Workshop 1

DEMAND FORECASTING FOR SHORT-RANGE AND LOW-CAPITAL OPTIONS

OBJECTIVES

Identify, review, and evaluate current and proposed travel demand forecasting techniques and procedures for use in assessing short-range and low-capital options in urban transportation.

Recommend new and improved forecasting procedures that are responsive to requirements of using the travel forecasts

Develop a recommended program of research that is responsive to the identified requirements of using the forecasts.

OPTIONS

Short-range options include all actions or projects that may be planned, designed, and implemented in fewer than 5 years. Therefore, spatial distribution of land uses may not be considered, but changes in the time distribution of activities may be as may changes in the cost of travel or methods of operating the system. Examples of low-capital transportation options include traffic engineering and operations improvements, priority lanes for high-occupancy vehicles, pricing policies for automobiles, transit operating improvements, transit fare policies and operating subsidies, transit marketing programs, no-build alternatives, parking restrictions and regulations, automobile-restricted zones, and transit service cutbacks. Examples of nontransportation options are staggered work hours, longer shopping hours and Sunday shopping, and a 3- or 4-day workweek. Examples of short-range options include the above plus certain high-capital options that can be quickly implemented such as construction or reconstruction at specific locations such as bridges, freeways, rail and bus rapid transit facilities, and parking and terminal facilities, and transportation demonstrations projects.

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Report

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Workshop 1 was concerned with the travel forecasting needs that are generally or uniquely experienced by decision-makers attempting to make choices among alternative short-range and low-capital transport options.

Options of this type are important and perhaps are predominant elements in transportation system development porgrams in most urban areas because such modifications amount to routine system maintenance activities and their costs are within the feasible range for most cities.

In addition, because of widespread citizen opposition to major capital-intensive transportation investment programs, low-capital options may represent the only way to preserve and improve transportation services in the coming decades. Such a restricted spectrum of transportation options may force consideration of ways to provide basic mobility services with the existing roadway system, and small modifications to it, and may also require limitation of the growth of (private mode) travel demand.

Furthermore, short-range options are of special concern to elected decision-makers, who generally find it difficult to place high priority on longer term planning, preferring instead to focus on more immediate ways to solve problems.

ROLE OF FORECASTING

Organized procedures for estimating the response to short-range and low-capital changes in transport services are needed for effective and responsive decision-making. Yet, decisions are often made with no information at all about the potential impacts that might result. Such information that may be available through the use of inexpensive travel forecasting techniques is often unreliable or of unknown reliability, inaccurate, or based on forecasting techniques that are essentially insensitive to the major attributes of the options being considered. Some information may be provided through the use of traditional, long-range, regional forecasting tools that have questionable validity, are always made at great expense in time and money, are usually made at a level of detail far too general to be meaningful,

and, again, are based on forecasting techniques that are insensitive to the major attributes of the options themselves.

SOME ATTRIBUTES OF SHORT-RANGE AND LOW-CAPITAL OPTIONS

If forecasting techniques are to be responsive to the planning of short-range and low-capital transportation options, they must be capable of predicting user response to changes in a variety of measures of levels of service that are not now explicitly included in contemporary forecasting models. These might include frequency of service, travel time reliability, comfort, convenience, access time and distance, crowding conditions, availability of information about services, parking constraints and policies, level of crime on the transport systems, exact fare pricing, waiting area conditions, parking availability, number of transfers, transfer times, regulation of taxis and jitneys, car-pooling policies, and area-wide vehicle restrictions.

Furthermore, those dimensions of service change associated with short-range and low-capital transport options and represented in current models are not effectively treated. These elements include monetary travel costs, transit routing patterns, and travel times. Contemporary models cannot efficiently treat responses to changes in such variables at a sufficiently detailed level, and they are frequently not realistically sensitive to small changes likely to be important to users of transportation.

SPECIAL INFORMATION REQUIREMENTS

Because of the nature and the scale of many short-range and low-capital transport options, planners are faced with the need to provide decision-makers with specific information that is generally not accommodated by contemporary forecasting techniques. For example, information is required on the sensitivity of travel demand to a variety of level-of-service measures common to the relevant options, but not explicitly treated in the current models. Furthermore, demand characteristics for travel modes not normally considered in the data collection and analysis phases of typical urban transportation planning studies may be important for short-range and low-capital planning. Such modes include bicycles and pedestrian trips. Special attention may also be necessary for "no-mode" (unmade) trips as well as for potential trips by modes having currently restricted usage because of regulatory policies, such as taxis and jitneys.

In some urban contexts where social and environmental pressures are very great, it may be necessary to provide information on the relations between travel demand and environmental impacts. More specifically, there are needs to estimate demand in response to traffic management (limitation) schemes designed to respect "environmental capacities." Information on the trade-offs among levels of service, travel demand, and environmental impacts has become essential in some situations. It would be desirable, for example, to have a rapid and efficient capability to estimate such trade-offs among the "go-around," the "go-through," and the "don't-go-at-all" options to respond to public suggestions and complaints and to speed up the search and choice process in planning. It is important to recognize that rapid analysis and decision-making not only may lower planning costs and make it possible to implement decisions sooner but also may facilitate making more choices in a given time period, leading to transport services that are more responsive to current needs.

Recognizing that transportation is a supporting service, and not an end in itself, the planner may appropriately develop demand-supply analysis techniques that allow him to specify environmental capacities initially and then determine both the characteristics of feasible transport services and the equilibrium demand. This synthesis approach places special requirements on demand forecasting techniques in terms of sensitivity to service-level variables and speed of response, which are not met by available methods.

Work-trip travel has been the focus of attention in long-range forecasting because it represents a large—and easily understood—fraction of all urban travel. Although

work trips may be of primary importance for the evaluation of many proposed short-range and low-capital transportations, other trip purposes may require special consideration in this context. For example, special off-peak transit services designed for disadvantaged travelers and oriented toward shopping, medical, and recreational purposes fall into this option category. Too little is known at present about the non-work travel market. In the case of the increasingly important weekend recreational trips, for example, forecasting capabilities are limited by the policy of collecting (long-range-oriented) origin-destination data on weekdays only.

Because short-range and low-capital transport options are often focused on a particular segment of the travel market, forecasting techniques may be called on to provide specific information about the market areas of proposed services and about the response to those services of different types of travelers. Generally, the requirement for highly disaggregate analysis places special pressures on short-range and low-capital forecasting processes.

THE DECISION-MAKING ENVIRONMENT

The uniqueness of the information needs for decisions about short-range and low-capital transport options does not lie only in the dimensions of service changes likely to occur. Certainly it is becoming increasingly more common to be faced with decisions about service changes not well described in terms of travel time and costs alone. Yet, such changes may well be proposed to meet long-range urban travel needs. Furthermore, the impacts of such changes may be widespread and long lasting.

It is apparent that the fundamental conceptual and theoretical bases for performing short-term travel demand forecasting must ultimately be consistent with the bases for long-range forecasting. The decision-making environment within which choices about short-range and low-capital alternatives are made serves to differentiate the characteristics of long- and short-range forecasting problems.

For example, the decision-makers involved in choices about short-range and low-capital options are often not the same ones concerned with long-term choices. They are often closer to the "operating" level and, thus, may hold narrower perspectives and be less favorably inclined toward dealing with complex information sets. Furthermore, the transportation planners concerned with these choices are likely to be different, in terms of skill levels and viewpoints, from those concerned with long-term decisions.

Who are the decision-makers? They include federal, state, and regional transportation professionals, local government officials, system operators, and ordinary citizens. The role of citizens in decision-making regarding short-range and low-capital options is likely to be large because of the immediacy of the choices, the rapidity with which some of the impacts arise, and the probable localization of those impacts. Citizen-participants have special information needs because they do not possess technical backgrounds and because they are likely to be directly affected by choices. Similarly, decision-makers, as laymen, present a special challenge to travel demand forecasters. This is amplified by the extreme time pressures common to short-range decision-making. The characteristics of the short-range decision-making environment lead to some very specific performance requirements for demand forecasting techniques. Among these are the following:

1. The need for rapid response to questions about reactions of the travel market to proposed transport changes;
2. The need for preparing impact estimates at low cost;
3. The need for a strong, simple, and obviously credible basis for forecasting;
4. The need for preparing detailed, disaggregate user-response estimates at the microlevel;
5. The need for providing easily understood measures of expected equilibrium service levels in terms meaningful to citizens and decision-makers (this requires measures that are trip oriented, perhaps describing door-to-door travel times for specific

trips, volumes on local streets, and delays at particular intersections); and

6. The opportunity in some cases to provide impact estimates with relatively high error margins when proposed service modifications are (essentially) reversible or easily adaptable.

All of these requirements might not apply to every short-range and low-capital decision situation, but they are all relevant to the general environment that forms the context for such options.

The importance of building and using forecasting capabilities responsive to such decision-maker needs is critical. Special concern must be placed on the linkage between planner and decision-maker if good choices and, perhaps, if any choices are to be made about the maintenance and development of urban transportation systems.

STATE OF THE ART

Forecasting capabilities that can meet the needs described above are not in general use in the United States today. The standard, long-range planning techniques are typically unresponsive to the issues and options, the scale, and the variables involved in questions about short-range and low-capital options. Long-range forecasting techniques clearly do not meet the time and cost performance requirements of typical short-range and low-capital options.

Yet, a reasonable amount of relevant information that would be useful in this decision-making environment does exist. This includes information on demand elasticities derived from previous experiments with changing transportation services. Such information may be in the form of case study results or in terms of the parameters of models calibrated in a variety of special forecasting studies. Advanced formulations of long-range models, such as those used in the United Kingdom based on generalized costs rather than travel time alone, may also have applicability in the study of short-range and low-capital options.

Unfortunately, the link between this information and its potential users is very weak. Many planners and decision-makers do not recognize the need for forecasting capabilities in this context. Those who do are often unaware of available information and techniques or are unable to put them to use because of inadequate documentation. Furthermore, there is a strong tendency to apply unresponsive and inappropriate long-range forecasting techniques because they are relatively well documented. It is apparent that these long-range methods have been unintentionally institutionalized, having acquired the appearance of the only way to estimate travel demand. The danger of institutionalization of techniques in the context of short-range and low-capital planning is very great, and steps are needed to foster continuing innovation.

The fact that some potentially useful approaches to short-range and low-capital forecasting do exist suggests the immediate need for a program of information dissemination. This program might include the assembly and codification of results of experiments, calibrated and special purpose models, and proven methods for expanding the sensitivity of existing, long-range models. In this manner, and without additional research, a greatly improved—but still very limited—capability for predicting the use of proposed short-range and low-capital transportation options could be structured and made available at low cost and in a very short period of time.

At the same time, a continuing research effort must be undertaken to improve these techniques in the context of both the needs stated previously and the experience with the use of off-the-shelf methods. Documentation of such experience with existing and innovative techniques in the context of carefully controlled surveillance of the actual impacts of short-range and low-capital transport improvements is essential for the development of a meaningful forecasting capability in the next few years.

DIMENSIONS OF AN ACTION PROGRAM

Improving operational capabilities to forecast response of the travel market to short-range and low-capital transport options should begin with identification, codification, and dissemination of available techniques. Initial results of this effort can be made available within 6 months. The state of the art will not remain stagnant, of course, and so this information collection and dissemination process must continue. The flow of information must move in 2 directions: Documentation of viable approaches must be provided to users in the field, and the experiences that users have with these methods, along with applications of their own innovative methods, must be returned to identify research needs, to provide data bases for research, and to make it possible for others to use locally developed approaches.

In the short term, at least, it is likely that 2 classes of short-range and low-capital options might call for 2 distinct approaches to the forecasting problem. These are differentiated by the scale of their impacts.

The first category includes options that produce only relatively small and highly localized facility or route-oriented user effects. Such alternatives might be dealt with by applying knowledge from existing data, special-purpose models, and case studies and presenting them through written reports, nomographs, or tables.

The second category includes those options that produce larger impacts on an area-wide basis. It is likely that the time and budget constraints applicable in such situations would be less limiting than those applied to the first category of options. Larger scale, more costly forecasting procedures might thus be used. Introduction of generalized costs and application of currently available behavioral models of mode choice should receive high priority. Prediction of mode- and route-choice shifts alone may be sufficient for short-term evaluation of some of these options. Yet, it is well known that even some apparently small changes in characteristics of transport services can result in shifts in destination choice, trip generation, and even the spatial arrangement of activities. Every effort must be made to anticipate such impacts. If available models cannot respond to such changes effectively and efficiently, research needs should be clearly documented.

It is patently obvious that existing models, modified in light of available knowledge, will not fulfill all of the requirements of the short-range and low-capital forecasting environment. An organized research program is badly needed. In particular, efficient models that are appropriately sensitive to level-of-service changes common to short-range and low-capital transport modifications must be developed. To accomplish this requires a reliable, disaggregate data base describing market responses to real changes in these variables. The collection of such a data base might best be accomplished through add-on studies as a part of existing federal and state transportation improvement funding projects, with case studies selected for special data collection efforts by an interdisciplinary research advisory council. This will require the precise specification of research needs and the careful monitoring of opportunities for data collection and analysis. Such an approach will make it possible to learn from the planned changes in transportation services that occur daily throughout the nation. It amounts to taking appropriate advantage of existing opportunities. Recent developments in disaggregate modeling suggest that large volumes of costly data will not be required. Instead, it will be of critical importance to collect the right data in the right situations, based on the nature of the hypotheses to be tested and the models to be calibrated. Data collection methods and format specifications should be uniform across case studies to promote maximum use of collected data and to facilitate intersituational comparisons for the purposes of extending the range of known demand elasticities.

Special arrangements should be made for rapid-response funding of highly specialized data collection activites in the context of infrequently occurring targets of opportunity, including strikes, extreme environmental conditions, accidents, facility closures due to repairs, and price or service changes. All collected data should be made relatively available to any researchers who wish to use them and to those agencies funded to perform analytic research in order to maximize the benefits derived from the collection efforts. In particular, this may offer universities an opportunity to perform

unfunded, exploratory research directly relevant to forecasting needs faced by planners.

Specific model development efforts should focus on improving existing techniques and testing and developing emerging behavioral models. Near-term research (1 to 5 years) should seek to quantify the traveler-type-specific elasticity of travel demand with respect to typical short-range and low-capital option attributes, as listed above. Longer term research should seek to define the more fundamental characteristics of travel behavior. Such research is of critical, direct relevance to the solution of the forecasting problems faced by transportation planners, decision-makers, and citizens on a daily basis. Forgoing basic research entirely in order to meet short-term needs alone is clearly a form of disinvesting and will result in an even more critical situation in transportation planning in the coming years.

Data collection and research efforts must continue, perhaps at a lower level of effort, after initial research projects have been completed. This will ensure that future forecasting methods are timely and responsive to the evolving needs of decision-makers, the changing characteristics of travelers, and the emerging characteristics of transport options. Furthermore, monitoring of the efficacy of operational forecasting techniques, through the surveillance of the actual response of the travel market to implemented changes in service, will make it possible to validate existing forecasting methods. An organized monitoring program is particularly appropriate for many short-range and low-capital options, the impacts of which may be felt very rapidly.

Beginning immediately, it should be possible to organize a family of forecasting techniques appropriate for evaluating short-range and low-capital transport options. Each of the methods within this family might be appropriate for a particular forecasting situation, defined in terms of the travel market characteristics, option characteristics, and impact characteristics. Just as the range of the complexity of the forecasting environment might be quite broad, so might the range of the forecasting methods. The need for establishing consistency between methods is, of course, essential and must be the subject of continuing research. The search for a reliable, behavioral basis for forecasting models is likely to ensure this consistency. In the immediate future and for less complex forecasting environments, the codification of existing knowledge in the form of tables, charts, and nomographs is a reasonable direction to pursue.

The product of these efforts might be prepared and distributed in the form of a set of loose-leaf guidelines that permit users to quickly identify one or more appropriate forecasting approaches, based on the characteristics of the problem at hand. Documentation of these techniques, including specifications of the limits of their validity and applicability, should be thorough. The loose-leaf form is recommended for easy updating. Guidelines should be prepared and distributed in such a manner that institutionalization of methods is discouraged. It should be recognized that the current state of the art is sufficiently limited to make institutionalization very dangerous. Innovation in demand forecasting should be encouraged and, where appropriate, actively supported.

MARKETING REQUIREMENTS

Along with development and organization of appropriate travel-demand forecasting capabilities, it will be important to recognize and to meet the need for marketing these capabilities to potential users. This includes educating the analyst about his forecasting needs, the techniques to meet them, and the limitations of those techniques. It includes providing both the analyst and the decision-maker with information about forecasting needs and methods so that they can work effectively together. Finally, there is a need to provide the analyst with a basis for communicating to lay citizens not only the results of the forecasting process but also the philosophy, validity, and meaning of the forecasting process itself.