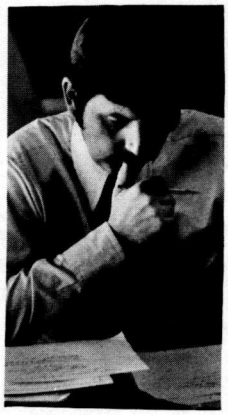

OBJECTIVES

To identify and evaluate current techniques being used to develop statewide multimodal transportation plans, priorities, and programs for both person and goods movement.

To recommend improvements in planning methodology including data and management elements necessary to ensure a continuous and viable process.

To develop a recommended program of research in statewide multimodal transportation planning methodology.

ISSUES

What are the essential data requirements for the preparation of comprehensive multimodal transportation plans, priorities, and programs for person travel?

What are the current techniques for collection of data on person travel within states? Are sources adequate?

What techniques are available to forecast statewide person travel by mode?

What techniques are currently available to develop and evaluate transportation plan alternatives? Can alternative systems be developed at the state level?

Are composite regional transportation plans building blocks for statewide plans?

What special studies and analyses are required to develop plans for the various modes?

How do procedures and methodology for analysis, forecasting, evaluation, and plan preparation differ for various modes?

What techniques are currently being used to evaluate social, environmental, and economic impacts? Are they adequate?

What procedures and techniques are available to respond to new and emerging issues such as energy?

What techniques are used to reevaluate plans, priorities, and programs on a continuing basis?

What techniques are used to provide opportunities for input to the transportation planning process by citizens, elected officials, interest groups, and others?

What techniques are used to integrate and coordinate transportation planning with land use and other functional planning activities?

Are the data collection and analytical techniques developed for urban transportation planning appropriate for statewide planning purposes? Can statewide planning techniques be used for urban transportation planning?

What techniques are used to establish prorities both within modes and between modes?

What techniques are used to develop programs for high-capital and low-capital programs?

WORKSHOP 3A: SYSTEMS PLANNING AND PROGRAMMING METHODOLOGY—PASSENGER TRAVEL

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Report

Thomas F. Humphrey, Massachusetts Department of Public Works, chairman

This report contains the summary of findings of Workshop 3A and the reports of the 3 groups into which the workshop was divided. The first group addressed the issues involved in, and reasons for, statewide planning and programming: Why do we need statewide planning and programming, and what does it involve? The second group focused on the available methodologies that are useful for statewide systems planning and programming and the desirable characteristics of those methodologies. Out of these

initial discussions came a strong consensus on the research needs for the methodological improvements required to improve the effectiveness of systems planning and programming and 3 high-priority areas where research is required. This was the task of the third group.

SUMMARY OF FINDINGS

Existing Methodology

Methodologies available and necessary for statewide systems planning and programming are grouped into 5 broad categories:

1. Travel demand, simulation, and impact prediction;
2. Econometric, land use, activity allocation, and simulation;
3. Resource allocation, fiscal policy, and programming;
4. Comparison and evaluation; and
5. Surveillance (data collection and monitoring).

Within each category, the techniques available to statewide planning vary widely as to cost, accuracy, and current degree of development. In addition to the traditional approaches or models for system planning that fall in each of these categories, methodologies are required at the policy level in order to test a broad range of statewide policies and their implications on issues such as energy shortages and environmental concerns.

The most important question addressed by Workshop 3A participants focused on the appropriateness of existing methodology (both urban and regional) for statewide systems planning and programming. An overwhelming consensus was that the value of the available methodologies, especially those developed during the 1950s and 1960s during urban transportation studies and generally referred to as the Urban Transportation Planning Process, is seriously doubted unless some significant changes and adaptations occur in these methods. An even stronger consensus, however, was that the scope of the traditional modeling techniques in their present form is limited; i.e., there has been a significant overemphasis to date on traffic and network simulation procedures by statewide planners (although this is changing rapidly in some states).

Transportation planning has had to broaden its scope and objectives in the past few years in response to changes in technology, changes in institutional structure, and changes in attitudes and values. It is now, more than ever, a multimodal process; it must recognize short-run, low-capital options as well as the more traditional capital-intensive fixed investments; it must also address uncertainties in funding sources and constraints; and it must involve the public at all levels of decision-making. In fact, the group concluded that transportation planning has become so much more complex and encompassing in the recent past that a fresh look must be taken at the requirements of methodologies for accomplishing statewide planning. Clearly, the process must become much more flexible than the urban procedures now are and be much broader than a set of techniques to produce traffic volumes and turning movements for project location staff and designers. It is, therefore, imperative for statewide systems planning to go beyond the traditional approaches and explore and develop new techniques for predicting a wide range of impacts, including environmental, social, and economic impacts; evaluating trade-offs among modes and multilevel objectives; programming and fiscal planning that can respond to uncertainties; and recognizing a variety of political and institutional constraints. These new techniques should augment and, in some cases, supplant the more traditional network simulation and traffic models.

Policy Analysis Tools

A second major finding of the workshop was that the present system of models, even given the adaptations and extensions required for addressing the statewide problems that are described in the resource paper, is overly cumbersome and far too expensive to be used to address the wide range of policy questions now facing states. Existing network simulation and related techniques do have a role in statewide and regional planning; however, there is an immediate need for a set of techniques to be used by statewide system planners as policy-sensitive analysis tools, similar to simple sketch-planning tools now being developed at the urban level.

These policy-sensitive models are analytical procedures that would be useful to address a broad range of policy-oriented questions such as pricing schemes, subsidies, equity issues, alternative allocation formulas, and modal trade-offs, but are not necessarily so elaborate as the network simulation models. These models would be used to support positions on state policy and provide preliminary results prior to more detailed and comprehensive analysis. These methods must be policy-responsive, they must have fast turn-around time, and they must be inexpensive to run if a large number of policies are to be tested. Existing network simulation and related techniques are too cumbersome and expensive to operate in exploring the large number of options currently facing states. A number of these policy-level techniques have been developed at the urban and national levels in a specific problem context. Some of these can be adapted for statewide planning, but research is needed into the exact structure and nature of a number of new procedures required for addressing problems such as energy, environmental, and subsidy issues now facing states.

Interface Between Statewide Planning and Programming

A third major finding of the workshop concerned the current lack of effective ties between planning and programming. That lack has hampered decision-making at the urban area level and will most certainly continue if unchanged at the state level. Currently, system planning has very little impact on what actually gets programmed in a state. Program decisions are driven more by funding sources and constraints (total budget, area minimums, functional classification minimums) and what can get built than by what is desirable from economic, community, and social-value points of view. One way to improve the process is, first, to begin to develop system plans as time-staged investment sequences in which long-range system plans are related to short-term programs and, second, to recognize budget constraints and uncertainty explicitly and early in the process. In addition, the plans and program packages must be multimodal, and they must include long-run capital improvements as well as shorter run low-capital options such as pricing and operating policies for rail and transit. Research is needed on the structure of the process required to improve this interface, including information flows and institutional structure and responsibility, as well as on the technical and nontechnical criteria that reflect the economic, social, and community values in determining priorities for investment. Immediate research should be undertaken to determine the nature and role of "needs" studies in a multimodal environment: How can functional classification and needs studies (and should they) be expanded to include multiple modes and to address economic, social, environmental, and travel needs in a positive way? There was also serious concern expressed for a general lack of evaluation tools and techniques for making comparisons and trade-offs between and among modes at the corridor, regional, and state levels.

Incremental and Immediate Improvements

The workshop generally concluded that there are a great many immediate improvements that can be made to incrementally adapt and adjust existing methods so that states can immediately address a number of the more pressing issues. Some of these adaptations

will produce techniques that can be used as policy-sensitive analysis tools described in the earlier section and as behavioral models for the traditional network simulation techniques. These improvements include adapting stochastic disaggregate demand models to statewide travel, incorporating on-the-shelf existing environmental air-quality models and multimodal models, and using existing evidence on the elasticity and cross elasticities of travel patterns for alternative modes from a number of sources. These are summarized in more detail in the resource paper and the summary discussions to follow.

System simulation models themselves must become much more flexible in nature and be able to aggregate or disaggregate networks easily and effectively because of the immense cost involved in running these models. The workshop recognized that the appropriateness of this methodology for particular states obviously depends on the nature of that state and the kinds of problems it must address. Clearly, there is a need for the network simulation methodology to be able to address the complex network interdependencies that exist. The workshop felt that network simulation methodology is useful at the corridor, subregional, and regional levels for predicting travel flows, but there was concern over the usefulness of these techniques at the statewide level. It was recommended that research be undertaken to evaluate the effectiveness of network simulation techniques at the statewide level and to determine the appropriate area and zone size, time frame, and accuracy of these procedures required. It was also recommended that this should be strongly related to the freight-flow prediction problem.

Dissemination of Information on Statewide Methodology and Process

The workshop concluded that there is a pressing need for continued dissemination of information by and for states on available methodologies, including their costs, accuracy, biases, data requirements, and problem context. A considerable number of techniques now available in some states could be transferred to others very readily. Similarly, a number of policy-oriented models available in urban areas and in other related transportation areas, such as port and airport planning, could be effectively utilized by state agencies.

In addition to a better dissemination of information on existing techniques and procedures, there is a need for a number of tutorial manuals on ways of applying these techniques. It was suggested that these not be manuals in the sense of a rote, mechanistic set of rules to follow in the application of a technique. Rather they should be designed in a tutorial sense as a flexible and educational set of case studies that allow each state the ability to adapt and adjust these procedures to its own specific problems and requirements.

NEED FOR STATEWIDE PLANNING AND PROGRAMMING

Changing values in society concerning the environment, energy, and even life-style raise serious questions about the traditional approaches to transportation planning. Questions were raised early in the discussions by some members of Workshop 3A as to whether the problems of transportation were becoming so broad, the events of the future were becoming so uncertain, and planning is being attempted at the lowest possible local level that statewide planning is not necessarily so important as it was a few years ago. One or two people even questioned whether it was needed at all. The consensus of the group however was that, more than ever, it is an essential part of a state agency's responsibility for the reasons described below.

Why Statewide Systems Planning and Programming Are Required

There are 3 basic reasons why methodologies are required to support systems planning and programming at the state level.

1. To provide the information needed to formulate regional and state policy in those areas that either are currently the responsibility of state transportation agencies or at least should be in the future. There are 5 broad areas: (a) to determine the level of funding for transportation and the trade-offs between transportation programs and nontransportation programs such as health, education, recreation, and water resource programs at the federal, state and local levels; (b) to help direct state policy toward issues such as land use development policy, recreational development opportunities and objectives of the state, interagency cooperation with regional and local interests, and water and natural resource conservation; (c) to interface effectively transport investment decisions with regulatory decisions by the transportation regulatory agencies on issues such as price regulation and entry and exit to markets; (d) to effectively integrate public policy decisions with decisions being made in the private sectors on locational choices, development schemes, and economic growth; and (e) to effectively integrate decisions affecting the movement of both freight and passengers.
2. To define and effectively allocate resources among and within the various transport modes. Statewide planning is required to predict funding sources, whether federal, state, or local; the degree of uncertainty about those sources; and mechanisms for transferring or generating additional funds and identifying modal budget constraints and area minimums. It is also required to effectively settle priorities for investment programs and determine the appropriate modal trade-offs of alternative programs.
3. To ensure equity in providing transportation services throughout the state. This involves making service-level trade-offs for geographical areas, e.g., rural versus urban, and interpersonal trade-offs for users and nonusers of the transportation system, including the poor, the aged, the handicapped, and those with less than average mobility.

Structure and Content of Statewide Transportation Planning

The group agreed that statewide transportation planning (STP) involves more than the traditional approaches to urban area planning and existing approaches of states to statewide planning. It should involve more than merely the modeling methodologies of network simulation procedures and urban transportation planning (UTP) techniques. To support the 3 functions of a state organization described in the previous section, statewide system planning should consist of a set of techniques that can both predict and evaluate a wide range of transportation and transportation-related impacts, including social, environmental, economic, and general land use impacts.

In addition, the prediction techniques must be capable of capturing intertemporal effects, i.e., predicting impacts recursively over multiple time periods if an effective interface is going to occur between planning and programming. Very little research on these techniques either has been undertaken or is directly applicable to the statewide problem.

The second conclusion of the group concerning the structure and content of statewide planning and programming is that the models and methodology developed should be flexibly structured as a hierarchical set of tools to address the 3 functions of level of funding, allocation of funds, and equity.

Although members of the group agreed on the need for network simulation and related techniques for resolving issues at the state, regional, and corridor levels (although some people had difficulty justifying the use of these techniques at the state level without major changes in the way they now operate and in their cost of operation), they suggested that these tools should be much more flexible in their operation and able to operate at many different levels of analysis (regional, corridor, subregional) without significant additional data collection efforts and recoding of network structure.

In addition to flexible network simulation techniques, a set of policy analysis tools is needed that operates on a much simpler conceptual level than the network simulation and related methodology. These analysis procedures must be behavioral, yet be simple to understand, relatively inexpensive to operate, and capable of discrimination among alternative policies. Therefore, they cannot be so elaborate as the network

simulation methodology. These techniques could be used both as an aid to determining state policy on transportation and transportation-related issues and as preliminary sketch-planning tools for exploring a wide variety of specific network and technology-related issues.

Obviously, the distinction between the hierarchical structure of policy analysis tools and network-related simulation models becomes blurry when one begins to use network simulation techniques as aggregate, sketch-planning tools. Both are needed, however, to investigate the implications of new technology, such as demand-responsive buses, personal rapid transit, and dual mode, as well as more conventional alternatives, such as rail and air passenger services. In some of these cases, network structure and network interdependencies will be important. In other cases, for example, state policy toward rail or transit subsidies, these factors will be unimportant or of secondary importance to the overall impact on state objectives and policy to achieve those objectives. Only through considerable research effort on both policy analysis tools and network simulation methodology will the differences, similarities, and overlap become apparent.

Sketch-planning tools that have some of these features are now under development for urban area problems. Research should be carried out on the requirements for statewide planning methodology to determine whether the current developments in the methods of sketch planning for urban areas can be transferred to the statewide problems and, if not, to determine what the structure and content of a methodology of statewide travel should be.

A third point on the structure and content of statewide planning and programming is that it is also more than a methodology or set of techniques for predicting and evaluating impacts. The methodology must recognize the institutional and organizational context within which the methodology will be utilized. The organization and use of technical planning activities and information should reflect the requirements of the implementation and decision-making process. For example, technical tools, the impacts predicted with these tools, and the priorities that are set must be integrated with the political planning process associated with local, regional, and statewide interests. The methodology must recognize the cyclical and iterative nature of the process as well as the diverse set of evaluation criteria imposed on it. In other words, the methodology cannot be simply a technique; it must not be divorced from the process within which it will be used. The methodology is, in fact, the technique and the process (or context) within which it will be used.

The final issue discussed by the group dealt with the concept that statewide planning and programming should be a process that is anticipatory rather than reactive in nature. That is, it should be a process that attempts to anticipate future actions, potential policies, and the state's posture toward these policies rather than be a process that simply reacts to current short-run problems and crisis. It is first and most important a process that must provide a definition to transportation needs, clarify problems and issues, and give assistance in predicting the impacts of alternative policies.

Most participants agreed that the whole issue of "needs" studies, including the definition and use of a needs methodology, requires basic research, which should be undertaken to determine its appropriateness for statewide planning studies. The group was unanimous in its opinion that any needs methodology certainly should be broadened from the current narrow definition of highway needs, which focus on a specified level of service that must be achieved for a particular functional class of highway. Because there are scarce economic resources that exist in all sectors of the economy, it makes no sense to determine a need without evaluating alternatives that must be foregone in order to satisfy those needs. Needs studies, therefore, should also be broadened to recognize that investment decisions should be based on community and environmental objectives, on alternatives both within and among modes, and on realistic budget constraints.

Summarizing these points, the group felt that the statewide planning and programming process should embody the following characteristics:

1. The actions in statewide planning must involve alternative time-phased courses

of action and include short-run as well as long-run options;

2. The process should evaluate alternative strategies and provide state policy planners with statements of the impacts of policy on goals and objectives for different state programs (in fact, the primary purpose of the process is to evaluate the impacts of specific policies, such as subsidies and investments, which are intended to achieve certain broad statewide objectives);
3. The process should provide the information necessary to establish priorities and recommend transportation programs;
4. It should provide a mechanism for monitoring system performance over time and for suggesting changes in policies; and
5. It should provide the interface for planning among different agencies, including the relations between federal, state, regional, and urban planning activities.

METHODOLOGIES

Some time was spent evaluating the existing methodologies by discussing the desirable and undesirable features of each approach. Out of this discussion came agreement and some general conclusions on existing methodologies, a taxonomy of required methodologies, and a list of criteria or desirable characteristics that a methodology must inherently possess if it is to be credible and effective.

Existing Methodologies

The following general conclusions were formed with regard to existing methodologies:

1. The procedure and methodology developed and applied for the UTP process is not necessarily adequate or acceptable for application at the statewide level (in fact, given the present state of the art, caution must be used in considering the use of the UTP models at all on the statewide level unless major modifications to the models are undertaken as outlined in the resource paper);
2. The geographic and time scales that are addressed as part of the STP process are so diverse that a variety of methodologies that are tailored to best fit the scale of the problem being addressed should be developed;
3. The methodology for STP must be oriented to address the questions of the economic and land use impacts of transportation alternatives as well as the more traditional user-oriented impacts;
4. Methodology is needed for integrating the private transportation sector into public planning and evaluation methodology, and procedures are needed that will evaluate regulatory, operational, and low- and non-capital alternatives as complements to or substitutes for capital investments; and
5. Existing methodology does not adequately integrate transportation planning options with comprehensive planning and policy options.

Out of these general findings on the failure of existing techniques and procedures as applied to statewide planning and the need for other methodologies over and above the network simulation procedures came the consensus that there is a need for 5 basic methodologies for statewide planning:

1. Travel demand, simulation, and impact prediction;
2. Econometric, land use, activity allocation, and simulation;
3. Resource allocation, fiscal policy, and programming;
4. Comparison and evaluation; and
5. Surveillance (data collection and monitoring).

The resource paper and the following sections summarize the research needs for each of these methodologies.

Desirable Characteristics

For the 5 broad methodological areas, it was concluded that each should have the following characteristics:

1. It must be policy sensitive and capable of evaluating alternative policies in combination with transportation system components of physical networks, vehicles, and operating policies;
2. The cost (manpower and money) to apply the methodology and the time needed for application must be compatible with the time and funds available to solve a particular problem;
3. It must be capable of providing information for multiple time horizons, i.e., short-term and long-term periods;
4. It must produce credible results for professionals, politicians, and citizens and at appropriate levels of detail for state, regional, and corridor levels;
5. It must be flexible enought to predict the impact of alternatives for changing conditions, for example, the fuel shortage, as well as for multiple objectives and interest groups;
6. It must have the ability to consider uncertainty, i.e., the probabilities of events that may or may not occur, and the impact of that uncertainty on the transportation decisions;
7. It must provide the appropriate linkages among systems planning, priority identification, and programming and recognize the institutional and organizational constraints on the process; and
8. It must be able to identify intermodal, geographic, and equity relations implicit in alternate programming decisions.

RESEARCH NEEDS FOR IMPROVING METHODOLOGY

For each methodology, a set of high-priority research needs that were felt to be essential for a statewide planning and programming process was developed for both the short and long run.

Travel Demand, Simulation, and Impact-Prediction Methodology

Short Run

1. Study of the incremental adjustments required of existing demand models, designed to achieve internal consistency and models that are more behavioral and policy sensitive.
2. Study of the impact-prediction techniques related to travel, designed as a study and selection of models and tools for the prediction of environmental and community-related impacts that provide a level of results consistent with level of input efforts.
3. Prototype study of on-the-shelf multimodal network analysis models for statewide application (or regional application as input to the statewide process), designed to test the feasibility of applying existing multimodal models.
4. Development of specialized models for single-purpose modes and for modal interface problems, such as air travel, major terminal submodal split, port models, and rail travel, designed to survey existing methodologies and adapt or develop models for specialized problems.
5. Development of stochastic disaggregate behavioral demand models for a single statewide travel purpose, such as recreation, designed to test the feasibility, costs, and transferability of results of stochastic disaggregate approaches for the statewide problems.
6. Evaluation of the UTP methodology and its applicability to statewide planning, designed to explore the feasibility of application of the UTP procedure, changes re-

quired, and most desirable mode of operation.

7. Comparison of statewide multimodal demand model approaches such as UTP, direct, and stochastic disaggregate, designed to produce a statewide travel demand model (or models) that is policy-responsive and useful for a network simulation procedure and as a policy analysis tool.

8. Techniques to evaluate travel behavior impacts of operational and policy changes, low-capital investments, and pricing policies, designed to provide immediate tools useful for evaluating short-run changes.

Long Run

1. Technical consistency between travel demand models and land use-econometric models, designed to study the interface between the travel demand methodology and long-run land use and econometric models.

2. Behavioral aspects of demand, designed to determine behavioral variables of importance for statewide travel for various trip purposes.

Econometric, Land Use, Activity Allocation, and Simulation Methodology

Short Run

1. Methods of forecasting and distributing economic growth, designed to survey methods available for forecasting and distributing economic growth, including a comparison of costs, accuracy, inputs required, and interface with travel demand models, and to emphasize procedures to be used at the state, regional, and corridor levels.

2. Relations between accessibility and regional population growth, designed to define accessibility for different socioeconomic groups and its relation to population growth.

3. Factors affecting industrial location choices, designed to study behavioral factors affecting industrial location choices and their relation to transportation decisions.

4. Survey and comparison of existing land use models and their application at the statewide level, designed to survey existing methods (EMPIRIC, PLUM, NBER), to carry out a comparative analysis to determine the appropriateness of each model for state, regional, and local applications, and to emphasize the behavioral nature of the models and its interface with transport decisions.

5. Survey of economic and employment impact-prediction techniques, designed to survey the field for economic and employment impact-prediction techniques, evaluating alternative techniques, their cost to construct and run, accuracy, biases, limitations; and to determine which impact-prediction techniques are available and useful for statewide planning and programming, what their deficiencies are, and what research is required to develop these techniques; and to emphasize the comparison of different levels of existing models, their requirements and accuracy (for example, economic activity models should include economic base, input-output models, highway usage indicators, econometric models, and business displacement studies).

Long Run

1. Development of statewide economic input-output model, designed to predict economic growth and relation of critical industries to transport sector and intended to interface with transport simulation model.

2. Development of simplified econometric model for determining effective investment levels, designed to develop a simpler model than the input-output model to be used at policy analysis level.

3. Development of behavioral, land use model, based on research in the short run on existing techniques and their deficiencies, designed to develop a reasonable model

for predicting land use changes over time and their interaction with the transport sector and for recognizing the scale (corridor, region, state) at which it is appropriate and the cost of collecting data and running it.

Resource Allocation, Fiscal Policy, and Programming Methodology

Short Run

1. Revenue projection techniques.
2. Analysis of modal operating subsidies.
3. Allocation of transportation funds by mode, by geographical area, by level of government, by capital costs versus operations and maintenance costs, and by regional "tranline" facilities versus local service facilities (functional classification).
4. Interface between system planning and programming.
5. Priority-setting process and procedures.

Long Run

1. Equity considerations, assignment of costs and benefits, transportation for disadvantaged, tax policy implications.
2. Tools to evaluate private sector changes, regulatory effects, pricing mechanisms.
3. Techniques for determining impacts of resource allocation to transportation and to other sectors.
4. Techniques for handling uncertainty in resource allocation.

Comparison and Evaluation Methodology

Short Run

1. Techniques for comparing and evaluating multimodal systems.
2. Cost-effectiveness techniques for capital versus operating decisions, project scale trade-offs, low-capital projects.
3. Investigation of concept of functional classification and levels of service for other modes.
4. Development of revised needs criteria for relative comparisons of multimodal systems.
5. Development of standardized criteria for economic analysis.
6. Techniques for making systematic trade-offs among impacts.

Long Run

Techniques for handling uncertainty and risk in evaluation.

Surveillance Methodology

Short Run

1. Collection of data on intercity bus passenger travel.
2. Collection of freight origin-destination data on shipper-receiver sources and on carrier sources.

3. Vehicle-counting techniques (including vehicle occupancy).
4. Transit-usage counting or monitoring techniques.
5. Collection procedures for air origin-destination data.
6. Collection procedures for rail origin-destination data.
7. Study on the continuing data collection process.

Long Run

1. Environmental monitoring.
2. Travel behavior monitoring, including origin-destination updates, trip generation changes, trip purpose splits, modal choice, and peaking characteristics.
3. Monitoring of relation changes between urban development and transportation policies.
4. Traffic and physical system inventory by satellite.

Resource Paper

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The movement of goods and the provision of services by the transportation sector typically account for approximately 20 percent of the gross national product of this country each year. Problems in the transportation sector, such as a lack of facilities (for example, railroad cars) or of power (for example, crude oil and gasoline), will usually have serious repercussions throughout the economy. In the case of a lack of rail cars, the effect is relatively localized and the impact is limited to a small part of the economy; there is enough flexibility in the total transportation infrastructure to permit shifts to occur. The consequences of such facility shortages may be a difference of only a few cents in the cost of some goods. In the case of a lack of basic energy to drive the transport sector, it is clear that we are only just beginning to realize the implications for the economy and our way of life.

Partially in recognition of transport's importance to the economy and the interdependence of the modes of transport, modal agencies in many states have begun to shift to departments of transportation charged with a responsibility to plan for the total transport needs of the state. (By August 1973, 20 states had created departments of transportation, and 12 others were studying legislation to enhance the state's role in multimodal transportation.) Other factors have prompted this shift in responsibility and structure as well: changes in the values of the users of transport services and recognition that, although highways can provide extremely good service for most travelers, they can seriously disrupt urban areas and impose social costs that may well outweigh the benefits. Many states are, in fact, having considerable difficulty constructing any new highways, both in urban and rural areas, primarily because of environmental and social concerns. These problems will most certainly be compounded by fuel shortages.

Because of all these factors as well as the problems and the recent changes in institutional structure and funding, state transportation agencies must now consider a whole new set of options in maintaining and improving transportation services. The Environmental Protection Agency has proposed an impressive list of options as alternative ways to meet environmental standards in urban areas (3). These options range all the way from improved traffic flow programs through pricing and regulation to a restructuring of public transit services. Although not designed as such, they may turn out to be viable alternatives for easing the current energy crisis as well. Those options, listed below, are arranged in 3 groups according to the primary purpose intended to be achieved.