Challenges in Urban Travel Forecasting

David S. Gendell, Federal Highway Administration

Almost any transportation issue involves travel demand in one way or another. At any point, the transportation system is in equilibrium; the supply side is in balance with demand. Before changing the transportation system, we should understand how the changes will affect travel demand because that in turn affects service, socioeconomic conditions, public finances, and the environment.

During the 10 years that followed the passage of the Federal-Aid Highway Act of 1962, which required transportation planning in urbanized areas of more than 50,000 population, tremendous activity occurred in the field of travel demand forecasting. This work, which typically focused on a 20- to 25-year forecast period, was successful in several ways.

1. It led to the development of transportation plans in the urbanized areas in the United States and in many cities throughout the world;
2. The model assisted engineers and designers in designing and locating the Interstate Highway System;
3. Because of their mathematical base, the models allowed different practitioners to obtain the same or similar answers by using the same parameters;
4. The modularity of the models allowed one model to be improved in structure, theory, or computer technology without interfering with the use of the other models;
5. The models can be understood and applied by the average practitioner (more than 1,300 people have been taught these procedures in the Federal Highway Administration's 2-week Urban Transportation Planning Course); and
6. The models successfully forecast travel.

With regard to the last point, a number of studies calibrated travel forecasting models based on data collected 8 to 10 years ago. These models were then applied to current socioeconomic data, and the resulting travel was assigned to current-year networks. In each test area, the assigned traffic volumes matched current ground counts about as well as the assigned base-year data matched ground counts 8 to 10 years ago, in spite of average travel increases of more than 50 percent.

The traffic forecasting models were successful in the 1960s, but will they be just as successful in the 1970s? The problems are not the same, and the urban planning process will have to change to reflect current needs.

In city centers planning will be concerned with distribution systems, peripheral parking concepts, traffic-free zones, bicycle and taxi modes, and movement of goods. In other portions of cities, planning will be concerned with public transportation and concepts to keep traffic off local streets and to reduce the impacts of traffic on resi-

dential areas. Noise and air pollution must be reduced, and mobility must be provided for the transportation disadvantaged.

In the suburbs, planning will focus on 3 areas.

1. Land use controls so that land use intensity levels do not overload the sewerage, school, transportation, or other public facility systems. The ability to expand highway capacity is becoming more limited and may soon require that development be limited to that which can be accommodated by the transportation system. In travel demand estimation, system capacity will be the starting point, and the amount of demographic activity and land use will be the output. In addition, the clients for these efforts should be those who control urban development and those who build and operate the transportation system.
2. The impact of transportation improvements on development. The amount and form of development and the resulting life-style will become paramount in future years in making transportation decisions. Current models have some capability of dealing with these issues through an iterative process, which is costly and time-consuming, and most of the new direct demand models cannot deal with them at all.
3. Short-range or program-oriented roadway and transit improvements for the proper expenditure of available funds. The need for work in this area will be accentuated by the changing nature of federal aid for urban transportation.

Current or developing models, because of their regional orientation and cumbersome, costly, and time-consuming operations, cannot be easily used for this type of planning. We need simpler, quicker, and more powerful models.

There are also other problems with these models. They do not easily respond to the increasing number of legislative requirements, such as those of the Clean Air Amendments of 1970 for implementation of air quality plans or development of strategies for conserving energy resources. Both of these involve controlling travel demand, yet what is the best course of action toward this end? Is the current state of the art in travel demand forecasting adequate for evaluating transportation options such as vehicle licensing schemes, automobile-free zones, parking constraints, car-pool locator systems, staggered 4-day workweeks, staggered work hours, no-build alternatives, demand-responsive and dual-mode transportation systems, other new transportation systems, parking pricing and other pricing policies, priority lanes, flow metering and other traffic control schemes, increased fuel costs and fuel shortages, para-transit options such as jitneys and bus pooling, free transit, and changes in service or marketing?

The capability to evaluate these options or even the more traditional ones such as adding additional highway capacity is not entirely adequate. Perhaps the most frequently asked question involving the decision to build major highways concerns the amount of additional travel the improvement will generate. Although all travel forecasting procedures produce travel demand that varies with system supply, they seem unable to respond directly to this issue. The question is complicated by the fact that the change in supply also results in a change in land use. What is needed is the ability to predict the 2-way equilibrium among level of service or supply, urban development, and travel demand and to express the result in a way that is meaningful to the decision-maker.

That there is a clear need to move ahead in the area of travel demand forecasting is, therefore, readily apparent. But in what direction should we head? The earlier Conference on Urban Travel Demand Forecasting (1) led to a broad definition of the needs. The purpose of this conference was to further refine those needs and to develop concise recommendations. That requires each one to put aside loyalties to particular approaches and to develop a consensus on a direction for both practice and research requirements. For while the profession debates, decisions are being made that need sound forecasts.

The other element of this conference was the value of travel time. A clear distinction needs to be made between the value of travel time as used in determining the relation between time and cost in predicting travel behavior and the value of travel time as used in evaluating alternative transportation options. Considerable work has been undertaken in recent years in the former area. The value placed on travel time is found to

vary with respect to factors such as income, trip purpose, segment of the trip (travel time spent in the vehicle and out of the vehicle), amount of time saved, and decision sequence (e.g., travel time for trip-destination decision is different from that for travel-mode choice). Although this work is important in the understanding of travel behavior, unfortunately the values are being used as the basis for evaluating alternative courses of action in the public sector. I believe that this is inappropriate in many instances and that the value of travel time should be a policy decision.

For example, assume that 2 transportation options are to be evaluated. One involves some form of high-speed transportation, and the other involves a demand-responsive urban transit system aimed at serving a poor area. The potential users of the first system value their time at $20 per hour, and those of the demand-responsive transit system value their time at only 50 cents per hour. An economic evaluation might justify the high-speed system but not the demand-responsive system. Should we, therefore, invest public tax money in the high-speed alternative and not in the transit option? I believe we should not.

The value of travel time used in investment analyses involving the expenditure of general tax revenues by the public sector should be a policy variable. In effect, the government says, public tax money will be invested in transportation improvements for which such expenditures are justified based on a value of travel time stated as a matter of public policy. If, in fact, segments of the population value time at a higher rate, 2 options appear to be open. First, the private sector might make the investment, recouping the invested resources through user charges. Second, the government might set up a mechanism through which the high-cost facility could be built and subsequently paid off by user revenues. In the latter case, the government would be justified in using the actual value of the potential user's travel time.

We must, therefore, make it clear that the appropriate value of travel time for use in public investment analysis should in some instances be a policy determination and point out that in analyses of the behavioral value of travel time the possible misuse of the product of the research has social implications.

Past efforts in travel demand forecasting were largely successful for the purposes for which they were intended, but the current transportation-related issues are far more complex and require a concerted effort on the part of the profession to meet the challenge.

We must make our work more understandable not only to decision-makers but also to practitioners who must apply the procedures. How many of these people understand the meaning of terminology such as multinomial logit, probit or discriminant analysis, behavioral, disaggregate, maximum likelihood method, stochastic, probabilistic, and utility maximization? The test of our effectiveness is how relevant our work is to solving the real-world problems they face.

REFERENCE

1. Urban Travel Demand Forecasting. HRB Spec. Rept. 143, 1973.