Workshop 4

SOCIAL, ECONOMIC, AND ENVIRONMENTAL IMPACTS OF TRANSPORTATION SYSTEMS

OBJECTIVES

Identify, review, and evaluate the important relations between the amounts and distribution of travel and the social, economic, and environmental impacts of transportation facilities and systems.

Recommend improvements in the linkages between travel demand forecasting procedures and procedures for estimating the social, economic, and environmental impacts of transportation facilities and systems.

Recommend improved procedures for impact forecasting.

Develop recommended program of research that will improve impact forecasting.

IMPACTS

Social, economic, and environmental impacts include consequences of the transportation options considered by Workshops 1, 2, and 3. Examples are changes in direct costs of transportation options, travel costs, transportation system performance measures, and neighborhood street safety; effects on air quality, noise, vibration, aesthetics, water quality and availability, spatial arrangement of activities, existing transportation operations, and tax base; disruption of community during construction and destruction of public facilities; relocation of families, businesses, and institutions; impedance or improvement of social linkages; and expansion of labor-sheds and market areas.

PARTICIPANTS

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Report

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Sections 1 and 2 of this report were prepared by subcommittees of Workshop 3 but were reviewed and agreed to by all workshop members. The requirements given in section 3 were agreed to by workshop members and presented during the conference but were prepared in final form by the chairman after the conference. Section 4 summarizes the research projects proposed by Workshop 4. It was prepared by the chairman and was not reviewed or approved by workshop members.

ISSUES

Rapidly changing societal priorities establish a need for the transportation planning process to consider a wider range of concerns. These changes also require flexibility in the specification of impacts to be forecast. Specifically needed are a wider range of travel system performance measures; capability to predict impacts of transportation decisions on land use and urban structure and on social groups and economic interests; and recognition that environmental impacts and mechanisms for the control of impacts can, in turn, bring about changes in travel demand patterns over time.

Although the impact-related issues that follow have relevance to the structuring of urban environments in general, the focus here is on those aspects related to the urban transportation planning process. Many of these issues are complex, interacting, and in some cases competing. Thus, a "new" planning process is required that addresses these issues in a systematic, organized manner, rather than in a series of unrelated responses to particular controversies.

Comprehensiveness

Measures of transportation system performance needed for use in program and project evaluation are (a) accessibility to opportunities, particularly for the aged, the young, the handicapped, and the unemployed; and (b) accessibility of unique trip generators such as airports, universities, major nodes of concentrated employment, and convention centers.

Any particular category of social, eco-

nomic, or environmental impact may have to be modeled by using different functional forms and different variables in order to allow different scales of analysis. For example, the evaluation of the air pollution consequences of a regional transportation network is quite different from the evaluation of the air pollution consequences of a particular link or interchange.

Current models assume that the major objective is to forecast demand for travel based on predicted levels of population and economic activity. An alternative is a goal-seeking or normative model that derives flows from equalization of accessibility to opportunities, for example. The principal concern in the development of goal-seeking models should be on the performance impacts of the transportation system as objectives, rather than on the second-order consequences as constraints.

We need the capability to disaggregate along at least 3 dimensions: (a) by particular socioeconomic and interest groups and by trip destination; (b) by time of day in order to measure impacts at critical time periods, such as peak-hour measurements of accessibility to work and nighttime hour measurements of noise impacts in residential areas; and (c) by vehicle types because different vehicle types have different impacts on the environment and because there are different control strategies for the impacts of various kinds of vehicles. In addition, there is a need to develop a capability to shift from one level of aggregation to another during the analysis and planning processes and a consistency should be built into the modeling process that allows such flexibility in disaggregation.

Both positive and negative impacts of the "null" alternative should be considered in the evaluation of the impacts of all available alternatives.

It is important to consider the time flow of impacts during the life of the programs and facilities. For example, when air pollution is considered, the time-dependent growth in travel should be considered in terms of interaction with the time-dependent streams of changes in exhaust control technology.

Basic research should be continued in human behavior and in the physical relations between transportation technology and environment. Although the required research will have to extend over a long time period, concern for answers to immediate problems should not eclipse the ultimate need for greater understanding of basic processes.

Timeliness

Simplified techniques are needed to produce rapid response with minimal resource commitments. Such techniques can at least point to directions of change or define ranges of impacts. The estimates may be more useful than detailed answers that arrive too late.

Credibility and Reliability

The assumptions that underlie the reduction of complex data sets to presentations of performance and impact measures must be made explicit to the user of the information. In addition, estimates of the reliability of the measures, and their sensitivity to assumptions, should be provided to decision-makers, citizen groups, and other users.

Performance and impact measures should be presented in such a way that the characteristics of the performance of the alternatives can be easily communicated to citizen groups and politicians. Charts, tables, and graphs are more useful than piles of computer printouts

IMPACTS

The social, economic, and environmental impacts listed below were identified by Workshop 4 as being those that the transportation planning community is being pressed to address.

1. Mobility and accessibility
   a. Mobility of special groups such as the aged, handicapped, young, poor, and unemployed
   b. Mobility of the population as a whole and by subgroups in terms of modal mix to destinations, level of services to destinations, travel cost and time, comfort and convenience, numbers of opportunities, and emergency response capability
   c. Accessibility of special generators such as concentrated job locations, commercial sales facilities, airports and other terminals, hospitals, schools, service centers, and recreation centers
   d. Geographic location possibilities of population groups, modal alternatives, and destination locations

2. Environmental impact
   a. Air pollution in terms of spatial considerations (regional, subregional, or local), dispersion and fallout, pollution components and form, proximate versus ultimate source, mode and submode, age and maintenance levels of vehicles, level of service, level of technology of emission control and new energy sources, effect on users and nonusers, toxic effects, and time of occurrence and duration
   b. Noise in terms of spatial considerations (regional or subregional facility), impact on adjacent land use, mode, users versus nonusers, health effects, and time of day
   c. Natural environment in terms of accessibility to natural areas and effects on natural systems
   d. Management of solid, fluid, particulate, and radioactive wastes

3. Energy and other resources
   a. Use of gas, electric, oil, coal, and nuclear energy relative to reserves
   b. Use of nonenergy resources such as land for transportation purposes

4. Aesthetics
   a. Obtrusive structures for light and visibility
   b. Provision of desirable land uses such as parks and playgrounds
   c. Provision of open space
   d. Removal of eye sores

5. Community effects
   a. Development opportunities for factories and businesses, commercial facilities, parks and recreation facilities, housing, and social linkages
   b. Community disruption such as housing and business displaced, community services separated from users, breaking of intracommunity social linkages, and separation of ethnic and cultural groups
   c. Increased accessibility to different activities and to different parts of the urban area
   d. Institutional effects including tax base and community organization

6. Safety and security
   a. Safety with respect to mode, facility mix within mode, facility age, specific accident prevention and care facilities, class of injury, and total injuries and injury rates
   b. Security by mode, incident type, and time of day

7. Transportation performance and economic efficiency
   a. Travel time and costs, system performance, and economic efficiency with respect to level of investment, modal mix, system components, system users and user groups, user time budgets, and psychological effects
   b. System-facility costs, benefits, and performance within modes with regard to system-facility mix, new investment mix, individual new investments, existing versus new facilities, investment versus no investment versus disinvestment, urban versus suburban investments, investments benefiting different population groups, service coordination (transit), urban-interurban connections, and efficient operation and management of systems
   c. Costs and benefits among modes with regard to automobile-transit trade-offs, urban-interurban trade-offs and interconnections, passenger-freight and freight-freight interconnections, and utility-transportation corridor interconnections

8. Urban structure
   a. Effect of transportation systems on land use in terms of distribution, mix, intensity, development patterns, and development rate
   b. Urban structure, economic efficiency, and performance with respect to CBD-urban sprawl, new towns in town or out of town, land use, urban size, modal mix and density, nonvehicular travel, urban development and redevelopment patterns, nonpassenger travel modes, use of urban land for transportation, level and distribution of travel demand, and nontransportation economy and intrastructure costs

Other transportation investment options that have social, environmental, and economic implications and that relate to (specialized modal) problems are freight terminal location distribution, integrated downtown passenger terminals, satellite airports and airport access, additional airports and their location, and distribution and location of general aviation airports.

REQUIREMENTS

For the 8 identified areas of social, economic, and environmental impacts, Workshop 4 agreed on the following requirements for travel demand forecasting.

1. Mobility and Accessibility

Major modeling efforts will be necessarily directed toward forecasting travel demand for population subgroups and special generators for special trip purposes. Prime requirements are in the areas of data and understanding of travel behavior.

2. Environmental Impact

The UTP package can be used to simulate regional air pollution and noise but less sophisticated tools can probably be just as effective at the regional level for lesser cost. Simulation of air pollution and noise gradients from local sources can probably best be based on link volumes. The actual modeling, however, will be not demand modeling, but activity modeling. The relation between travel demand forecasting and assessing impacts on the natural environment other than air and noise appears to be tenuous.

3. Energy and Other Resources

Basic necessary research in the area of energy use and reserves probably lies largely outside the field of travel demand forecasting, except in terms of using gross aggregates of regional and other travel.

4. Aesthetics

The relation between aesthetics and travel demand forecasting appears to be tenuous. The closest relation is in areas such as estimating the impact of banning automobiles for aesthetic reasons. Aesthetics is primarily a question related to design and community acceptance.

5. Community Effects

A use and a need exist for demand analysis in the area of community effects, particularly as it relates to imposed constraints. There is a need for micromodeling of community travel demand either within or independent of the regional UTP process (or both).

6. Safety and Security

There is a long history of incorporation of safety measures in the existing UTP process. This type of inclusion will remain important. More such measures are necessary, particularly in subregional analysis and in planning safety systems.

7. Transportation System Performance and Efficiency

Measures of performance and efficiency have historically been an integral part of the UTP process. Such measures need to be incorporated in all new models.

8. Urban Structure

One of the most important questions that travel demand forecasting must address is urban structure. Land use modeling needs to be incorporated into the existing UTP process and also to become a basic element of many UTP extensions. It is crucial to much modeling independent of the UTP process.

RESEARCH NEEDS

The general view that became stronger during the conference is that the existing UTP process is extremely important both in its original context of regional systems planning and in many of the new and broadened concerns that planners are now being asked to address. For example, it appears that the necessary measurements of air pollution levels are a logical and reasonable output of existing model packages with at most slight modification. Similarly, it appears that, regardless of the changing emphases from long- to short-run concerns, the need for overall systems simulation and planning will remain. Extensions of the existing package will certainly take place, but its basic form will remain durable and useful.

At the same time, however, a completely new set of models must be developed that are directed not toward total regional highway and transit systems planning but toward subregional, project, and other demand questions, mostly in the short-range and medium time frame. Because these subregional, short-range concerns cover a great variety of planning problems and questions, a correspondingly great number of models will need to be developed. It appears likely that in their development similar underlying themes of theory and structure will occur. Data requirements in each of the problem areas will frequently be different because the problems are different. Similarly, the actual models will differ from problem area to problem area.

In the context of subregional and problem analysis, it appears that some of the recent efforts to make regional network models more and more detailed are to a degree misdirected. The existing regional data—and any conceivable regional data—are simply not fine enough for networks with many thousands of nodes. Even if we could have sufficient detailed data, we could hardly understand or assimilate the model output (even if we could afford it). Even adequate "windowing" devices appear to have extremely great problems of data and outside network relations. Almost by definition regional modeling must be coarse modeling, and there appears to be little benefit to trying to make it otherwise.

Subregional and minor link problems themselves can easily and appropriately be addressed at suitable degrees of disaggregation. There is no need in most of the subregional questions to consider the region as a whole, and a complete regional simulation is unnecessary. Here, though, even the most basic models do not exist. They need to be developed.

The direction of certain criticism has been toward the development of various types of disaggregate models. The criticism has been made that disaggregated models have overly small relevance to the regional UTP package and, thus, have little reason for development. According to this argument, the only use for disaggregate models is to "tune" the UTP package and possibly to make it more realistic and responsive to policy concerns. Indeed, this is a major fruitful application for disaggregate techniques and results. Probably of more importance, though, is the use of disaggregate models outside of the regional context. It is in the context of subregional and project problems that disaggregate models have their most direct application. In these contexts the models are suited to the problems and they can be used easily and cheaply, if we bother to develop them.

A final conclusion has to do with the need for basic understanding of the travel phenomenon and of the interrelations between human and urban systems. In the past we have expended considerable energy in the analysis of basic theoretical relations among alternative model structures. It appears that this type of endeavor can probably be made far more relevant and productive if it is accompanied with a great deal of in-

vestigation of the underlying determinants of the travel phenomenon and of the actual relations between human and urban systems. The results of such combined theoretical and empirical analysis should have powerful impacts on the transportation planning process at all levels of generality and in all time frames.