Workshop 6

ANALYTICAL STRUCTURES

OBJECTIVES

Identify, review, and evaluate the various analytical structures currently used and proposed for travel demand forecasting.

Identify and recommend improvements.

Develop a recommended program of research.

EXAMPLES

The analytical structure of a travel demand forecasting technique is the way it is formulated, manipulated, sequenced, and solved (generally symbolically or mathematically). The structure fundamentally affects many of its characteristics, including its sensitivity to alternative transportation proposals, and its prediction characteristics. Examples of analytical structures are direct versus indirect, abstract versus mode specific, aggregate versus disaggregate, behavioral (causal) versus associative, optimizing versus simple predictive, correlative versus trend, multimodal versus unimodal, econometric versus multinomial logit, simultaneous versus simple regression, and incremental versus iterative.

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Report

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The view of Workshop 6 is that analytic structures cannot be considered independently of transportation theory, that neither is likely to develop in meaningful ways outside of the context of real problems, and that the structure of the real problem dictates or at least suggests the structure of the analytic tools required for its solution. Nor can travel demand estimation models be viewed independently of the remainder of the urban planning process. Economic development, urban land use, urban activity patterns, and population growth all have impacts on future travel patterns. General questions to be considered about any analytic structure for forecasting travel demand must include at least the following: Are the results sensitive to land use? Are the results sensitive to transportation policies and at what levels? How can the results be disaggregated for equity analyses? Are the results transferable at some or any level of aggregation? If transferability exists, can it be used to eliminate the need for further origin-destination studies except possibly to answer new behavioral questions?

The interactions among transportation supply, urban activity distribution, and travel demand are areas where research is badly needed. The estimation of future travel demand and the evaluation of impacts of various transportation options cannot be accomplished satisfactorily without a full consideration of these interactions. Research is needed in developing and improving analytical structures that quantitatively describe these interactions. The research should include short-run, small-change (marginal), long-run equilibrium, and dynamic models. Attention should be given to the effects of land use regulations and their impact on the control of traffic and possible use for that purpose. Short-range models are required to provide quick response to developers' proposals in terms of transportation impacts. Models should have capability of investigating land use management as a means of protecting the transportation system.

There is a need for research to explore systematically analytic structures for aggregation of data related to transportation system attributes. The following dimensions, as well as others, must be explored:

1. Effects of zone size including access

and egress links due to the spatial dispersion of trip ends within analysis zones;

2. Aggregation of paths, submodes, and modes where the analysis requires such aggregation;
3. Time aggregation, including time-of-day effects, aggregate capacity constraints, and aggregated measures of impedance and performance;
4. Aggregation across population and income groups; and
5. Relation between market segments and other aggregations with a view to adequate definition of market segments.

Until such time as generally accepted aggregation methods are found, the problem should explicitly be addressed by the developers and users of models. Publications documenting model development should include a section suggesting aggregation methods to be used with the models and analyzing the possible effects of aggregation on the model's performance. Similarly, reports on the calibration of the models should carefully specify the aggregation methods used and their effects.

There is a need for the forecasts to be stated in probabilistic terms in the sense that at least some measure of the variability of the estimates should be provided. In this direction, studies should be made to explore the use of Monte Carlo and gaming techniques as well as closed-form models of uncertainty related to making probabilistic forecasts.

A large part of the information required for comprehensive evaluation and impact analysis is created as part of the existing UTP process or is relatively easily derivable from its output. To make efficient use of these data requires the development of efficient methods for storage and retrieval of the information; effective and extensive post-processing tools, including evaluation models, manipulating and summarizing programs, and batch and interactive computer graphics systems; compatibility between these tools and the information methods to ensure fast and easy processing; and efficient analytical structures for "pivot-point" analysis compatible with the information methods.

These tools can be used to obtain fast demand estimates and rapid response to decision-oriented questions that are functions of these estimates.

Transportation planning is a continuous process and not a set of unrelated projects. Workshop 6 proposes that continuing transportation planning agencies be charged with maintenance of comprehensive historical data and a continually updated data set. The updated set is intended to be used with the tools described above for short-range, small-scale planning. In this case model sophistication is being traded for more up-to-date input data. The resulting time series data can be used for the testing and refinement of the operational models. There is a need for research to define a minimal, standard data set and methods for its acquisition and processing.

There is a need for models that reflect the effects of operator behavior on travel demand estimates. In particular, the effects of the quality of management need to be considered.

Current models not only fail to adequately treat the questions related to systems management but also give little attention to marketing effects. The effects of marketing need to be better understood, and its relation to value-oriented decisions on other than a utility basis needs to be described. Models that relate marketing to transportation forecasts and to transportation variables are needed.

Travel demand estimation models could legitimately be used to limit or manage traffic on either a local or area-wide basis. The purpose might be to meet ambient air quality standards, produce desired life-styles, or reduce noise and accidents. To do this, the models would have to produce not necessarily flows or links but perhaps vehicle-miles of travel by time of day, trip numbers and lengths, person-miles of travel, and possibly speeds and travel times. The models need to be capable of dealing with automobile-free zones, parking, management policies, capacity restraints, and so on.