smaller MPOs indicated that NARC should provide modeling guidance and update the best practices manual. About three-quarters of the large MPOs felt the same way. There was concern that any guidance should be advisory and that local autonomy in modeling practices should be preserved. Several MPOs expressed the hope that NARC and the Association of Metropolitan Planning Organizations (AMPO) could work together and coordinate their efforts in this area.

Some 80 percent of both small and large MPOs felt that NARC should lobby for MPO modeling interests in the upcoming federal legislation, particularly to insure that sufficient funds are made available for planned model validations and enhancements.

TABLE 12 NARC's Role in Promoting Modeling

	Smaller MPOs	Large MPOs
NARC should provide modeling guidance	86%	76%
NARC should update the Best Practices Manual	100%	74%
NARC should lobby for MPO modeling interests	80%	82%

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[1] Manual of Regional Transportation Modeling Practice for Air Quality Analysis, National Association of Regional Councils, Washington, D.C., 1993.

V. LEGISLATIVE PROGRAM FOR MPO MODELING CAPABILITIES

Most urban regions of the United States face relentless continuing growth in highway travel volumes as a result of population and employment growth. Decentralization of land use patterns into auto-oriented suburban and rural areas also plays a role, as do demographic shifts, increases in auto ownership, and other causes.

The urban travel demand forecasting models are, and will continue to be, an integral part of the planning establishment in all urban regions in the US. As the urban fabric of the US matures into an auto-oriented development pattern, transportation infrastructure capacity expansion is increasingly difficult from the financial, legal, and environmental impact standpoints. In this setting, the models become even more important in optimizing and legitimizing planning efforts and resolving related disputes. Uses of the models can be categorized into five interrelated areas, briefly discussed in the following sections.

A. New Transportation Facility Construction and the Expansion of Existing Facilities

Continued growth in highway congestion has precipitated intense demand for additional system capacity through the construction of new highway and transit facilities, and the expansion of existing facilities. Facility expansions are often coordinated with the design life-related reconstruction of existing facilities. This traditional use of travel forecasting models, and the demand for corridor, major investment, and environmental impact studies is intense. The models are also used for the traditional functions of evaluating the transportation element of the long-range plan.

B. Land Use Planning and Growth Management

Long-range land use planning usually involves evaluation of land use scenarios. An important factor in the evaluation of these scenarios is the impact on the transportation infrastructure through the evaluation of congestion and environmental impacts. Smart growth planning attempts to make maximum use of the existing highway system and encourage development patterns conducive to public transportation. The models provide an indication of the probable success of smart growth.

C. Travel Demand Management

Congestion management is in part based on projected levels of congestion. Also, the current travel forecasts provide estimates of traffic volumes and congestion levels on roadway links not covered by traffic counts and travel time surveys. Planning for public transit and HOV facilities is heavily dependant on the use of the models to evaluate alternatives and design new facilities. Non-motorized travel is not traditionally considered by the models, but will play an increasing role in transportation planning.

D. Economic and Environmental Justice

Environmental justice issues related to planned facility improvements have emerged. These include the environmental and neighborhood impacts of new highway and transit, and the distribution of associated benefits. Economic justice will also be a concern if more widespread designation of HOV lanes and other single occupancy vehicle restrictions, congestion pricing, and aggressive traffic control measures are used to control vehicular congestion. Planning for implementation of these measures is likely to be difficult. The models have a role in evaluating the efficacy of transportation proposals and quantifying the environmental and economic impacts.

E. Environmental Concerns and Air Quality Planning

This is a very important continuing use of travel demand models, particularly in regions that have to continue to demonstrate conformity of their capital program with air quality standards. This may result from not having achieved attainment with the 1-hour standard or still being in air quality maintenance mode. Continuing growth in highway travel may threaten air quality even in regions that have reached attainment. The more stringent 8-hour standard will result in reclassification of most if not all medium and large MPOs into non-attainment.

Larger MPOs already have network-based travel simulation models and have staffs capable of applying them. MPOs, some originally classified as moderate or better under the 1-hour standard, may have to upgrade and validate their transportation models and acquire mobile source emissions estimation capabilities as a result of the 8-hour standard. These upgrades, for the most part, can be undertaken within ongoing model maintenance and enhancement activities.

The more stringent new 8-hour air quality standards are also likely to result in regulation of mobile source emissions for hundreds of new counties in the United States. Most of these newly regulated counties will probably be located east of the Mississippi River. Many of them are served by small urban MPOs or rural planning agencies that do not have the transportation and mobile source emissions modeling expertise or adequate staffing levels to independently conduct in-house conformity demonstrations.

Provisions in the new law must be made to provide the required support to these smaller organizations. In general, three paradigm could be followed to provide conformity demonstration support for smaller MPO’s.

1. States could provide smaller MPOs with conformity demonstrations support as an adjunct to the SIP development process.

2. Smaller MPO’s could band together into consortiums and hire consultants and prepare conformity analyses as a group. Or,

3. Smaller MPO’s could go it alone and acquire their own conformity demonstration resources through staff acquisitions or consultant contracts.

In most cases, the third option is likely to be the least efficient mode of operation and will be unacceptable. There are significant economies of scale in combining the technical work associated with conformity analyses for small urban and rural planning organizations. It is natural to provide support for newly re-designated smaller MPOs from the state because many of the emissions calculations and processes required to prepare the SIP are directly applicable for conformity demonstrations. It may be possible to provide for the conformity demonstration needs of all of the smaller MPOs within the statewide SIP consultant contract. Existing staff in these organizations who prepare the TIP and long range plan may be adequate to prepare conformity demonstrations using methods provided by State transportation and environmental protection agencies through their consultants.

However, consortiums of smaller MPO’s may be attractive and provide acceptable economies of scale in some situations. The choice between the three paradigms depends on the size and spacial distribution of non-attainment MPOs and the planning culture that exists at the local, regional, and state levels.

VI. SPECIFIC LEGISLATIVE RECOMMENDATIONS

It is very clear that the travel demand models and related land use and emissions estimation procedures will continue to be the most important elements in regional transportation and environmental planning activities. The new transportation bill should make explicit provisions for the validation and maintenance of regional models and for selective upgrades. These enhancements are needed to remain consistent with acceptable modeling practice and to address emerging transportation planning issues. The bill must make adequate funding levels available to MPOs and states for these activities. Suggested guidelines for this legislation follow:

1. *Adequate funding for routine model validation, maintenance, and enhancement should be provided.* Section IV-C provides an estimate of planned spending by MPOs on their models. This planned spending, for the most part, reflects required model validations and incremental improvements to the models and related software. Lawsuits related to proposed transportation projects are very common. Issues related to the adequacy of the travel forecasting models used in planning stages are always central to the legal arguments and often pivotal in the decision.

2. *MPOs should be given flexibility to tailor their modeling processes to local planning issues and requirements.* The flexibility is particularly important for land use modeling. However, transportation modeling requirements also reflect the local planning culture in terms of transportation issues, data availability, and the current specification of the models.

3. *Detailed model specification issues should not be addressed in the legislation.* Rather, funds should be made available to update the 1993 NARC Best Practices Manual. There is a need for an updated review of best practices. The travel modeling community is served by an active academic and professional community that can assist in this task.

4. *If new transportation planning initiatives not adequately addressed by regional models are included in the bill, funding for the required model upgrades should be provided.* Modeling of congestion pricing and other aggressive demand management policies may require model upgrades. The data and computation requirements of TRANSIMS are very large and extensive. As of this writing, the results of the model trials in Portland, Oregon have not been published. Therefore, NARC can’t take a position on the implementation of this new model at this time. However, implementing TRANSIMS will be a very large and expensive effort for MPOs. It requires a near complete replacement of the existing regional models and their associated databases. Specific funding must be provided in the bill for TRANSIMS implementation, if the decision is made to go ahead with the model.

5. *Model requirements, such as validations, should be coordinated with the availability of Census and other survey data.* This will improve the efficiency of the conformity process and improve the quality of the results by eliminating the need for interim year validation forecasts.

6. *Specific provisions should be made in the bill to provide technical resources for MPO's who are placed in a non-attainment status as a result of the 8-hour air quality standards*. For smaller MPOs, this conformity demonstration support, in many cases, may be provided by state environmental protection and transportation departments as an adjunct to the SIP development process. Special situations may also exist where individual large MPOs might need to upgrade their technical process or MPOs might form consortiums to acquire and apply the technical expertise needed to conduct conformity analyses.

Appendix

List of Participating Metropolitan Planning Organizations

Akron Metropolitan Area Transportation Study (AMATS)
Anchorage Metropolitan Area Transportation Study (AMATS)
Atlanta Regional Commission
Bi-State Regional Commission Rock Island, IL
Boston Metropolitan Planning Organization
Champaign County Regional Planning Commission (IL)
Chicago Area Transportation Study
Delaware Valley Regional Planning Commission (DVRPC)
Des Moines Area MPO (DMAMPO)
Hampton Roads Planning District Commission
Indianapolis MPO
Kern Council of Governments
KIPDA Louisville, KY
Lafayette Consolidated Government
Lehigh Valley Planning Commission
Maricopa Association of Governments
Metropolitan Area Planning Agency (MAPA)
Metropolitan Transportation Commission
Mid-America Regional Council (Kansas City, MO)
New York Metropolitan Transportation Council (NYMTC)
New Jersey Transportation Planning Organization (NJTPA)
North Central Texas Council of Governments
Portland Metro
Rhode Island Statewide Planning Program
San Diego Council of Governments
South Jersey Transportation Planning Organization (SJTPO)
Southeast Texas RPC
Southern California Association of Governments
Southwest Washington Regional Transportation Council (Vancouver)
Southwest Regional Council of Governments (SEMCOG)
West Florida Regional Planning Council