

SUMMARY OF WORKSHOP ON MODELS OF ACTIVITY ENGAGEMENT AND TRAVEL BEHAVIOR

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Introduction

This workshop primarily focused on the availability, use, and research needs of activity-based models of travel behavior. The workshop group consisted of academics, consultants, practitioners from public agencies, and researchers providing a forum for the brisk and informative exchange of diverse viewpoints and perspectives. The workshop convened over a two-day period with specific objectives charged to the group in order to ensure that a clear set of recommendations emerged from the discussions. The workshop started with presentations by two discussants who offered their perspectives on activity based models of travel behavior. Following their presentations, the group worked on developing an ambitious agenda for moving activity-based models of travel behavior into mainstream practice.

Presentations by Discussants

Chuck Purvis, with the San Francisco Bay Area MTC, served as the first discussant for the workshop. His presentation served as an opening practitioner perspective on the topic of activity-based modeling and his thoughts were echoed repeatedly by members of the group over the two-day period. Chuck mentioned that models need to respond to different scales of analysis including regional and subregional modeling efforts that MPO's typically engage in on a day-to-day basis. Models need to be especially responsive to network-level issues which are the primary concern of transportation planning agencies. Rarely do the MPO's concern themselves with new transport policies such as congestion pricing, parking surcharges, and other transportation control measures (TCM).

Chuck also mentioned that models should be understandable to practitioners. He indicated that, for most MPO staff persons engaged in travel demand forecasting, techniques such as structural equations, neural networks, and hazard functions of survival models are complicated. There is a need for training to understand and apply these procedures. In addition, he felt that there is a clear need for proving the performance of new modeling methods before they are accepted and implemented in practice.

Tom Golob, with the Institute of Transportation Studies at the University of California, Irvine, served as the second workshop discussant. Tom presented a structural equation model system that models the two-way interactive relationships between activity engagement behavior and travel behavior. In developing the model system, several aspects of travel and activity behavior were addressed. Interactions between household members were taken into consideration. Tom noted that there may be activities that household members engage in as a group and that cars owned by a household have to be

shared by all driving members. The trade-offs involved when considering in-home activity engagement as opposed to out-of-home activity engagement also were addressed. Tom also addressed the degree of flexibility associated with various activities. He classified various activities into three broad categories, namely, work and work-related, maintenance (shopping, personal business, etc.) and discretionary (social recreation, etc.). Mobility may be represented by trip rates by mode, travel times, and travel distances (vehicle miles traveled). The structural equation system was estimated on data from Portland, Oregon to relate activity and travel behavior to a set of exogenous or explanatory variables. Tom noted that the model system can be extended to consider such aspects of behavior as trip chaining, ridesharing (driver or passenger), and use of non-motorized modes for short trips. In addition, Tom indicated that stated preference questions can also be incorporated into the model system thus providing a more powerful TDM policy analysis tool.

Various issues were raised in light of Tom's presentation. Some of the issues raised included the following:

- Analysis of weekend activity behavior and travel
- Use of longitudinal data to track changes in behavior over time
- Stability of relationships over time; it was noted that relationships are more likely to be stable in the short-term as opposed to the long-term
- Day-to-day variability in activity and travel behavior
- Need for supply side models; how does travel time and distance relate to congestion levels on network

Following the presentations by discussants, the group addressed four fundamental questions with regard to models of activity engagement and travel behavior. They are:

1. What activity-based models or techniques are available to use now?
2. What needs to be done to bring these models into practice within the next two years?
3. What are the application areas where activity based models may be applied in the next five years?
4. What are the barriers to implementation and what needs to be done to overcome them to facilitate moving activity based models into mainstream practice?

Question 1: Models Implemented and/or Available

The group discussed several model systems that have been implemented or are available, but have not been implemented yet in a real world environment. The group felt that there are several categories into which model systems may be classified depending on their level of complexity and the extent to which they replace or interface with various components of the currently used four-step UTPS process.

With regard to models that have been implemented and tested in a real-world environment, the workshop group identified several model systems. First, the group identified models that constitute an extension of the current UTPS process where

elements of activity based analysis are incorporated into current modeling procedures. The effort at the San Francisco Bay Area MTC was mentioned in this regard.

A second class of model systems involved the use of discrete choice methods to model the choice of activities and/or trip chains that people pursue. In this context, three model systems were identified by the group. These included the Dutch National Model, the Simulation Model System (SIMS) applied in Stockholm, and the discrete choice models implemented in Boise, Idaho and New Hampshire.

A third class of models was considered to offer a higher level of complexity and detail with regard to the modeling of activity and travel patterns. This class involved the microsimulation model systems of AMOS (activity mobility simulator) tested in the Washington D.C. metropolitan area and MIDAS (microanalytic integrated demographic accounting system) that was tested in The Netherlands.

The typology of models implemented may be summarized as follows:

- Extensions of UTPS Process
 - San Francisco Bay Area MTC
- Discrete choice models
 - Dutch National Model
 - SIMS (Stockholm)
 - Boise, Idaho
 - New Hampshire
- Microsimulation models
 - AMOS
 - MIDAS

In addition, the workshop group identified a few other model systems that have been developed, but have not yet been implemented in practice. One of the model systems is the Activity Tour Model developed at MIT and being implemented in Portland, Oregon over the next one to two years. Another model is TAMOS (transactions activity mobility simulator) that is being developed for the California Energy Commission. Also mentioned were STEPS, a model system developed in Berkeley, California, and a series of models that have been developed in Europe, but have not yet been implemented in practice. These mainly include activity scheduling models such as CARLA, SCHEDULER, SMASH, and DynaMIT. The workshop group made a note that very little is known among practitioners about international efforts and that there is a greater need for the dissemination of model development news.

Several issues were raised regarding the availability and implementation of model systems that have been developed over the last several years. These include:

- The definition of a tour or trip chain for activity based modeling of travel behavior. Several different definitions have been used across model systems and the need for a consistent definition was felt.
- There may be two avenues that are necessary for the implementation of activity based models; one avenue involving the upgrading of existing elements of UTPS and another involving an overall upgrade to a new model system.
- The diversity of methods is mind-boggling for the practitioner. There is a need for a greater amount of consistency of procedures.
- The question was raised as to whether models that have been successful in one location can be applied in another location? Do activity based models have the same difficulties in transferability that trip based models have?

Question 2: Steps for Immediate Implementation

The next question addressed by the workshop group was concerned with the steps that need to be taken to move the existing models (identified in Question 1) into practice within a very short time frame. A very lively discussion raised and addressed several issues concerned with immediate implementation of activity based model systems.

The group felt strongly that the applicability of activity-based models needs to be demonstrated in practice in an environment that is either their own or very similar to their own. The workshop strongly recommended that demonstration projects be conducted in several areas across the country. The areas should be of a diverse nature with considerable variation with respect to the following characteristics:

- Size (large, medium, and small)
- Population density
- Intensity of development
- Strength of CBD
- Urban vs. rural characteristics
- Availability of activity vs. trip-based data

In addition, the demonstration projects should involve the testing of multiple methods to facilitate a comparison of various methods and a determination of the methods most suitable for different planning environments. The group indicated that implementation will occur only after a proof of concept has taken place in the real-world.

Another major thrust area identified by the group was the formation of partnerships. It was felt that academics, researchers, MPO's, and consultants need to work together to make activity based modeling a reality. MPO's would like to understand the tool and its capabilities thoroughly before they actually use the model systems for their planning

studies. It was felt that partnerships among the various developmental and user groups would greatly accelerate the movement of these methods into practice.

MPO's and practitioners indicated that they were not aware of how close and suitable the various models were to actual application in practice. They indicated that MPO's need models that can be applied immediately as they do not have the time and resources to develop new model systems or customize generic model systems to their environment. Also, the group noted that MPO's need to make a slow transition from their current modeling procedures to the new modeling procedures. In fact, for some time period, it is anticipated that parallel procedures will be in place until an MPO is willing to completely adopt a new modeling method. Also, MPO's are of a very diverse nature. While some MPO's may have the technical abilities and staff resources, they may not have the data needed for implementing the models. At other MPO's, the reverse may be true. As such, there is a need to customize activity based modeling procedures to the specific situation in which they will be applied.

Education, training, and information dissemination through workshops, reports, short courses, and seminars were identified as key ingredients to the process of moving activity based methods to practice. It was felt that TMIP should take a lead in these efforts to keep practitioners fully informed of activity based model developments. In addition, it was felt that the technical and policy staff at planning agencies would have to be trained and educated about the new modeling methods before they can be applied in practice. Universities and industry should take a lead in offering short-courses, on-site training, and do-it-yourself user manuals for the application of activity based models.

Several other issues were raised in regard to the immediate application of activity based models in practice. With regard to the question of why MPO's have been slow in adopting new procedures, it was felt that time and resources (staff and funds) were too scarce to allow radical changes. Federal support is needed to facilitate the transition to new methods. It was felt that other planning agencies such as land use planning boards, city and county transportation divisions, and other agencies that are affected by transportation planning decisions should also be involved in any transition to new modeling methods. It must be ensured that activity based models are responsive to local, state, and federal legislative requirements as they govern and dictate many provisions of the planning process.

Some concern was raised with regard to a comparison of existing modeling procedures with activity based models. If the modeling processes offer different results, then how does one know which is correct? The group felt that activity based models should be able to replicate base year conditions and be responsive to new transport policies without having to apply various adjustment factors that are often applied in UTPS models. Also, it was felt that the results obtained from activity based models would, in many instances, complement and not compete with those provided by traditional UTPS models.

Question 3: Application Areas for Five Year Implementation

The workshop group discussed the various types of application areas for which activity-based models may be applied in a few years. The group discussed several issues in light of the different planning needs of transportation agencies. One issue dealt with the potential difficulty of relating activity-based information to network flows that most transportation planning studies typically need. The potential for activity based modeling to address land use impacts of transportation decisions in a more robust framework was identified as a key advantage of activity based analysis. The need to model trip making on a point-to-point basis rather than a zone-to-zone basis was mentioned as another area where activity based models may offer unique capabilities. GIS databases and procedures may offer powerful tools in this regard. The group felt that destination choice is a key challenge facing travel behavior modelers at the present time. In order to demonstrate that activity based models can be used for planning studies, one member indicated that activity based models should be applied in an urban context where only traditional zonal trip data are available as only a very few urban areas around the country are collecting detailed activity data.

The group identified three classes of application areas in which activity based models may be applied over the next few years. These are briefly discussed below:

Traditional Planning Studies

The group indicated that MPO's typically spend most of their time doing traditional planning studies and that activity based models would have to lend themselves to these types of applications to be accepted in practice. Examples of these studies included:

- Long Range Transportation Plans
- TIP Conformity Analysis
- Land Use Impact Analysis
- Project Development and Evaluation

Policy Questions

A second application area identified by the group pertained to the analysis of new transport policies. The group felt that this is the area where activity based models hold the greatest promise as traditional UTPS type modeling procedures were not developed to handle policy questions related to the implementation of travel demand management strategies, transportation control measures, and new technologies. Examples of policy questions identified by the group included:

- Congestion pricing
- Employer trip reduction programs
- Intelligent Transportation Systems
- HOV and Car/Vanpool programs
- Fare structure changes and tolls

- Other TDM strategies and TCM's
- Alternative fuels

Non-Traditional and Other Studies

Finally, the group identified a third class of planning studies which is intended to serve as the “catch-all” category for those that don't fall into the previous two categories. Within this category, the group identified special planning studies that deal with the study of unique population segments or rare behavior. Examples of special studies that could be included in this class were identified as:

- Analysis of special population segments (elderly, handicapped, etc.)
- Equity studies of transportation investments
- Analysis of Non-motorized mode use
- Telecommunications impacts on travel

The group also noted that the movement of freight and the explicit recognition of intermodalism have been lacking in activity-based analysis and urged the research community to consider these aspects of the transportation system in future developmental work.

Question 4: Overcoming Barriers to Implementation in Practice

The final question addressed by the group was concerned with identifying the barriers to implementing activity-based models in practice and the steps that need to be taken to overcome the barriers. Some of the discussion related to this question overlapped with the discussion surrounding Question 2 where steps needed for immediate implementation were identified.

The biggest barrier to implementation in practice was identified as the lack of proof that activity based models would work in several urban contexts. The group emphasized that planning agencies around the country would not adopt activity based models in mainstream practice until they are convinced of the credibility of such models and are confident of the results they provide. In order to establish credibility and confidence, the group identified two preliminary criteria that may be of use to researchers and developers:

- Activity based models should be able to replicate base year conditions without having to apply various adjustment factors that are typically used in UTPS modeling procedures
- Activity based models should be sensitive to new transport policies (such as TDM strategies and TCM's) that current UTPS models are not equipped to address and should provide intuitively meaningful results

In this regard, the group once again strongly emphasized the need for a multi-location demonstration study where multiple activity based methods would be applied in different types of urban contexts to prove the abilities of activity based models in meeting planning needs.

Another major barrier to implementation was related to data requirements for activity based modeling and the monetary resources needed to collect such data. The group felt that it would be prudent to study the transferability of activity based data. In this regard, it was mentioned that the variability in activity engagement rates is much smaller than that for trip rates, perhaps making activity data more transferable than traditional trip data. Within this context, the group noted that funds should be made available to local planning agencies to consider implementation of activity based models. As implementation of new model systems is resource intensive and local planning agencies are already operating under tight fiscal constraints, it was strongly felt that MPO's would be very slow to consider new modeling procedures without monetary assistance from the federal agencies.

Staff expertise and training needs were identified as another major requirement for moving these methods into mainstream practice. The group mentioned that various technology transfer and training materials should be made available for planning agency staff to become knowledgeable in the area of activity based analysis. Primers or readers on activity based models, short-courses, conferences and workshops, demonstration studies with researcher/practitioner partnerships, and on-site software training were identified as the main ingredients to effective technology transfer.

In this context, the group also talked about short-term research needs to address some of the issues in activity based analysis for which adequate insights have not been obtained. The research needs identified include:

- The impacts of land use patterns and destination opportunities on activity patterns need to be determined and the underlying relationships should be unraveled using real-world activity data that is merged with land use data
- The level of detail needed from models for various types of planning applications should be determined in order to identify the types of modeling methods most appropriate for different applications
- Detailed descriptions of activity patterns and how they relate to travel patterns are needed to establish the link between activity information and travel on networks
- Transferability of activity data should be studied in light of the fact that only a very few urban areas have collected detailed activity data
- A synthesis of time use surveys should be undertaken to summarize the lessons learnt and knowledge gained from such surveys

Finally, the group indicated that while these short-term research needs will provide benefits for moving activity based models into practice, it should be recognized that activity based models are the culmination of decades of research into travel behavior and its underlying forces. As such, the value of long-term research should be recognized and long-term research and development efforts should be continued to further enhance model specifications and estimation methods.

In summary, the steps that would help move activity based methods into mainstream practice are as follows:

- Multi-location multi-method demonstration projects to prove concept in practice
- Researcher/practitioner partnerships
- Education and training
- Reader/Primer on activity based methods
- Conferences, workshops, and short-courses around the country
- Monetary resources and incentives
- Sample activity data sets with computer model demos
- Continued support for long-term research and development

The workshop group concluded its discussions at the end of the second day having accomplished its mission.