STATE TRANSPORTATION ISSUES AND ACTIONS

SPECIAL REPORT 189

Transportation Research Board
Commission on Sociotechnical Systems
National Research Council

NATIONAL ACADEMY OF SCIENCES
WASHINGTON, D.C.

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Proceedings of a Conference on Statewide Transportation Planning and Programming
conducted by the Transportation Research Board
and sponsored by the U.S. Department of Transportation and Its Modal Administrations

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Preface

The second Conference on Statewide Transportation Planning and Programming, conducted by the Transportation Research Board at the request of the U.S. Department of Transportation and its modal administrations, sought to do the following:

1. Identify the challenges that will be faced by the states, now and in the next 20 years, particularly in the areas of the economy, energy, urban policy, and changes in transportation systems;
2. Report on the best available planning techniques and on research for new ones;
3. Recommend the optimum role for state departments of transportation in multimodal statewide transportation planning;
4. Identify techniques for optimum programming of scarce state resources, for example, between modes and categorical programs;
5. Discuss the proper content of a state transportation plan; and
6. Discuss ways of increasing the effectiveness of state departments of transportation in implementing state transportation plans.

The conference, held April 29-May 2, 1979, in Warrenton, Virginia, attracted more than 100 participants, representing various local, state, and federal governments, associations, consulting firms, and universities.

This report contains the proceedings of the conference. Part 1 summarizes the meeting's highlights. Recommendations by participants are noted in Part 2. Part 3 contains the resource papers prepared for conference participants, along with reports of other presentations made during the meeting. Part 4 summarizes the workshop discussions on the various aspects of implementing statewide transportation plans and on the key elements of such plans. The participants and their affiliations are listed in Part 5.

Part One

Highlights and Summary

Issues and Actions Affecting State Transportation Plans and Programs

Change—unrelenting, sometimes abrupt, more often incremental in its impact on state transportation systems—is the single, most plaguing problem to have faced state departments of transportation since the 1950s. One of the most dramatic examples of such change in early 1979 was the announcement by the Organization of Petroleum Exporting Countries (OPEC) of oil price increases. These increases were, and still are, likely to result in reduced automobile travel, reduced gasoline tax receipts, higher truck freight costs, and possible economic recession.

Equally significant, however, is the effect of higher energy costs as they are superimposed on other problems, for example, deregulation of aviation, prospective deregulation of trucking and rail, possible deregulation and financial problems of the intercity bus industry, large operating deficits of the National Railroad Passenger Corporation (Amtrak), and declining state gasoline tax receipts. Underlying these problems, are others, particularly the sluggishness of both public and private institutions, management, and labor to respond to the needs of the times and the opportunities presented by new technology.

The essence of the 1979 conference on statewide transportation planning—what it should mean to the executives of the state departments of transportation and to their professional planning staffs—has to do with how to deal with change, not only in the highway and transit fields, but also as it occurs in other public and private modes. This is not a trivial problem; transportation finds itself today at the focal point of many problems in the nation's life, not only because of transportation's enormous use of energy, but also because it is one type of linkage between all economic and social activities.

Responses to Change

In the 1960s, when some of the problems cited here began to loom larger than others, the common complaint was that the nation and the states had an inadequate, though unified, transportation policy to deal with multiple systems for moving people and goods. The first response had to be an organizational one, that is, to create departments of transportation for developing and implementing a unified policy. In 1967, three states had established departments of transportation and the U.S. Department of Transportation (DOT) was created. The number of state agencies rose to 23 by 1974 and to 40 by 1979.

Until 1974 and the statewide transportation planning conference held that year in Williamsburg, Virginia, and conducted by the Transportation Research Board, the focus of efforts was on developing a comprehensive and consistent philosophy for dealing with the state transportation problems of both public and private systems. Many sound ideas were advanced at the Williamsburg meeting, and important research needs were identified. However, there was still very little experience to draw upon; and, if there is any fault to be found with the plans discussed there, it was in the emphasis given to an overly complex approach to problem solving—an approach that kept the transportation analyst separated from the executive.

In the five years since the conference in Williamsburg, a great surge of new accomplishments was registered by state departments of transportation. Given the pressure of events, states have developed and implemented plans in the areas of rail and aviation, have prepared unified transit programs, have examined environmental and land use aspects of alternative transportation policies, and have continued to improve their highway and corridor planning skills. Capital programs are widely published. Most important is the fact that these programs have been worked out in an atmosphere of action and implementation.

As for today, if a single message is to be found in the problems, issues, and ideas that were examined at the 1979 transportation planning conference, it would have two elements. First, change will continue as the dominant problem. The demand for the movement of people and goods will continue to increase. Departments of transportation are the agencies to which state governments should look for policy leadership and for a unified and consistent transportation implementation program. If transportation department executives are to cope with changing transportation circumstances, they must demand closer relations with their professional transportation planning staffs. They must use their planning staffs to warn them of impending change, to consider the effects of alternative responses, to analyze current policies, and to program implementing actions within available financial resources. Second, management and planning, under the force of current pressures, have mutual short-range and long-range interests. The transportation department executive can no longer ignore those strategic forces that keep infiltrating from outside spheres to impact state systems. The department executive and the planning staff, in turn, must work with

the legislature because that group is so important in determining financial policy.

The 1979 conference offered some practical solutions to the problems prompted by change. New problems can be anticipated (to a large extent) and successfully attacked if state departments of transportation establish certain programs and carry them out in a thorough and professional manner. A few of these are new programs, but most are well known. Together they constitute an effective approach—elements of which are briefly noted below:

1. Early warning. Staff time should be set aside each year to anticipate problems—physical, financial, energy, settlement, and so forth. This requires a variety of types of information, and a regular report should be issued to the department executive.
2. Surveillance for management. Measures of how well the state's transportation systems, both public and private, are actually working need to be communicated to management each year. Is the public being well served? Are services and physical facilities improving or deteriorating?
3. Programming. More and more states are using programming and budgeting systems for scheduling and implementing projects and new services. Such systems incorporate local ideas as well as statewide views. Programming needs to be supported by a critical analysis of the effectiveness of investment and by long-range fiscal-resource estimation.
4. Communication. The complexities of multimodal transportation at the state level require not only increased, but also more efficient, communication among all involved parties. This implies good organization and an increased level of understanding of transportation by both policymakers and staff.
5. Short-range and long-range perspectives. Professional staffs must have an increased ability to provide quick analysis of short-range problems to respond to the needs of executives. These responses, however, must be supported by policies, estimates, and system plans that establish a framework for short-range decision making and that permit the long-range consequences of short-range decisions to be estimated more accurately. Dealing with short-range problems requires a good understanding by staff professionals of the workings of private transportation systems.

The sum of this program is the deployment of analytical skill to aid the executive and to encourage the communication that leads to implementation. This emphasis is a natural consequence of a period in which management of existing systems, rather than construction, is of paramount importance.

If state departments of transportation adopt a program, like that described here, they will need to make additional efforts and to receive additional support from DOT. The key changes to be concerned about include the following:

1. National policy. Many state transportation problems are strongly influenced by external national decisions, for example, on deregulation, Amtrak, rail freight systems, and energy. There needs to be an early transmission of federal policies and their expected impacts to the states, but more important than this is the need to have federal programs that complement each other. Unity of national transportation policy still has not been achieved, and it must be.
2. Training and education. State departments of transportation must venture into new fields, such as regulation, and must understand the workings of private transportation systems. Training and educational materials, including planning manuals, should be provided to transportation department staffs and to policymakers interested in better decision making.
3. More professionals. State transportation departments should add professionals to support their executives in the programs described in this report. Skills in economics (for the early warning function), in communication (but by a transportation professional), and in programming are particularly needed.
4. Unified planning fund. The new program needs outlined in this report would suffer under categorical (modal) planning funding. Greater flexibility is needed, and a unified planning fund is recommended.
5. Critical review of governmental structure for decision making. The complex decision-making processes that are required to deal successfully with change indicate that decision-making processes need to be reviewed carefully in order to increase their effectiveness.

The External Challenge

Prior to the 1979 meeting, the Steering Committee for the Conference on Statewide Transportation Planning and Programming had recognized that, in contrast to that relatively stable period when state government needed to focus only on its own highway system, the situation now exists where a wide variety of forces outside of the control of state government affect, and will continue to affect, state transportation systems. Among these forces are (a) population distribution and economic growth, (b) world energy supplies and prices, (c) national policies establishing transportation systems (e.g., Amtrak), (d) national changes in regulation, and (e) decisions of major transportation firms, such as railroads and airlines, whose systems span several states.

In this new situation, it becomes necessary for state governments to understand the operations of these larger systems on a continuing basis so that they may protect their own internal economies and transportation operations. The most vivid example of this need to look beyond state borders is in the field of energy contingency planning, but there are many other areas of need for external alertness—railroad corporate consolidations, transportation of energy, and rail, air, and bus passenger service systems.

In light of these concerns, the committee commissioned four authors to prepare papers that would specifically advise the conference on what to expect (insofar as this could be foreseen) from the national perspective in the areas of freight systems, passenger transportation, energy futures and costs, and regulation and deregulation. The texts of these papers are included in Part 3 of this report, and are briefly summarized here.

Structure of the Nation's Future Freight System

Paul O. Roberts, a professor at the Massachusetts Institute of Technology, Cambridge, argues that the U.S. freight transportation system is a product of three basic forces: economic growth, regulation, and technology. The economy can be considered as a game; regulation establishes the rules, and technology furnishes the physical devices in order to play the game. If any of these basic forces change, then the system of freight transportation will change in response.

The national economy has been characterized by steady growth in population, by substantial economies of scale in the production of goods, by a decline in the share of employment found in agriculture and mining, and by recent trends toward vertical integration of the firm, conglomeratization, and internationalization.

Roberts concludes that for the next 10 or 20 years the national economy will have very much the same structure that it has today. For example, transport output (sales) is expected to grow from 150 to 250 percent, although transport output as a percentage of the gross national product will decline somewhat. This action would reflect a shift from a manufacturing, agriculture, and mining economy to a more service-oriented economy. Also, the most rapidly growing transport-related sector of the economy is import and export trade, which has expanded fourfold between 1965 and 1978. Continued rapid increases are to be expected as the United States becomes less insular and the world more interdependent.

For more than 50 years, the U.S. freight system has been dominated by the existence of economic regulation. This process is complicated, difficult to rationalize, and subject to many exceptions. Regulations have not protected rail freight transportation but, on the contrary, have allowed other modes, principally truck and waterway, to erode rail's market base.

If regulatory rules are changed, then the game of freight transportation systems will be changed. The principal determinant of the future modal makeup of the transportation system is the existing federal regulatory reform process. The outcome of this process is currently unpredictable. However, the freight system probably will not be changed dramatically in physical appearance, although market shares are likely to increase for truck and to decrease for rail. From a national viewpoint, this may not be as important as the health of the separate components of the freight transportation system.

In the field of technology, Roberts concludes that large-scale, entirely new freight transport systems are unlikely to be implemented, but an array of minor technological improvements will be incorporated into freight transportation. The principal products of technology research are expected to be new fuels, improved combustion processes, and more efficient propulsive devices. Increased containerization is to be expected (particularly with the highway trailer, the most ubiquitous container of this era); however, regulatory and institutional barriers will have to be overcome.

After regulatory reform, the impact of fuel price and availability is the second biggest unknown in freight transportation. If fuel prices rise to very high levels, this action could have major consequences for continued economic growth. The more probable occurrence, however, is a series of shorter-term fuel crises. Methods for coping with these crises without damaging the U.S. economy must be sought.

Future of the Nation's Passenger Transportation System

Francis P. Mulvey, a professor at Northeastern University, Boston, observes that new forces are gathering to shape the future of the national passenger transportation system. He assumes continued population growth and a conservative average annual real growth rate of 2.5 percent in the nation's gross national product. The national passenger system, however, will be influenced by constraints of energy availability, environmental protection, and goals reflecting consideration of the needs of minorities, the elderly, and the transportation handicapped. A renewed emphasis on economic efficiency, however, is expected, and this will be reflected in a growing reluctance to underwrite transportation services that do not produce significant social benefits.

Regarding intercity bus transportation, Mulvey states that, if current trends continue, the industry will operate unprofitably in the early 1980s. This may result in curtailment of unprofitable operations, particularly to small cities and low-density regions. Deregulation may hasten this process. The states may suddenly be faced with difficult decisions as to whether to subsidize unprofitable operations in order to maintain service to small communities and low-density regions.

The future of Amtrak rests primarily with the U.S. Congress. Congress must balance annual operating losses in excess of $500 million against its goals of maintaining an alternative transportation system with its claims of energy efficiency and low environmental impact. Former U.S. Secretary of Transportation Brock Adams had proposed a cutback from 43 200 to 25 600 route-km (27 000 to 16 000 route miles). Mulvey advocates policies placing greater emphasis on economic efficiency with subsidies limited to those necessary to produce identifiable and at least conceptually measurable social benefits. With such an approach, Amtrak would most likely cease to be a national, interconnected rail passenger network; it would become instead a series of regional or interstate rail services concentrated in high-density urban corridors.

In the field of aviation, Mulvey anticipates continued rapid growth of passenger kilometers of travel by air, although at lower rates than in the recent past. Although the effects of deregulation are still not clear, the probable impacts could include (a) lower fares, (b) increased takeovers of routes to small cities by commuter airlines, and (c) continuing adjustments by major air carriers as they attempt to respond to changed market conditions. General aviation demand will increase, but at lower rates due to higher fuel costs and possible increases in landing fees as airports adjust their prices in order to better manage limited airspace and airport capacity.

Automobiles will continue to dominate both intercity and urban travel. Improved operating efficiency will partially offset expected increases in fuel prices. Mulvey notes, "If fuel prices increase fourfold and vehicle efficiency doubles, then, even if real income grows by only 2.5 percent [annually], the real operating cost faced by the motorist in the year 2000 will be only 20 percent above current levels. This increase is far too small to induce a major shift in modal [use]."

In the past, public authorities have failed to increase use of fee revenues. Unless taxes are raised or alternative financial resources are found, there will be virtually no money available for highway capital expenditures in the late 1990s—not even for routine resurfacing.

Energy Futures and Costs: Impact on States

Irving Hoch of Resources for the Future, a Washington, D.C., research organization, examines the impact of energy prices on regional settlement and on highway finance. OPEC price increases may well reflect changed conditions worldwide. World energy demands have increased. Environmental regulations have impacted energy efficiency. Some energy price increases would likely have occurred even in a competitive market, but OPEC is a cartel and higher prices in the short and long runs, accompanied by spot shortages, are to be expected.

However, U.S. domestic energy price controls set below market price by the political process do not give consumers a signal to consume less. Compared to 1967, 1978 energy prices to households have risen only 13 percent above other price increases. On the basis of constant 1972 dollars, the real price of gasoline jumped 20 percent between 1973 and 1974, but then maintained a relative stability through 1978 in deflated prices.

One impact of higher energy prices will be on settlement patterns. North central and northeastern states can expect relatively lower growth rates; the sunbelt and the western states, which produce significant amounts

of energy, can be expected to grow faster. Within states, Hoch feels that faster growth can be expected in small cities where low transportation costs and low wage rates are not as highly affected by inflation. (Higher-income areas suffer because inflation pushes more families into the higher-income tax brackets.)

In 1977, the real income derived by states from taxes on fuel by the liter declined to 0.7-0.8 percent of 1972 levels. This significant fact has resulted in serious disinvestment in the existing highway plant, as evidenced by deteriorated pavements and bridges. To correct this situation, higher motor fuel taxes ought to be imposed in most states.

Regulation and Deregulation

The subject of regulation and deregulation is a virtually new one to most professionals working in state departments of transportation. Thus, in his paper, John W. Fuller, Deputy Director of the National Transportation Policy Study Commission, surveys the origins of regulation, tabulates current basic national regulatory policy, and then notes two major trends.

The first of these trends concerns economic regulation, defined as control of rates and conditions of service offered by transport firms. Economic regulation has been reduced in the last several years through passage of the Railroad Revitalization and Regulatory Reform Act of 1976, the Air Transport Deregulation Act of 1978, and administrative actions taken by the Interstate Commerce Commission and by the Civil Aeronautics Board.

In contrast, the second trend indicates that social regulation, dealing with health, safety, and environmental protection, has been greatly expanded in its impacts on transportation—also by legislation. These legislative acts are the National Environmental Policy Act of 1969, the Clean Air Act as amended in 1977, the Noise Control Act of 1972, the Resource Conservation and Recovery Act of 1976, the Federal Water Pollution Control Act and its 1972 amendments, and the Clean Water Act of 1977. These citations do not include safety regulations.

Fuller identifies major issues in economic regulation and presents some key research findings regarding the impacts of change in economic regulation. He summarizes the impacts of regulation and deregulation by using a format that relates impacts to 11 important national transportation goals. These goals are (a) adequate service, (b) appropriate rates and prices, (c) economic efficiency, (d) energy conservation development, (e) environmental protection and enhancement, (f) safety, (g) employment, (h) industry promotion and protection, (i) regional and urban development, (j) equity, and (k) defense.

The Management Challenge

What are the needs and desires of policymakers for information and solutions to transportation problems? What should the professionals produce to be most effective in and for state government? These questions underscore the intense need for information and guidance so that transportation professionals may work with greater certainty toward implementation of programs. Several policymakers were therefore invited to present their viewpoints on what is required from transportation planning staffs. (See Part 3 and the comments below.)

The Federal View

The underlying federal concern, according to John S. Hassell, Jr., Associate Administrator for Planning, Federal Highway Administration, is that state planning should be responsive to the management decision process. To be responsive, planning should include those activities needed to develop each state's program of capital projects and operating assistance, which is the bottom line.

Effective response calls for three levels of planning: (a) policy planning, (b) systems planning, and (c) program planning. Policy planning is the basis for statewide, multimodal decisions. It should be in the form of a clear statement of goals and objectives. These goals and objectives, then, become the mission of the state department of transportation to achieve. Systems planning is viewed as mode-specific—for example, aviation plans, rail plans, port plans, and intercity bus systems plans. Each systems plan should be prepared, however, with a view toward coordination with other modes. Programming is the activity that produces a capital program of projects for all modes with accompanying budgets for operations and maintenance.

Good planning practice must be able to deliver five products—the successful preparation of which requires active public involvement in all stages of statewide transportation planning. These products are

1. A policy plan defining goals, objectives, and basic organizational policies (the policy plan should include an assignment of jurisdictional responsibilities between state and local authorities);
2. A financial plan, identifying both short- and long-range funding sources;
3. A long-range physical development plan, providing guidance as to how the physical transportation systems of the state should be developed for the future (physical development plans should be based on the study of alternatives);
4. A short-range transportation improvement program for capital budgeting of projects arranged in priority order (transportation improvement programs should be revised regularly and should be concerned with operating and maintenance expenditures as well as with capital projects); and
5. An evaluation process—a program of surveillance and evaluation to provide top management with periodic reports and evaluations of how the agency's mission, goals, objectives, policies, and programs are being accomplished.

The Legislative View

State Representative Louis R. Nickinello, chairman of the Massachusetts Legislature's Transportation Committee, strongly urges state department of transportation personnel to work with their legislators as much as with their governors and department executives. Nickinello notes that

1. Members of state legislatures are concerned about transportation, want to learn more about it, and want to be part of the planning process before the process begins;
2. Members of state legislatures are elected to represent their constituents and, as such, are concerned that the citizen-participation process, which is mandated by Congress, may bring in individuals who do not necessarily represent local interests; and
3. Other federal requirements, including categorical grants and requirements to have municipal planning offices and other regional or area planning commissions, establish programs that are outside the control of state legislatures and administrative and budgeting processes and, at the same time, that commit the legislatures to certain funding actions.

It is getting harder and harder to convince people to support transportation expenditures, even from dedicated funds like the highway funds. This situation makes it more important than ever to involve state legislators, to communicate with them, and to include them in the planning process from the beginning.

The State View

The executive of a state department of transportation, according to Jack Kinstlinger of the Colorado Department of Highways, Denver, needs four principal outputs from his or her professional planning staff:

1. An early warning system to identify emerging issues and trends that state government, through its department of transportation, will have to face—especially those issues and trends that cannot be controlled by government but that must be accommodated by shifts in its programs;
2. Sound policy analysis of those issues that can be influenced by government and the alternatives that must be evaluated;
3. A programming and budgeting system, a valuable tool that permits a state department of transportation to negotiate openly with local government and private interests and to communicate effectively with the state legislature; and
4. A continuing program of surveillance of the state's transportation system and services so that the executive will know how well the programs and the agency are performing.

"The planner's role in a transportation agency is probably more essential now than it has ever been before," Kinstlinger noted. However, it needs sharper definition and must stress activities that will generate useful information for management.

Professional Response to Management Needs

Can the needs of top management in state departments of transportation be met? This is not only a question of whether but also of how. Problem solving must consider the length of time it has taken to decide on an approach, the cost of achieving a solution, and the style in which reports are communicated. These are as important to the attainment of an implementable, credible result as the finding of a correct answer to the problem. In the conference's keynote technical paper, Marvin L. Manheim, a professor at the Massachusetts Institute of Technology, Cambridge, and Lance A. Neumann of Cambridge Systematics, Incorporated, develop the initial response to this important question. (See Part 3.)

Decision makers require a range of information and analysis organized to highlight the implications of choices that are open. These information requirements include (a) a wide range of options; (b) the impacts of each option on a wide range of human, economic, and environmental interests; (c) evidence of an open planning process; and (d) explicit recognition of the uncertainties that surround any problem.

These requirements today differ from those of urban transportation planning—the dominant style of transportation planning in the 1960s and a strong influence on the early years of statewide transportation planning. The classical style required large-scale data-collection efforts, sophisticated but very time-consuming simulation models, and an objective, value-neutral assessment of the likely effects of alternative courses of action.

Wholesale transfer of the urban planning technology to the statewide level was not considered practical because state problems are characterized by (a) multiple issues, (b) the need for a variety of analytical techniques, (c) the presence of a variety of analytical capabilities, (d) the wide range of required types of data, and (e) the need for a variety of products.

The new role for the professional is to provide timely information for the decision-making process. The role, however, goes beyond this function; it will often require the professional to work almost in an entrepreneurial fashion, interacting with a wide variety of individuals and with both public and private organizations.

Manheim and Neumann give primary emphasis to the multiyear program plan as the principal product of statewide transportation planning. Such a program plan corresponds to the transportation improvement program, describing capital projects and other actions scheduled to take place within a five-year period. The program plan should be updated on an annual basis.

The implication of this view of the professional response to the management challenge is that staffs in state departments of transportation have to adapt themselves to much more complex challenges and a more complicated role than has been the case in the past. This will be quite different in many cases from the well-defined production process by which highway plans were evaluated, designed, built, and maintained. A great deal of work is needed, therefore, to develop staff capabilities for the exciting, diverse, difficult, but ultimately very rewarding, work of the future.

Roger L. Creighton of Roger Creighton Associates, Delmar, New York, prepared the draft of the report contained in Part 1.

Part Two

Recommendations

Summary of Recommendations

The recommendations that evolved from the statewide transportation planning conference are summarized in this section. These recommendations are grouped as they relate to (a) general and organizational concerns, (b) professional planning staff activities, (c) professional planning staff products, (d) policy, and (e) resources and research needs.

GENERAL AND ORGANIZATIONAL CONCERNS

As the times and circumstances affecting transportation change, attention must focus on the role and function of state departments of transportation in the face of such change. Thus, the following recommendations are made regarding organizational and planning activities, as well as mechanisms to aid in decision making.

1. The increasing influences of external forces require state departments of transportation to assume a more aggressive and far-seeing role, to anticipate changes, and to be prepared with advice and programs of action—including contingency plans—for consideration by governors and state legislators.
2. The chief executive of a state department of transportation is the chief architect of state transportation policy. In critical times, great leadership and ingenuity are required. The chief executive should orient his or her professional planning staff to the kind of activity that will produce the information needed to develop state policies and programs.
3. On a regular basis, the executive of each state department of transportation should obtain from the professional planning staff: (a) early warnings of problems (e.g., highway deterioration, financial concerns, and energy problems); (b) an annual or biennial surveillance of the performance of both public and private transportation systems; and (c) analyses of particular issues, problems, or prospective policy changes that are essential to executive decision making.
4. In the course of their work, the executive and the planning staff should regularly communicate with the legislature because it plays an important role in the establishment of financial policy, both for revenues and for the allocation of funds to modes and programs.
5. Mechanisms are needed to resolve conflicting transportation goals and directives, particularly those arising from conflicting policies of the concerned major U.S. agencies and departments. In part, this is a federal responsibility. An annual statement by federal and state agencies, which includes capital and noncapital programs, economic policy, and performance objectives, should be used to resolve conflicts among federal agencies and state departments of transportation. However, power to resolve conflicts should be delegated to the level of government where implementation takes place. The state department of transportation, as a prime implementing agent, can assume the role of problem solver and should use its short-range capital-operating program or budget as a mechanism for decision making.
6. A reexamination should occur of the functions, roles, and relations among the state executive, the state legislature, the state department of transportation, metropolitan planning organizations, regional planning organizations, and citizen-participation groups. In particular, there is a need to examine whether expenditures for citizen participation are cost-effective and whether citizen groups adequately represent their peers.
7. The need for closer relations between state departments of transportation and state regulatory commissions is rapidly increasing. The practice of near-zero communication should no longer be tolerated because economic regulation affects the cost of shipment, the mode choice, and the location patterns of industry.

PROFESSIONAL PLANNING STAFF ACTIVITIES

To provide better service to the transportation department executive, the department's professional planning staff should include the following activities in their work program.

1. Early warning system. An early warning system or lookout activity should be part of the planning function. Long-range in nature, the early warning system attempts to identify problems before they occur and to alert the state's executive and legislative branches to these problems in advance.
2. Policy analysis. An important function of the planning staff is to analyze and estimate the impacts of alternative transportation department policies in such areas as human and economic interests, fiscal resources, energy policies, mass transportation policies, alternative energy sources, and environmental pollution. Analyses should report explicitly on the uncertainties that exist.
3. Surveillance. Monitoring or surveillance of the performance of transportation systems and services should be a regular function of state transportation department planning staffs. Surveillance should only

be undertaken for a few very important variables or characteristics that are closely related to the most important goals and objectives spelled out in a statewide transportation plan.
4. Quick-response studies. The professional time of skilled persons should be budgeted, just as data and planning techniques must be available, to respond to the quick-turnaround needs of executives as they respond to changes and crises.
5. Long-range background estimates. In support of the early warning system and to provide perspectives for controlling the quick-response studies, transportation planning staffs should have regularly updated long-range estimates of population, economic growth, transportation demand, energy use, and fiscal resources.

PROFESSIONAL PLANNING STAFF PRODUCTS

Whether published as a statewide transportation plan or maintained as a regularly updated record of its analyses and conclusions or recommendations, the following products of the work of a state transportation department planning staff should be available to the state's chief executive, the legislature, and the general public:

1. Policy statements indicating the state's transportation goals and the principal directions for transportation construction, operations, management, and regulation activities in the near future;
2. Policy statements on the role of the state's department of transportation and the allocations of responsibility and authority between it and other local, regional, and state agencies in the field of transportation;
3. Separate system plans (primarily long-range plans) for each of the principal modes that describe proposed physical development, management, operations, and regulation;
4. A discussion of intermodal coordination, analyses, and plans where relevant;
5. A multiyear program of projects, including a first-year (or first two-year) element as determined by the state's budget cycle;
6. A financial plan that includes an estimate of fiscal resources and a projection of a range of resources under alternative economic and taxation conditions; and
7. A general description of the process by which the above products are prepared, including the roles of those agencies and groups expected to play a part in the process.

The publication of these products, both in draft and final form, is an essential part of participation and communication. Moreover, because it is recognized that no plan or program is final, revisions are to be expected.

POLICY

The policy-related recommendations that follow stress the need for (a) adequate and accurate data to assist persons who have decision-making responsibilities and (b) coordinated planning and programming at all levels.

1. Because receipts from motor fuel taxes have declined in real terms and because this has prevented adequate maintenance and reconstruction of existing highways, motor fuel taxes must be increased or alternative stable sources of revenue must be found.
2. Economy and efficiency should be given much greater consideration in federal and state transportation decision making, including decisions regarding the environment and federal-state support of competing modes.
3. Because the availability of federal funds for planning and programming restricts analysis and planning to certain modes and makes it difficult to plan for all modes on a comparable basis, it is recommended that a unified planning fund be established, as recommended in 1978 by the American Association of State Highway and Transportation Officials.
4. States should anticipate rapid growth in U.S. export and import of freight in the 1980s by providing efficient and adequate port transshipment facilities and landside transportation capacity, including inland waterways.
5. Federal policies relating to the National Railroad Passenger Corporation (Amtrak), intercity bus service, and numerous rural and small-city transit programs are in conflict and need to be coordinated.
6. To increase the credibility of environmental evaluations, the speed and efficiency of environmental reviews must be substantially improved.

RESOURCES AND RESEARCH NEEDS

Concerns about the resources available and the research programs required for comprehensive transportation planning prompted the following recommendations:

1. Mechanisms should be developed—and established through national legislation, if necessary—to maintain the flow of data. Data are needed for statewide transportation issues analysis. Data would also be required from private carriers in the event of deregulation. If possible, the flow of essential data should be improved and should include reporting of adequate samples of commodity tonnage, ton-kilometers, rates, vehicle flows, origin-destination patterns, equipment, and financial condition.
2. Research is needed on (a) the changes of modal flows and economic activities that can be expected from regulatory changes in freight and passenger transportation and (b) the estimation of their fiscal impacts on the several modes.
3. Professional staffs engaged in issue analysis and planning need to acquire new skills, particularly in the areas of (a) operations of the private transportation industry and (b) financial analysis. Other needed skills include those in public and media presentations, labor relations, and contract negotiations. All are critical to the success of implementing plans and programs in the fields of transportation that are currently dominated by private enterprise.
4. A handbook or manual should be developed to assist state and local staffs in port and waterway systems planning and in port master planning.
5. Analytical methods are needed for determining the capacity of locks, ports, terminals, and waterway systems.
6. A clearinghouse, or a regular series of multistate regional workshops, is needed to gather and disseminate information on techniques and processes applicable to the analysis of transportation problems at the state level. There should be broad involvement from government, universities, private transportation agencies, and privately sponsored transportation planning and research groups.
7. There is a need to train both decision makers and policy analysts serving in state legislatures so that they will be better equipped to deal with the complex issues facing states (and the federal government) in the field of transportation.

8. Research is needed to improve performance evaluation tools to indicate how well transportation facilities, equipment, and services are meeting specific state goals and objectives.
9. Research and information exchange is essential in the areas of financial analysis, cost allocation, revenue generation, and budgeting, all of which could assist state departments of transportation in working with constrained financial resources.

Part Three

Resource Papers

Federal Expectations for Statewide Planning

John S. Hassell, Jr., Federal Highway Administration

This is a time of challenge for the transportation planning community. This conference provides a particularly timely opportunity for statewide transportation planners to set ways to meet that challenge. I believe we can best do it by focusing on statewide transportation issues and planning products. The underlying concern must be on planning that is responsive to the management decision process.

The U.S. Department of Transportation (DOT) views the role of statewide planning and programming as one of three levels of policy development and decision making; the other two levels are national and urban. We must look at urban transportation decisions, however, as an important part of the statewide planning process just as statewide planning is a part of national planning. Most multimodal system planning has occurred at the urban level.

There has been relatively little federal structure provided for statewide planning in rail, air, and transit, although we can point to the Railroad Revitalization and Regulatory Reform Act of 1976 or the Airport and Airways Development Act of 1970 as a basis for some activity with a national perspective. Most statewide activity has been related to highways, and multimodal statewide planning and programming have not received the same development support as urban planning.

You will recall that DOT proposed a broader role for statewide planning in the 1978 legislation. The proposal was for a process to focus on

1. Product—a program of projects based on a statewide multimodal planning process;
2. Issues—land use development, system performance, energy, and other social, economic, and environmental concerns; and
3. All modes.

These provisions were not included in the final legislation.

PLANNING ACTIVITIES

Given these facts, I see the federal expectation for statewide transportation planning as including those activities needed to support a state's program of capital projects and operating assistance. To meet this expectation, good planning practice calls for three levels of planning activities to develop this product: (a) policy, (b) systems, and (c) program planning.

I view policy planning as the basis for statewide multimodal decisions. This has to be a primary function of statewide planning—resulting in a clear policy statement—along with setting goals and objectives for the agency's mission. Arizona, for example, has an annual retreat where the mission of the state transportation agency is examined, redefined, and translated into goals and objectives. Wisconsin is developing a multimodal policy plan addressing critical issues. The next stage involves developing more focused policy for actions or decision making based on the policies. The Minnesota Department of Transportation has developed a Framework for Action to guide it in making project selection decisions for all modes.

In systems planning, the focus must become mode specific and begin to address modal trade-offs at the system level especially in the urban area. There are four areas of emphasis:

1. Modal shift opportunities such as rural high-density passenger corridors and expanded trailer on flat car,
2. Interface between modes so that parts of the system are properly linked and integrated,
3. New service for transportation-deficient population segments (e.g., rural public transit and ride-sharing), and
4. Preservation of existing services through operating subsidies, regional rail reorganization (3R) activities, and transportation system management (TSM) measures at the state level.

Systems planning efforts to date have included studies of intercity bus systems in Michigan and Oregon; efforts in Maryland to update its aviation and rail plans and to develop a state port system plan; and modal plans in Iowa that cover airport, rail, public transportation, water, and highway modes.

Programming is the activity leading to the state's 105-program of projects in the highway area and its multimodal equivalent for other modes with related information in support of a capital investment program, operations, maintenance, and administration.

PRODUCTS

The planning practices noted here must be able to deliver products that are responsive to management's needs. There are five key products that should evolve from the statewide planning process and that should enable management to make the key programmatic decision necessary.

First is a policy plan that states goals, objectives, and organizational policies. Concerns such as the assignment of jurisdictional responsibilities are part of the policy plan. Further, a systematic method of keeping up to date on which level of government has what

responsibilities for the various levels of transportation systems should also be included. In some cases, the way in which state and local officials are assigned responsibility is neither as rational nor as stable as it might be. This has a major impact on the use of available funds. The extent of the system for which a highway agency can be responsible is obviously related to the level of funding it will need to carry out that responsibility. Any substantial realignment of highway jurisdiction, for example, will require funding adjustments. Some states are reviewing jurisdictional responsibility to make optimum use of available funds. With the need to look at funding questions, it makes sense to look at jurisdictional problems at the same time. Then a more rational assignment of jurisdiction and an equitable funding plan can be proposed at the same time.

A financial plan that identifies both short- and long-range funding sources and availability is the second key management product. The problem of providing the best transportation service for the least cost has always been central to transportation management. This issue has become more critical because of changes in the historical relation between how funds are obtained and how they are expended.

Some states have approached the situation by reconsidering the perceived need for certain transportation improvements. This is reflected in the approaches used in Texas and California. They reevaluated the appropriateness of existing improvement standards in terms of the benefits that could be obtained. The result was a system-oriented planning approach. A higher level of total benefits in the whole highway system might be achieved by (a) balancing projected quality of service, measured by such factors as safety and mobility, throughout the transportation network; (b) ensuring that proposed projects closed gaps, thus providing system continuity; and (c) using design alternatives that would result in lower overall project cost.

A third product is a long-range physical development plan. Such a plan, based on adopted policy, goals, and objectives, gives guidance as to how the physical system should be developed to serve a future way of life—presuming, of course, that the plan is fiscally realistic. These plans should provide management with alternative transportation improvement choices in the future and the necessary related funding programs to support them.

Trade-offs between modes are an important consideration in certain cases. Generally, however, planning at the statewide level will have to avoid complex simulations of competing modal systems and to focus more on specific issues and corridors. Probably more important is the interface between modes so that the various parts of the transportation system are properly linked and integrated. With a soundly conceived transportation plan, an improvement program can be developed by comparing project mixes with the policy embodied in the plan. The plan then helps to focus efforts on those activities that will help bring the plan to fruition.

It is critical, then, that the process through which the plan is developed is keyed to the issues facing state transportation managers. An issue-oriented planning process will have more likelihood of being on line and of providing planning information for program decisions.

A fourth product is a short-range transportation improvement program. Priorities of projects reflected in a short-range program must result from the best rationale that maximizes benefits within cost, environmental, community, and social constraints. The ability to address the setting of priorities and to make sound project decisions is important in post-Proposition 13 years and during these times of severe energy concerns.

Finally, an evaluation process must be found to ensure adequate control of statewide programs and to provide greater efficiency in the use of personnel and funds. In its broadest sense, this is a program of surveillance and evaluation and a means to provide top management with periodic progress reports and evaluations of how the agency's mission, goals, objectives, policies, and programs are being accomplished.

Critical to successful development of all these products is an active public involvement process throughout all stages of statewide planning. It is important for broad support of financial programs, physical development plans and programs, issue analysis, and ultimate project development activity. The most successful programs we have seen key on early and continued public involvement, thus ensuring that the public has input to the analysis of issues and development of goals and objectives.

ISSUES

Four national issues that are likely to affect statewide transportation planning should be considered.

First is governmental efficiency and effectiveness. The current administration is greatly interested in how we are organized and in our productivity. Within DOT, some reorganization has taken place already. The staff of the Office of the Secretary was reduced and reorganized, and a Research and Special Program Administration was established.

There is also the proposed merger of the Urban Mass Transportation Administration and the Federal Highway Administration into a Surface Transportation Administration. Congress leaned toward a closer relation between the two surface transportation programs of these agencies with the passage of the Surface Transportation Assistance Act of 1978. We know that it is time to stop thinking of highways and transit as competitors and to work to coordinate these resources for better transportation.

Further government efficiency is a goal of the new Civil Service Reform Act of 1978. An important element is the establishment of job performance evaluation criteria, such as improvements in efficiency and productivity, work quality, timeliness of performance, and success in meeting affirmative-action goals.

Government effectiveness is becoming increasingly important. Are the various federal programs accomplishing what they were intended to do? Are the highest-priority programs being funded at the appropriate level? These are key questions that are of growing concern. Zero-based budgeting attempts to examine each program's merits in relation to all other programs. Within the highway program, a new tool—the Highway Performance Monitoring System—will facilitate the continual assessment of current highway programs, the possible need for modification of such programs, and the need for new programs.

The second issue is energy. We are headed for some extremely critical periods. Gasoline shortages are possible. Refineries will be concentrating on reducing the shortage of aviation fuel and producing stocks of winter heating oil. The crude oil for these fuels will result in reductions in automobile gasoline production, and the highway sector will surely feel the shortage. States, if they have not already, should begin developing contingency plans to help cope with this situation.

Contingency planning is recognized as an important issue that requires action at the federal, state, and local levels. Such plans should include a wide variety of measures that can be implemented quickly during an energy emergency to mitigate its impact.

A third issue is financial. With the existing public

clamor over government waste and the reluctance to approve new taxes, transportation programs must be planned and managed much more effectively than in the past. Existing programs should be reexamined in the light of today's environment to see if they are still relevant. New construction must be carefully balanced with the need to reconstruct and maintain the existing system. The methods of distributing revenues should be examined so that today's managers have sufficient flexibility to respond to changing requirements.

Transportation programs will increasingly be competing with other programs for the public dollar. The public must be convinced that their transportation systems are managed properly before additional funding will be authorized.

The fourth issue is urban policy. President Carter's urban policy and DOT's five-point policy objectives are designed to help restore the vitality of major cities through careful management of transportation grants. In this regard, there is a need in the states and in local areas to concentrate on five specific objectives:

1. Ensure that proposed projects are fully a part of a comprehensive plan for the region. This must show, through analysis, the project's overall favorable impact on the preservation of neighborhoods, particularly in the central city, and must ensure ample opportunity for joint implementation of urban development and transportation projects.
2. Increase efforts to conserve energy through ride-sharing and transit patronage. Every urban area must have an effective program, with priority consideration given to the types of facilities that give preference to high-occupancy use of vehicles. Energy impact analyses should be a part of the project planning efforts.
3. Provide equitable compensation for those persons adversely affected by urban highways. Urban transportation projects must be reviewed to ensure that they do not reduce existing housing stocks, particularly for elderly, minority, and low-income groups. Local communities advocating millions of dollars of transportation projects will have to be willing to provide programs that will salvage or replace housing eliminated by these projects and to create positive steps for job opportunities to mitigate adverse impacts.
4. Give serious consideration to no-build options supported by appropriate 3R and TSM proposals.
5. Analyze alternatives for all major highway and transit proposals. This will provide a comparison of the costs and effectiveness of each alternative.

The adequate consideration of urban issues by states is critical and a major part of the statewide planning function. It is as important a role for the state as is rural policy implementation.

The influence of all of these issues on the planning products is critical. Their impact is often dramatic, but the results of this analysis are what the decision maker wants and needs from the transportation planner.

Role of Planning in State Transportation Program

Jack Kinstlinger, Colorado State Department of Highways, Denver

I have been requested to share with you my views on what the state transportation manager can and should expect from a transportation planning program. At one time I was a transportation planner; now I am the director of a state transportation agency. Therefore, I have experienced both the intellectual and technical challenge of transportation planning and more recently the real-world environment in which transportation decisions are made or shaped largely by the outraged citizen, the demanding local official, the unsympathetic state legislator, the governor, and the federal official who wants you to expedite the program while at the same time restraining you with added regulations.

My expectations of transportation planning are less grandiose now, however, than they were when I was a planner and less grandiose than those discussed at the first conference on transportation planning held at Williamsburg, Virginia, in February 1974. According to the report of that conference, transportation systems were expected to shape land use, population, and economic development and to encourage desirable community patterns (1). Comprehensive land use planning was expected to be established on a statewide level and to be fully coordinated with transportation planning.

Since then, political, economic, and institutional realities have forced us to reduce our expectation. Long-range planning has fallen into question; events are moving so rapidly that it is difficult to predict the future over the next 5 years or much less the next 25 or 30 years. The ability of public policy to influence land use decisions has generally been a failure. Increasingly, there is a realization that public investments, including those in transportation, influence land use decisions marginally, if at all, and even local subdivision and zoning powers as currently exercised have little impact. Land use decisions are shaped largely by the private marketplace. In this era of deregulation and reduced governmental intervention, this situation is not likely to change in the near future.

Multimodal system planning, the darling of transpor-

tation planners over the last few decades, has been found useful only in our more complex metropolitan areas and within specific high-density corridors. However, even in these areas, such planning is often too costly, imperfect, and time-consuming to be effective. Frequently, transportation decisions are properly made on a link-by-link basis and on an individual mode basis. Increasingly, the challenge is how can we best preserve what we already have, rather than what new facilities or services are desirable.

Currently, I look to the transportation planner to accomplish several objectives:

1. Provide an early warning system to identify emerging issues and trends with which we will have to deal (In the Williamsburg conference report, this was defined as "the lookout role". It relates largely to those issues that cannot readily be controlled by government but must be accommodated through shifts in priorities, policies, and programs);
2. Provide sound policy analysis on those issues that can be influenced by government but where alternative directions are possible;
3. Support a technically sound programming and budgeting system wherein available resources are channeled and targeted to those projects and programs that best meet the objectives of the agency and the public; and
4. Conduct a continuing program of surveillance so that the manager is informed about how well the programs and the agency are performing and identify areas where further emphasis is required.

Several examples of how the Colorado State Department of Highways addressed these tasks are discussed below.

EARLY WARNING SYSTEM

The Colorado State Department of Highways has been working for a number of years with the Denver Regional Council of Governments and the Denver Transit Agency in formulating long-range highway and transit plans and short-range investment programs. The long-range planning element, in keeping with the philosophy of the Williamsburg conference and earlier planning concepts, was intended to be the framework within which short-term investments would be made. In traditional fashion, long-range (i.e., to the year 2000) land use, economic, and population forecasts were prepared and then highway and transit plans were sketched with the objective of meeting the resulting travel demands. As a result of recent financial analyses, this long-range planning exercise has taken on a new significance—not as a framework for investments but rather as an early warning signal concerning problems apparent in Denver's current and projected growth.

In performing the fiscal analysis for the long-range plan, trends in both construction cost inflation and reduced highway revenues were considered. The analysis indicated that—even with the use of modest inflation factors (11 percent per year through 1985 and 7 percent per year thereafter), a reasonably high transit modal share, a modest growth rate in vehicle kilometers of travel of 2 percent per year (compared to 6-7 percent annually as is currently experienced), and a doubling of highway congestion over that experienced currently during peak periods—expected state and federal highway funds would meet only about one-quarter of the cost of making the necessary highway improvements. Results of this analysis are pointing out to the public and its elected officials the real danger of rapid growth on the Denver regional transportation system that can be addressed in only one of two ways—either achieve a significant but unlikely increase in transportation funding or achieve significant reduction in travel through greater use of high-occupancy vehicles and better growth management.

A second example of transportation planning as an early warning system involves recent efforts on the part of the Colorado highway department to identify impacts from increasing coal, oil shale, and uranium mining activities now taking place on the west slope of Colorado and in neighboring Rocky Mountain states. As an example, coal mining in Colorado is expected to nearly triple between 1977 and 1985, and the number of 100-car coal trains moving within and through Colorado is expected to increase sevenfold by 1985—largely from traffic originating outside of and passing through Colorado.

After reviewing numerous publications, interviewing mining and power-generating companies, and visiting many local communities in western Colorado, our transportation planners have prepared projections of likely levels of activity in mining construction and operation and resulting movements of people and goods. As a result of these studies, we have identified likely impacts within the next several years, including deterioration of nearly 800 km (500 miles) of roads used to haul coal from mines to market or rail head and noise, safety, and traffic congestion problems created by the repeated movement of heavy trucks as well as unit coal trains through small communities, eventually creating the need for bypasses or overpasses where none now exist. The study revealed, for example, that currently 83 railroad-highway grade crossings have sufficient exposure factors to warrant grade separations, and by 1985 an additional 72 crossings will have such warrants. Against these expected needs—estimated into the hundreds of millions of dollars—there are limited funds designed to address the impact of energy resource extraction on transportation other than normal transportation dollars that are already overextended. Armed with these facts, a number of important steps have already been taken to allow Colorado to better cope with this problem.

First, Colorado's Governor Richard D. Lamm and Senator Gary Hart have been urging the U.S. Congress to appropriate energy impact funds to allow boom-town communities to better cope with increased needs in transportation as well as health, education, and other community services. Second, we have met with the railroads active in coal transportation and have received commitments to avoid routings of unit coal trains that will have the most damaging community impacts. Third, we have had some success with the state legislature in funding some of the more critical highway needs out of state mineral severance tax and oil shale royalty funds. Also, we are participating with the U.S. Department of Transportation and other federal agencies in a coal haul roads study and national energy transportation study with the hope that federal transportation dollars will become available to assist us in impacts caused by interstate energy transportation. Finally, the state legislature has authorized the department to evaluate the feasibility of constructing a rail line on Colorado's eastern plains that would divert coal traffic from the front-range urban areas and significantly reduce adverse impacts.

There are other areas where early warning activities are under way including the impact of rapid cost inflation on our construction program, erosion of our revenue base from increased vehicle fuel efficiency, probable decrease in travel resulting from the high cost and shortage of fuel supplies, as well as the impact of federal deregulation of private transportation carriers.

POLICY ANALYSIS

The department has been active in two related areas of policy analysis: the attempt to reduce transportation-related air pollution in the Denver region and transportation strategies designed to achieve energy conservation. Together with the Denver Regional Council of Governments, a land use-air quality sensitivity analysis was conducted to determine the impact on air quality from different development patterns and modal splits between private automobile and public transportation and highway levels of service. The analysis, recently completed, shows that more concentrated land use patterns and increased use of public transportation (a) will decrease only slightly the number of vehicle kilometers traveled and the amount of carbon monoxide pollution and (b) will have little impact on ozone pollution, a prevalent form of pollution in Denver. Interestingly, of all the options tested, the only significant air quality improvement was achieved by maintaining a high level of travel on public highways.

Working with other agencies, we participated in a state air quality implementation plan and a Colorado state energy conservation plan. Some of the results of these efforts are currently being implemented; they include adoption by the state legislature of a mandatory vehicle emissions inspection and maintenance system; efforts to increase bus ridership, bicycling, vanpooling and carpooling; increased efforts to enforce the 88-km/h (55-mph) speed limit; and a voluntary one-day-a-week no-drive day for vehicles registered in the Denver region. Other strategies, including regulating the supply and cost of parking spaces, converting existing freeway lanes to exclusive use by high-occupancy vehicles, and mandatory closing of retail service stations on an alternate-day basis in lieu of the federally proposed weekend station closings, are being studied for possible future implementation depending on the results of additional studies and future circumstances.

We have also been active in furthering control of access to state-owned highways. The highway commission late in 1977 adopted an innovative access control policy, establishing access controls on all roads under the department's jurisdiction and requiring promulgation of procedures for the exercise of these controls. The policy requires the development of access control plans in conjunction with the appropriate local jurisdiction for each highway on a priority basis specifying the functional access classification on the roadway, the location of intersections, constraints on future driveway locations, and other pertinent design criteria. The highway commission also stated that it would authorize the department to proceed into final design of any proposed limited-access highway interchange only when the existence of adequate local land use regulations for the area surrounding the proposed interchange had been determined.

The highway department is currently preparing a more detailed access control code, and the Colorado legislature is considering legislation that will significantly strengthen the state's ability to control access on state highways. For example, the draft legislation provides that local residential subdivisions must connect with local streets and roads, not directly onto state highways.

PROGRAMMING

A major function of the planner is to assist in the development of a priority program for investing available resources, especially in light of decreasing revenues and rapidly inflating construction and operating costs. The Colorado highway department only recently adopted and promulgated its first five-year program for highway improvements and equipment replacement. Increasingly, the program looks at measures designed to maintain existing facilities rather than to expand the highway system except for completion of essential gaps and improvements on the Interstate system. Repair and resurfacing, spot safety improvements, bridge replacements and repairs, construction of facilities to support high-occupancy vehicles, and better transportation system management are dominating the list of highway projects.

Priorities cannot always be determined on the basis of future needs. Revenues are hardly sufficient to accommodate current traffic demand and to correct current pavement deterioration, bridge deficiencies, and hazardous conditions.

The problem of programming has been compounded by inflation. For example, a recent analysis revealed that, under our normal Interstate apportionment and assuming an inflation factor of 11 percent annually through 1984 and 7 percent thereafter, it would take through the year 2004 to complete our remaining essential Interstate program—this despite the fact that Congress has mandated that all Interstate projects must be under contract by 1986.

The five-year program has become a valuable tool in allowing us to plan intelligently within the department in light of the multiyear life of so many of our improvement projects. It also allows us to negotiate openly with local government and private interests who are impacted by state highway improvements, and it allows us to communicate effectively with the legislature on which we depend for increased revenues. It also assures that investments are as cost-effective as possible considering such factors as surface condition, hazardous index, congestion, public acceptance and demand for improvements, and reasonable geographic distribution of investments.

In preparing the program there is a constant tension between completing a limited number of high-priority projects in the shortest time possible or distributing the available funds over a larger number of projects throughout the state and extending the completion dates, thereby satisfying the greatest number of requests for remedial action. Based on technical analysis alone, fewer projects would be undertaken, and such projects primarily would be located in the urban areas where traffic volumes are highest. Political realities, however, must also be brought into play, and a balance must be struck between technical analysis on the one hand and political realities as viewed by the state highway commission, legislature, and the governor on the other. The transportation planner has fully matured when he or she appreciates that the political arena makes as valuable a contribution to the programming effort as technical analysis.

SURVEILLANCE

Finally, the planner must continue to perform the traditional activities that allow the administrator to measure the performance of the system—surveys, counts, and inventories. Measures such as physical condition, accident history, travel time, occupancy or load factor, traffic type and volume, and level of service must continue to be monitored. These statistics are essential if we are to determine how the system is performing and whether in fact our investment of funds and effort result in an improvement or erosion of physical and travel conditions. They allow an identification of problem areas and prioritization of needs for purposes of designing the five-year program. Such measures, I have found, are essential also to support some of the newer management systems that we are implementing within the department. Our new management-by-objectives system requires

identification of goals and measurable objectives for individual units in the department, which, hopefully, will increase public support and understanding of the department's operation, achieve common direction within the department, and allow us to manage performance and products rather than activities. The successful implementation of the system requires intensive collection of information to support analysis of goals achievement. Some typical goals recently adopted for FY 1979-1980 by the highway division within the department include the following:

1. Minimize the degradation of the highway systems;
2. Reduce maintenance costs per kilometer by a certain predetermined percentage;
3. Reduce transportation-related accidents, injuries, and fatalities by a predetermined percentage;
4. Use more energy-conserving construction and maintenance methods and materials and reduce motor fuel consumed\per hour worked;
5. Increase the number of high-occupancy vehicles on the highway system;
6. Improve travel efficiency by reducing travel time between predetermined major community points; and
7. Reduce the period of time that the urban freeway system operates at less-than-tolerable levels of service.

It is evident that the system will be extremely data-hungry and will require the active and constructive participation of the planners in terms of providing the surveillance and data that undergird the measurement of objectives.

CONCLUSION

The planner's role in a transportation agency is probably more essential now than it has ever been before, but the function of a planner must be more sharply defined. In summary, it is to address specific issues and problem areas, to evaluate different policy options, to identify how existing and reasonably anticipated revenues can best be invested, and to help measure the effectiveness of the program.

REFERENCE

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Transportation Planning and Programming: A Legislator's Perspective

Louis R. Nickinello, Massachusetts House of Representatives, Natick

Legislators are people who are elected to represent their respective communities and who have different interests and different concerns. Sometimes these concerns are reflective of personal concerns; most of the time, they are reflective of the people who sent us to our respective state capitals. Trying to reflect those concerns through one collective voice is very often difficult at best. Trying to develop an expertise in fields that we heretofore knew nothing about is difficult at best, as is listening to the bureaucrats, as we legislators like to call them, and to the planners with expertise in a particular field.

These days, it seems, politicians are not held in great respect. But some of us still think that it is pretty good to be a politician—a legislator—and we are fighting to upgrade our image in the people's minds. Even people such as yourselves—planners, government officials, and so forth—see us as obstacles to overcome.

Most legislators know what people think about the legislative process—good and bad. We also know that there is an education process going on that, until now, has been one-sided and that is the point of my talk to you. We in the legislature resent you, whether you are bureaucrats or planners, because you do not educate us. You do not plug us in to the planning process before the process begins. You go to the public sector, to the citizens, but not to us.

Our beef as legislators is that we feel very much left out of the planning and decision-making processes, especially since the U.S. Congress wants to reach down to the local level to deal with the local community about transportation matters. As a result, the state and its legislators are being bypassed. Even when Congress speaks of state government, it is interpreted to refer only to the governor. When the governor says "yes," it is what state government is saying, regardless of whether the legislature in that state knows what is happening. However, it is the legislative branch that is later told it has to come up with money, because the governor of the state has obligated the legislature to do so.

Now, I ask, how would any of you feel after being placed constantly in that position?

I take great pride in being able to say that I am a partner in government with the people who elect me and that I have a right to be educated about and be a part of the process of planning. Thus, I am dismayed that the

federal government constantly bypasses state legislative bodies when it requires metropolitan planning organizations at the local level, when Congress does not recognize our rights and responsibilities on behalf of the people we represent, and when our function as a sounding board of the public is ignored.

Give us the tools to help do the job of planning in our respective states. Massachusetts is not like Arizona, and standards for Washington will not apply equally across the country.

State legislative bodies want to act in partnership with the federal government. It should establish the guidelines for us but should allow us to use our resources to follow through on the mandates we have been demanding on behalf of the general public of this country. Unless we change the current outlook, we are never going to get anything done.

And with that in mind, I would like to urge you to involve us earlier in the planning process, not after the fact when all planning has been done and you just want us to allocate funds. Unless this occurs, every state in this country through its legislative process will refuse to appropriate and authorize spending for the necessary things. Why? Because it is getting harder and harder to convince the public at large to support those expenditures, even from dedicated funds like the highway funds. So, I appeal to all of you to go back to your respective states and educate your legislators. Help your legislators to do the work necessary to serve as a partner in government.

This report was extracted from remarks made by L. Nickinello at the conference.

Energy, Regions, and Highway Finance

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This paper considers the impact of increased energy prices on the distribution of U.S. economic activity and population. It then draws some implications for highway finance.

The paper is organized into three main sections. The first is entitled World View: International and National Patterns because it not only presents and considers some of the major indicators on the world and national energy economy but also makes my particular policy stance evident. The section primarily provides background information and furnishes necessary underpinning to arguments and interpretations in the rest of the paper. The second section, Energy and Population Distribution, contains the core of the paper. It focuses on both production and consumption responses to higher energy prices and how these are traced out geographically. The geographic focus involves both (a) state and region and (b) local settlement. My thesis is that higher energy prices are likely to intensify the shift to the sunbelt, from both the production and the consumption side, including impacts on both the household consumer and the industry. The evidence that I have developed here tends to support my thesis. I also consider local impacts, and here the patterns do not seem so clear-cut; however, I believe it likely that higher energy prices will cause higher urban densities and will intensify the shift from larger to smaller places. The third section draws some implications for state transportation and focuses on state highway finance.

A basic message throughout is that much of our energy trouble is self-inflicted because of our reluctance to allow domestic prices to rise to world levels. OPEC sets oil prices and, in effect, sets all energy prices because an oil price increase is quickly translated into energy price increases across the board. In part, the OPEC price increase may well have reflected changed conditions. Because of increased worldwide automobile ownership and environmental regulations that fell heavily on energy production, some energy price increases would likely have occurred even in a competitive market. It is also possible that multinational oil companies pumped OPEC oil at a faster rate than was economical—if they perceived the risk of nationalization or expropriation of their holdings. Despite these qualifications, it seems clear that most of the OPEC price increase indeed involves the action of a cartel. Now, the way to break a cartel is by increased production, but domestic energy price controls set below market price do the opposite. Because higher prices are perceived as unfair, we end up by helping OPEC and hurting ourselves. If we produced no energy and if we believed that higher prices were unfair and set lower domestic prices by controls, OPEC would still demand payment at its price; the lower domestic prices could only be paid for by subsidies and, behind those subsidies, by taxes. Moreover, consumers would not get the signal to consume less. Because we produce energy, we can force U. S. producers to do so at the lower, "fair" price for a while. But eventually those low prices tend to dry up domestic supplies, and we are forced, more and more, to rely on OPEC.

Our reluctance to raise prices seems to carry over into a reluctance to raise taxes and, in particular, to raise highway motor fuel taxes. Real expenditures on highways have fallen in most states, and the disinvestment that seems a likely consequence appears to me to

be a bad bargain. At the risk of appearing politically naive, I suggest that higher motor fuel taxes ought to be imposed in most states. In line with this, I develop some evidence that suggests that, without higher taxes, state highway funding in the future may be in considerably worse straits than it is now.

The reluctance to raise energy prices and taxes explicitly draws much of its force from the current concern about inflation. But that concern seems to me to involve some flawed perceptions. The idea that we are running out of energy also seems to me to involve flawed perceptions, and I begin my review of the world and national scene by grappling with that issue.

WORLD VIEW: INTERNATIONAL AND NATIONAL PATTERNS

On Running Out of Energy

We are not running out of energy. There is plenty of energy to be had—at a price. To put this argument in perspective, consider the 1976 levels of fossil fuel production for the world and for the United States (1, p. 68):

	Production (10^{15} Btu)		
Fuel	World	United States	United States as Percentage of World
Petroleum	122.89	17.20	14.0
Natural gas	54.14	21.87	40.4
Bituminous coal	80.85	16.28	19.3
Anthracite coal	5.02	0.16	3.2
Total	262.90	55.51	21.1

[A British thermal unit (Btu) is the amount of energy required to raise the temperature of water 1°F; a gallon of gasoline contains 138 700 Btu; and 10^{15} Btu is a quadrillion or a thousand trillion Btu. A barrel of crude oil contains 42 gallons and 5.8 million Btu. Throughout this paper, statistics and other data are given in customary rather than metric units, thus reflecting the way they appeared in references cited.] Other sources of energy, including hydroelectric power, nuclear power, fuel wood, and unconventional sources, furnish relatively small amounts of energy in both the U.S. and the world economies.

Estimates of fossil fuel reserves are "iffy" and inherently speculative, but some U.S. Department of Interior estimates of U.S. reserves as of 1976 (2) are useful in documenting the point that we are not about to run out of energy:

	Reserve Estimate (10^{15} Btu)	
Fuel	Minimum	Maximum
Coal	5000	12 000+
Shale oil	460	5 800
Uranium	240	1 800
Geothermal	15	360
Petroleum	650	1 100

The maximum estimate for our shale oil reserves is roughly five times currently estimated Saudi Arabian oil reserves (3), and even the minimum coal reserve estimate is roughly 100 times our current annual use.

Of course, shale oil has been on the verge of production for 50 years but has always cost a bit too much to make production worthwhile. That pattern persists. Thus, in 1978, Schanz and Perry (4) figured that the price that would make shale oil economical would be around $18+/bbl, a few dollars above the then market price for oil. But this suggests fairly strongly that, at a doubling or tripling of current oil prices, shale oil would certainly be economical.

A liquefaction technology converting coal to liquid fuel has been in existence for many years, but the cost of the fuel is about three times that of crude oil (5). Another liquefaction process is producing small quantities of synthetic oil at a U.S. Department of Energy (DOE) pilot plant at Fort Lewis, Washington; the per-barrel cost of the fuel produced is estimated at about $30, in contrast to the current imported oil price of $20/bbl, but there are suggestions that the cost in commercial production might be considerably higher (6).

Although the conventional wisdom sees the world running out of natural gas and oil in the not-too-distant future, it is quite possible that the forecast is overly pessimistic. For example, a DOE group has predicted massive increases in gas supplies if prices were roughly doubled; admittedly, its Market-Oriented Program-Planning Study has never been officially sanctioned (7).

Though much expert opinion sees a decline in world oil production in a decade or two (8-9), similar forecasts have been wrong before. Thus, a panel of renowned geologists in 1922 argued that U.S. oil reserves were quite limited and would be exhausted in perhaps 20 years (10). Higher oil prices have furnished the incentive for substantially increased investment in enhanced oil recovery techniques and in oil exploration. Bonanzas remain possible; for example, consider the recent Mexican experience. That experience is documented in Table 1, which shows Mexican reserves of oil and gas over time as estimated by Pemex, the national oil company (11). Though Pemex has a reputation for conservatism and accuracy (12), its 1978 estimate of "proved and probable" reserves is more than twice a 1979 estimate of those reserves made by the U.S. Central Intelligence Agency (CIA), indicating the general uncertainty that attaches to data on reserves. Some comparable estimates by the CIA, in 10^{15} Btu, include the following: world, 6537; United States, 667; Saudi Arabia, 980; Iran, 969; and Mexico, 220.

Mexico's current production of oil is 1.4 million bbl/day, equivalent in Btu terms to 3×10^{15} Btu/year (1.4 million × 365 × 5.8 million). Pemex has a target of 2.2 million bbl/day by 1982, and the CIA has estimated a maximum production of 5-6 million bbl/day by 1985, equal to Iran's level until its change of government. But some experts predict higher levels of output, with exports reaching 10 million bbl/day by 1990, the maximum amount exported by Saudi Arabia in recent years (11, p. 17). Further, if credence is given to the reserve figures of Table 1, the Mexican addition to world reserves may be on the order of 20 percent of the current world "proved and probable" level, approaching twice the Saudi Arabian level. Hence, if it wanted to do so, Mexico might well be able to outproduce Saudi Arabia in the future.

The message, then, is twofold: (a) the depletion of oil and natural gas may occur much further in the future than many forecasts tell us, and (b) synthetic oil and

Table 1. Mexican estimates of oil and natural gas reserves.

	Reserves[a] (10^{15} Btu)				
Year	Proved	Probable	Total Proved and Probable	Potential	Grand Total
1938	7.0	-	7.0	-	7.0
1962	29.0	-	29.0	-	29.0
1975	36.5	-	36.5	-	36.5
1976	65.0	-	65.0	696.0	65.0
1977[b]	92.8	179.8	272.6	696.0	968.6
1978[b]	233.1	258.7	491.8	1160.0	1651.8

[a] Derived from data on barrels of oil-equivalent in reserves as listed in U.S. Senate report (11).
[b] As of December 31 of given year.

gas from shale oil and coal can replace oil and natural gas at a high, but not outrageous, price. I judge that even a doubling of price would not be outrageous on the basis of our recent energy experience. Some of the underlying causes and likely consequences of that experience are discussed in the following sections.

Causes of the Energy Crunch

If the perception that we are running out of energy is, at best, grossly exaggerated, how can we explain the energy crunch of the last six years? A number of interrelated explanations are possible. Some energy price increases likely would have occurred even in a competitive, or non-OPEC, world. Population increases, great increases in U.S. and European automobile ownership, and the European conversion from coal to oil for heating in the 1960s (13) meant considerable increases in the demand for energy, particularly for petroleum. U.S. environmental regulations have fallen heavily on energy production, limiting output and raising costs; and a similar regulatory process is under way abroad.

It is also likely that multinational oil companies depleted oil resources at a faster rate than was economical in many oil-producing countries; such would be a rational response to a fear of expropriation, a fear that generally has been realistic. Mexico is a case in point, both in terms of overpumping and expropriation (11).

Despite these competitive factors, it seems clear that most of the recent energy price increases are explainable as the monopolistic actions of a cartel, with Saudi Arabia as its dominant member and Iran, until recently, its leading junior partner. Also, it is plausible that many major non-OPEC producers attempt to act as de facto members of the cartel, restraining production to help keep prices up.

Finally, it seems likely that U.S. policies have aided and abetted the cartel. The Shah of Iran spent much of Iran's OPEC-generated gains on U.S. armaments, which suggests the tacit acceptance of higher oil prices in return for Iranian protection of the Persian Gulf. Again, our price controls on oil and natural gas have likely led to higher imports from OPEC than otherwise would have occurred. And last, higher oil prices have helped make Alaskan oil production economical, but it is U.S. policy to use all Alaskan production internally; this supply constraint should be of some help in keeping international oil prices high. Evidence to support these points follows.

Table 2 presents data on oil production of major nations or groups of nations for selected years (3). From Table 2 we can derive the following indexes of production by OPEC countries and by all other non-Communist countries, treating the 1973 output as the base index of 100:

Year	OPEC	Other Non-Communist
1973	100.0	100.0
1975	87.7	96.4
1977	101.2	103.4
1978 (January-June)	92.2	109.8
1978 (December)	97.9	117.4

The pattern of OPEC production seems consistent with deliberate output reduction; some observers have estimated that OPEC excess capacity may be as high as a quarter of its current output (14, p. D8). Table 2 suggests that much of this output shut-in is Saudi Arabian. There have been marked fluctuations in Saudi production. In late 1978, Saudi Arabia expanded its output considerably, perhaps in the expectation that the downturn in Iranian production was temporary. With the longer-term decision of the Iranian government to reduce its output to 3 million bbl/day (15, p. A23), about half its previous output, the Saudis probably decided it would be rational to cut their production back toward the roughly 8 million bbl/day they had adhered to since 1973, helping to drive prices up and sustaining higher revenues with less output. But in mid-1979, production was again increased. Various explanations are possible: an expected political quid pro quo, or an attempt to keep prices from increasing so much as to lead to a later glut, or even an attempt to ameliorate the contribution of a price increase to a likely economic recession in the United States, Europe, and Japan. The last explanation involves self-interest rather than altruism, given heavy Saudi investments abroad. In any event, Saudi clout seems evident.

Increased non-OPEC, non-Communist oil production is accounted for primarily by Alaskan, Norwegian, British, and Mexican production. But here some de facto cooperation with OPEC may limit the expansion. Norway has set a production ceiling of 1.8 million bbl/day for oil and natural gas and has postponed exploration north of the 62nd parallel, that is, about 160 km (100 miles) north of Bergen, where there may be huge oil reserves (16, p. 64). Although Britain has sought rapid development of North Sea oil, it also sharply increased taxes on that production, perhaps seeking to share in the OPEC profits but tending to dampen development (16, p. 36). Most analysts expect that Mexico will limit the exploitation of its recent finds. For example, "The production decision is a political one that will be made by the Mexican government. It is not realistic to expect the production decision to result in producing at maximum feasible levels at any time in the near future" (11, pp. 82-83).

U.S. policy may have aided OPEC directly through military-strategic considerations and indirectly through the effect of energy price controls and prohibitions. Relative to military-strategic considerations, George Ball noted that, in May 1972, President Nixon asked the Shah of Iran to function as our protector in the entire Persian Gulf area and maintain its oil supply. The Shah replied that he would do so provided he had the unrestricted right to buy our most advanced weapons (17). Ball adds that from 1950 through 1971 we had limited our aggregate military sales to Iran to only $1.2 billion; however, from 1972 onward, our aggregate military sales vaulted to $19.5 billion. (Even if we deflate the money values, the change is considerable.) Hence, it can be inferred that OPEC price increases in the Nixon administration had a beneficial aspect because a good portion of the gains was spent on armaments that the United States might otherwise have paid for itself. At this writing, it

Table 2. Production in selected major oil-producing nations.

Location	Production (bbl/day 000s) 1973	1975	1977	January-June 1978	December 1978
World	55 745	53 005	59 670	58 350	61 650
OPEC total (15 nations)	30 965	27 150	31 350	28 550	30 310
Saudi Arabia	7 595	7 075	9 200	7 760	10 400
Iran	5 860	5 350	5 665	5 570	2 370
Iraq	2 020	2 260	2 495	2 260	3 000
United States	9 210	8 375	8 180	8 650	8 760
Norway	30	196	280	350	360
United Kingdom	0*	20	770	980	1 350
Mexico	450	715	980	1 130	1 370
Communist countries	9 905	11 520	12 910	13 470	13 880

*Negligible.

can be hypothesized that Egypt may be viewed as a replacement for Iran in protecting the Middle Eastern oil supply, but it seems likely that armament costs will be shifted back to the United States. (The lack of support by Saudi Arabia for the Egypt-Israeli peace treaty might be interpreted as a ploy for shifting much of their defense burden to the United States.)

In regard to energy price controls and prohibitions, the political process in the United States has aimed at keeping energy prices to consumers low (or below market levels) and, insofar as that process has been successful, it has inhibited both consumer and producer response. Price controls on oil and natural gas give false signals. Consumers do not conserve as much and domestic producers do not produce as much as they would if they were given accurate signals. Consequently, U.S. imports from OPEC increase, relative to what they would have been in the absence of controls. Hence, our price control policies augment the power of the cartel. Again, the U.S. policy of prohibiting export of Alaskan oil, particularly the export of that oil to Japan, reduces the effective supply of Alaskan oil in world trade. The waste of much longer transportation of that oil, with much of it shipped to Gulf Coast ports via the Panama Canal, should make at least a modest contribution to keeping world oil prices high.

Energy Crunch and Consequences

Although OPEC imposed a fourfold price increase on crude oil in 1973, and this was transmitted to all energy prices, the crunch was somewhat ameliorated to consumers because the cost of energy typically includes a good deal of services by middlemen. These services, represented by wholesale and retail trade margins and taxes, have had less price inflation than the fuel component. Thus, the greater the proportion of these services, the smaller the percentage increase in energy prices; the maximum price increase occurs at the point of production, and the minimum at the household consumer level, with price increases to commercial and industrial users falling in between. The pattern is exhibited in the following indexes (18-21) of deflated 1977 prices on a 1972 base of 100 (deflation is obtained by dividing 1977 prices by the consumer price index for all items so that the effect of general inflation is removed, yielding a measure of "real" price change):

Energy Product	1977 Deflated Price (1972=100)
Petroleum products	
Gasoline at service station	120
No. 2 fuel oil (residential-commercial)	160
No. 6 fuel oil (industrial)	184
Natural gas	
Residential	136
Commercial	157
Industrial and other	269
Electricity	
Residential	115
Commercial	119
Industrial	213

After the 1973 price jump, energy prices were basically stable in real terms through 1978 and essentially moved in tandem with the rate of inflation. However, as most consumers are painfully aware, there has been a considerable spurt in real energy prices in 1979. These patterns are illustrated in Figure 1 (22) and are supported by the following data showing recent consumer price indexes for energy and all other items (23,24):

Item	Consumer Price Index (1967=100) November 1977	November 1978	June 1979
All items	185.4	202.0	216.6
Energy	211.2	225.9	275.4
All other than energy	183.6	200.4	212.2

Again, the price of regular, unleaded gasoline to the private motorist shows a deflated (or real) increase of about 20 percent between 1973 and 1974, relative stability through 1978, and a further increase of about 15 percent from 1978 to July 1979 (18, 25,26):

Year	Gasoline Price (cents/gal) Current	Deflated (real) 1972 Base
1970	35.69	38.46
1971	36.43	37.63
1972	36.13	36.13
1973	38.82	36.55
1974	52.41	44.45
1975	56.20	43.67
1976	58.70	43.13
1977	62.60	43.20
1978	64.00	42.66
1979 (June)	82.58	47.76
1979 (July)	87.86	50.23

Table 3 (18, pp. 4-14) shows broad patterns of U.S. energy use and production from 1972 through 1978. Total production of energy was relatively stable, with a slight downtrend from 1972 through 1975, and then a moderate upturn through 1978. Consumption showed

Figure 1. Energy cost to U.S. consumers over time by fuel type.

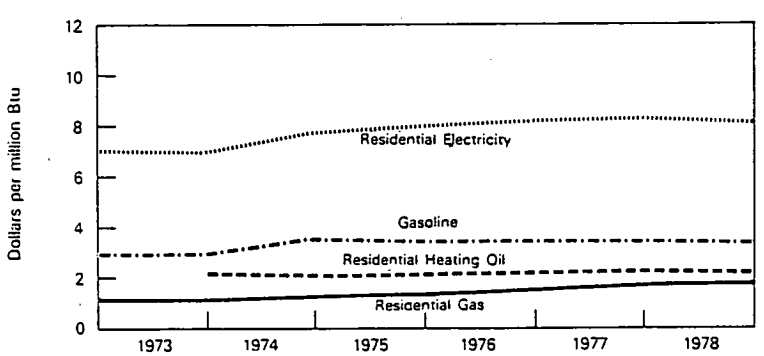


Table 3. Broad patterns of U.S. energy use and production.

Factor	Use and Production (10^{15} Btu) 1972	1975	1978
Major categories			
Production	62.81	60.02	61.03
Consumption	71.64	70.68	77.67
Exports	2.13	2.39	1.95
Imports	11.50	14.08	18.50
Petroleum imports			
Crude oil and refined products	9.81	12.49	16.40
Consumption by function			
Residential-commercial	25.36	26.20	29.35
Industrial	28.18	26.12	27.90
Transportation	18.10	18.36	20.42
Domestic production by source			
Natural gas and natural gas liquids	24.79	22.02	21.50
Crude oil	20.04	17.73	18.36
Coal	14.50	15.20	15.14
All other*	3.48	5.07	6.03

*Includes hydroelectric power, nuclear power, and geothermal elements, wood, and refuse for power. During the period, hydroelectric power was stable at around 3.00; nuclear power grew from 0.58 to 3.01; and the geothermal group was negligible at around 0.08.

some decline by 1975, but expanded thereafter, and by 1978 was well above 1972 levels. Imports consequently showed considerable expansion; most of the increase was accounted for by crude oil imports.

Subcategories show considerable variation. If 1972 is the base year, then industrial use of energy is essentially unchanged. Residential-commercial and transportation uses increase by 10-15 percent. These differences can be tied to the differences in price increases noted earlier; industrial use was faced with substantial real price increases, and other uses had relatively modest price increases.

The hypothesis may be presented that oil and gas price controls have effectively reduced incentives for consumers to conserve their use of energy and for producers to expand energy production. Consequently, although the increased imports shown in Table 3 may primarily reflect depletion of U.S. domestic resources, it is likelier that controls are a major factor.

The price control system is based on legal distinctions between "old" and "new" production, the former initiated before a given date and the latter, after that date. Generally, the price of old production is well below market price, and that of new is close to, but a bit below, market price. Thus, as of October 1978, these crude oil prices per barrel prevailed (18): U.S. lower tier (old), $5.60; U.S. upper tier (new), $12.43; and landed cost, imports from Saudi Arabia, $13.89.

Similarly, the Natural Gas Policy Act of 1978 set prices for different classes of natural gas, depending on the date the gas well commenced. Prices do include an inflation adjustment factor. As of October 1978, some of the prices set were (27)

Date Gas Well Started	Price ($/Btu 000 000)
Prior to January 1, 1973	0.33
1973 or 1974	1.06
January 1, 1975-February 18, 1977	1.63
After February 19, 1977	2.07

Obviously, oil prices paid to some domestic producers are considerably below what we pay OPEC. A corresponding situation in natural gas was one of the factors that led to the 1977 decision not to purchase large quantities of natural gas from Mexico.

Gradual decontrol of oil prices was initiated in June 1969, and, if it continues as planned, domestic oil prices as of October 1981 will be close to the world level. Thereafter, however, prices will be pegged to the general rate of inflation rather than to world (or OPEC) prices. Similarly, the expiration of gas price regulation is set for 1985, but further extensions would not be surprising.

The underlying rationale for price controls appears to have these elements: (a) once oil or gas is discovered, a fixed amount of output will be produced—whatever the price; (b) price incentives can bring about some new discoveries, but they are very likely to be modest because we have discovered roughly all there is to be discovered; (c) it is unfair to set prices too high; (d) the poor will suffer inordinately if controls are removed; and (e) removal of price controls now will fuel inflation. Some rebuttals to this rationale follow:

1. Old oil or gas wells likely could produce more at higher prices; for example, secondary recovery techniques could become economic at higher prices. Again, a low price could cause a well to be shut down earlier than necessary.
2. The only way to check the validity of imminent depletion is to test it in practice by allowing prices to rise.
3. There really is no such thing as a fair price. You might feel that a 10 percent higher price for what you sell and a 10 percent lower price for what you buy would be fair. But then, so might parties on the other side of those exchanges and with as much justification.
4. If the poor really do bear more of the burden of decontrol, then consider compensating them by income supplements. However, then the problem is one of poverty and not of energy.
5. The inflation argument is somewhat inaccurate and considerably misleading. It is inaccurate because measured price indexes have basic flaws. It is misleading because its focus is on price rather than on real income, and it fails to discriminate between two very different cases: (a) a general increase in all prices and in money income versus (b) an increase in the price of one commodity (or group of commodities) only, with no compensating increase in money income.

The official consumer price index—and indexes generally—has the basic flow of assuming an unchanging market basket. But if one commodity increases markedly in price relative to all others, consumers will shift away from that item. As a result, the market basket changes. Consequently, price indexes always involve some overstatement and, in the case of marked energy price increases, could involve a fair amount of overstatement. Incidentally, my use of price indexes earlier must now be qualified by recognition of this flaw. However, because energy prices at the consumer level—at least until recently—have not increased as much as commonly perceived, measurement error has probably been fairly modest.

In its pure sense, inflation to the economist means an increase in all prices although real income is unchanged. In the purest sense, all prices increase in the same proportion. The causal mechanism typically is an increase in the money supply, or its equivalent—an excess of government spending over revenue. If dollars double but goods remain the same, then prices double. In effect, we have changed our measuring rod, as if we had decided to label a half-inch rather than the inch as one unit. Consequently, a foot will now "trade" for 24 units rather than 12, but real lengths are unchanged.

In institutional practice, however, the numerical measurement of debts remains unchanged, so that a dollar of debt is cut in half in real terms, given a doubling of the general price level (all prices). This is pleasant for debtors and unpleasant for creditors. You will recall that in U.S. history, inflation was a preferred device for redistributing income from the rich (creditors) to the poor (debtors). Unfortunately for egalitarianism, the identification of the poor or relatively poor with debtors is no longer so clear-cut. The erosion of some savings of the relatively poor (assets in monetary form such as life insurance), the uncertainty imposed on planning, and the time and effort spent in getting around or ameliorating the effects of inflation are some of its real costs. If it is very difficult to protect savings under inflation, then investment, and consequently income growth, may suffer. But this is a consequence of our institutional practice in measuring debt; in countries where indexing occurs (e.g., Argentina and Israel), inflation is a nuisance but its real costs seem mild.

In contrast, an increase in the price of one commodity (such as energy) could be balanced by an offsetting decline in the prices of other commodities that just manage to keep real income unchanged. More generally, however, an increase in one price is usually associated with changes in real income. If the price rise occurs in something we buy (or import), rather than in something we sell (or export), and nothing else changes, then obviously we are worse off because our real income has declined. This is the nub of our complaint, and it is undiscriminating to label the problem one of inflation. In effect, OPEC has imposed a considerable tax on us, and the OPEC cartel members are the chief beneficiaries of that tax. Removal of price controls would shift some of those benefits from OPEC to domestic producers and to the federal treasury, depending on the level of excess profits tax ultimately imposed.

I have estimated that energy spending in 1972 accounted for about 5 percent of personal income and that household spending on energy equalled roughly half of all spending on energy (21).

Given those numbers, I would guess that the energy price increase initially cost Americans roughly 1-2 percent of their real income, and that, although some of that impact was ameliorated over time as people adjusted to changed circumstances, our growing import dependence on OPEC probably has balanced that trend. Hence, the tax bite by OPEC has likely absorbed a large percentage of our growth in income in recent years. As a consequence, the perception of a moderate price increase through 1978 does not preclude me from also agreeing with the general perception that the energy crunch is a pressing national problem with major consequences. The 1979 round of price increases underscores that conclusion. I would even agree that energy price increases may have contributed to inflation, but I see the process as indirect. As U.S. Rep. David Stockman (R.-Mich.) has suggested (28), the industrial nations may have inflated their economies in an attempt to counter the depression-inducing impact of the OPEC price rise; in any event, this counterstrategy was not too successful.

Because the energy market has inelastic demand and supply, short-term shifts in supply can cause considerable price swings, perceived as gluts or shortages in quantities available as prices are on their way to a new equilibrium. At this writing, for instance, it seems quite possible that the shortages and price increases of 1979 will be followed by another short-term glut. In the longer run, however, it seems reasonable to expect upward pressures on energy prices from increasing world population, automobile ownership, and environmental concerns. Doubts about nuclear power, fed by the Three Mile Island scare, OPEC's successes to date, and Saudi Arabia's dominant position in OPEC, and the perception by potential competitors of the benefits of monopoly must dampen hopes that the pressures will be countered or greatly slowed by competitive forces. The availability of synthetic fuels implies an upper bound on price increases. However, although those fuels should eventually become economic, the recent interest in speeding their production seems decidedly premature. Why pay double for what might be available for a considerable period at current market prices, given an end to controls? With an end to controls, I would expect prices to consumers to increase somewhat, followed by a gradual upward trend for a great many years before the price reached the synthetic fuel level.

One consequence of my guardedly optimistic forecast is that, for a considerable time to come, energy is likely to have important implications for the regional distribution of population and for transportation planning by the states. Those implications are now considered in detail.

ENERGY AND POPULATION DISTRIBUTION

Increases in the real price of energy appear to have considerable effect on the way people and economic activities sort themselves out. Effects from the supply side are easiest to see, with obvious expansions and booms in coal-, oil-, and gas-producing areas. But I believe that there are important effects from the demand side also, with population tending to move to places where the living is easier—that is, relatively easier—after a former balance has been disturbed. At the regional level, both the demand and supply shifts should intensify the shift to the sunbelt—a term used loosely to denote West and South—as against the frostbelt of the Northeast and North Central regions of the United States.

At the finer grain of the settlement, I expect that there are changed patterns also, but the shifts seem more open to question. I lean toward predicting that higher transportation and heating costs cause more clustering; however, this might take the form of greater centrality and higher density within urban areas or of greater development of settlement nodes or perhaps both. I would also predict a shift in comparative advantage to smaller places because of greater trip length with increasing size of place. This shift could be tied to the combined effects of inflation and the progressive income tax. People are moved into higher income tax brackets by inflation, and I believe the additional tax burden is higher in the North than in the South and that it increases with size of place because of price-level differences by locale. Because I have argued that inflation may have been a deliberate response to the OPEC price increase (but have denied the common argument that inflation is caused by energy price increases), it follows that the population shift in question is an indirect, rather than direct, effect of the OPEC energy price increase. That population shift embraces both (a) the inverse relation between size of metropolitan area and population growth (including absolute declines in the largest metropolitan areas) and (b) the rural turn-around—the revival of growth in nonmetropolitan places. It also follows that inflation is an additional factor causing a shift to the sunbelt South. Finally, a surprising amount of fuel extraction activity occurs within standard metropolitan statistical areas (SMSAs). Thus, boom-town effects can occur in Denver and Houston, as well as in Gillette, Wyoming.

All of these shifts are affected, and often tempered,

by public policies. Energy price regulation has tended to inhibit the growth of old energy locales and speed up that of new energy locales, so that growth in the Rocky Mountain area has been somewhat accelerated and growth in the Southwest somewhat retarded, relative to what would have been the case without regulation. Some recent air pollution regulation seems an obvious device to protect coal and coal miners in the East against the competition from the West.

I will now discuss these perceived relations in detail and present some key evidence about them. However, such evidence is often thin; therefore, my perceptions will require further development and refinement.

I will use a two-way classification, first covering state and regional relations and then turning to local settlement questions; within each topic, I will first consider production and then turn to consumption relations.

Fuel production and consumption are interrelated, of course, as shown in Figures 2 and 3 (29). These figures, respectively, map U.S. energy production by county and fuel use per capita by county, both in terms of Btu. A rather good association occurs between the two mappings, as can be verified by superimposing one map on the other. I would explain this result by noting that fuel is rather expensive to transport, in terms of value relative to weight. Hence, fuel should have a considerably lower price near its point of origin, yielding an incentive for heavier use as that point is approached. A corollary is the tendency of industry to specialize in the use of locally produced fuel, for example, natural gas in Texas and coal in Pennsylvania.

State and Regional Production Relations

Table 4 shows estimated 1978 production of petroleum, natural gas, and bituminous coal in trillion Btu, by state (30-32). By using the same sources for earlier years (33-35), some key production patterns can be traced out. Because oil and natural gas tend to be associated, they are considered here jointly in terms of state shares of U.S. production and change in output over time. Shares of U.S. oil production are indicated below:

Area	Share of U.S. Oil Production 1972	1977	1978	Output 1978/1972
Texas	0.377	0.381	0.340	0.823
Louisiana	0.258	0.189	0.169	0.599
California	0.100	0.117	0.109	0.996
Alaska	0.021	0.057	0.145	6.295
Rest of United States	0.244	0.256	0.237	0.891
U.S. total	1.000	1.000	1.000	0.916

Shares of U.S. gas production are shown in the following table:

Area	Share of U.S. Natural Gas Production 1972	1977	1978	Output 1978/1972
Texas	0.384	0.352	0.333	0.756
Louisiana	0.354	0.360	0.368	0.907
Oklahoma	0.080	0.088	0.090	0.982
New Mexico	0.054	0.061	0.061	0.980
Rest of United States	0.128	0.139	0.148	1.014
U.S. total	1.000	1.000	1.000	0.873

The dominant role of Texas and Louisiana in both oil and gas production is manifest. However, in both cases, production for those states shows a marked downtrend. As argued earlier, both price control and depletion may be sources of the decline. (There is evidence that Louisiana's oil production decline involves depletion to a considerable degree.) Alaskan oil production began its upward climb in 1977, with the advent of North Slope shipments, and by 1978 had almost attained the Louisiana output level. The general decline in gas production has often been treated as a clear manifestation of depletion. Recently, however, some new gas supplies have become available in many places where no new hookups had been allowed in years. At the time, U.S. Secretary of Energy James Schlesinger argued that higher gas prices had stimulated a surprising amount of gas production (36). More likely, however, the current gas bubble primarily involves a shift to interstate use of gas formerly sold in intrastate markets because of much higher prices in those markets. The new gas law removes that incentive. Of course, higher prices should stimulate at least some new gas production and, perhaps, a considerable amount will eventually be realized. Note that some increased production from 1972 to 1978 occurred for the group of states other than the leading producers.

Total U.S. coal production increased considerably from 1972 through 1978, but there was a small decline, relative to the previous year, in 1978. However, eastern tonnage produced remained relatively constant from 1972 through 1977 and then declined by about 10 percent. Western production, on the other hand, increased throughout the period, moving from a 10 percent share of total production to almost 30 percent in 1978. The shares of total coal production are indicated in Table 5.

The switch to western coal is not surprising because it is cheaper and cleaner than eastern coal. Most western coal is strip-mined, and strip-mined coal typically is much cheaper than coal mined underground; thus, strip-mined coal can compete with the underground variety, even though its length of haul typically is much greater. In 1971, the production of strip-mined coal just equalled that of coal mined underground, but by 1978 its output was 1.5 times that of underground coal (36, p. 81). In addition, western coal has a much lower sulfur content than eastern coal. The Clean Air Act Amendments of 1977 call for a percentage reduction in emissions for all coal used in new utility boilers, rather than the meeting of a specific target or standard. In practice, this will probably mean that low-sulfur coal will be subject to as costly a sulfur dioxide removal process (full scrubbing) as high-sulfur coal, often removing its competitive advantage as well as a much smaller absolute amount of pollutants. Not surprisingly, economic analysis of alternatives indicates that the full-scrubbing rule is not cost-effective; it costs more and achieves no greater pollution reduction than alternative regulations that implement the Clean Air Act Amendments (37). In any event, whatever the final form of regulation, the percentage reduction rule seems obviously intended to protect eastern coal production from western competition.

Increased energy prices have brought both increased wage rates and employment in energy extraction, documented for the nation in Table 6 (38-39). Table 6 compares wage rates and employment in the energy extraction industries to other industries, with some focus on transportation industries. Wage rates are in index number terms, setting the U.S. average wage rate for all industries at 100 in every year covered. From Table 6 we can derive the following ratios of 1977 to 1972 levels:

Industry	1977/1972 Wage Rates	1977/1972 Employment
All industries	1.00	1.10
Coal	1.14	1.51
Oil and gas	1.15	1.41

Figure 2. Total U.S. fuel and hydroproduction by county.

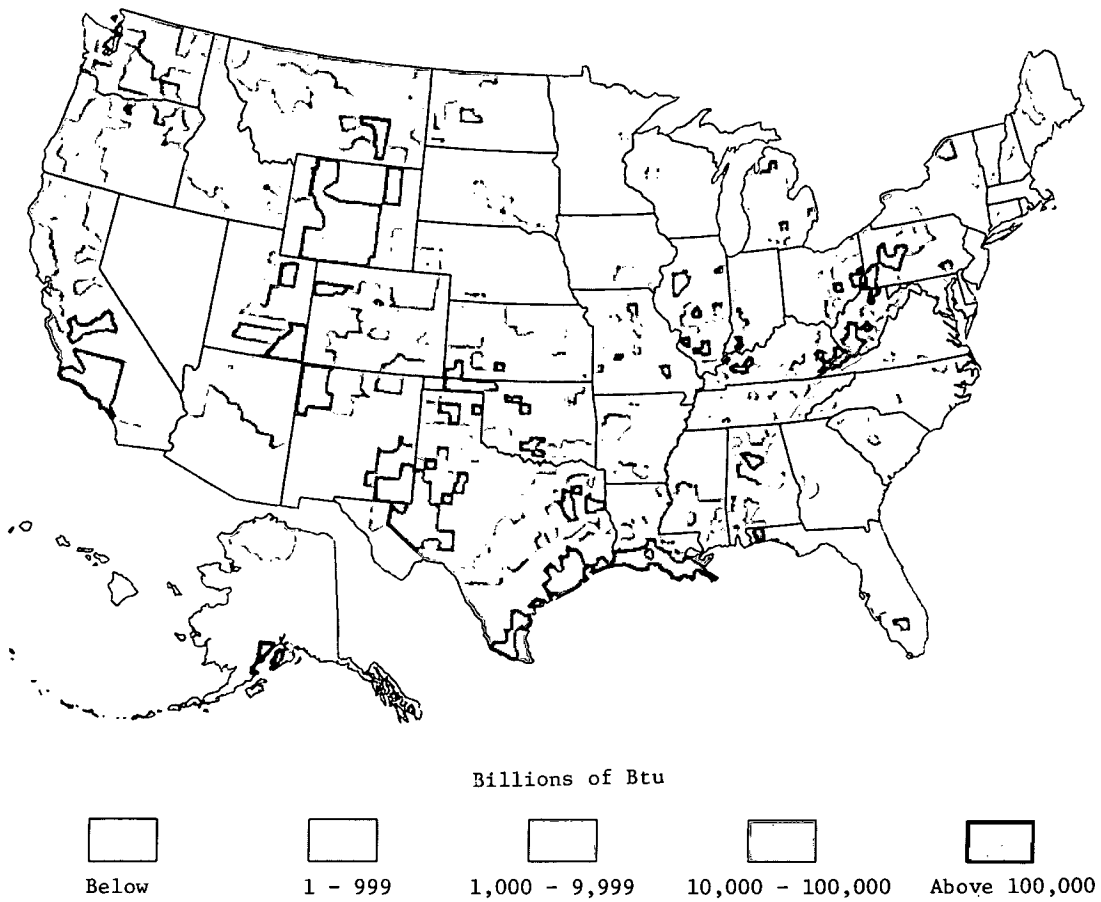
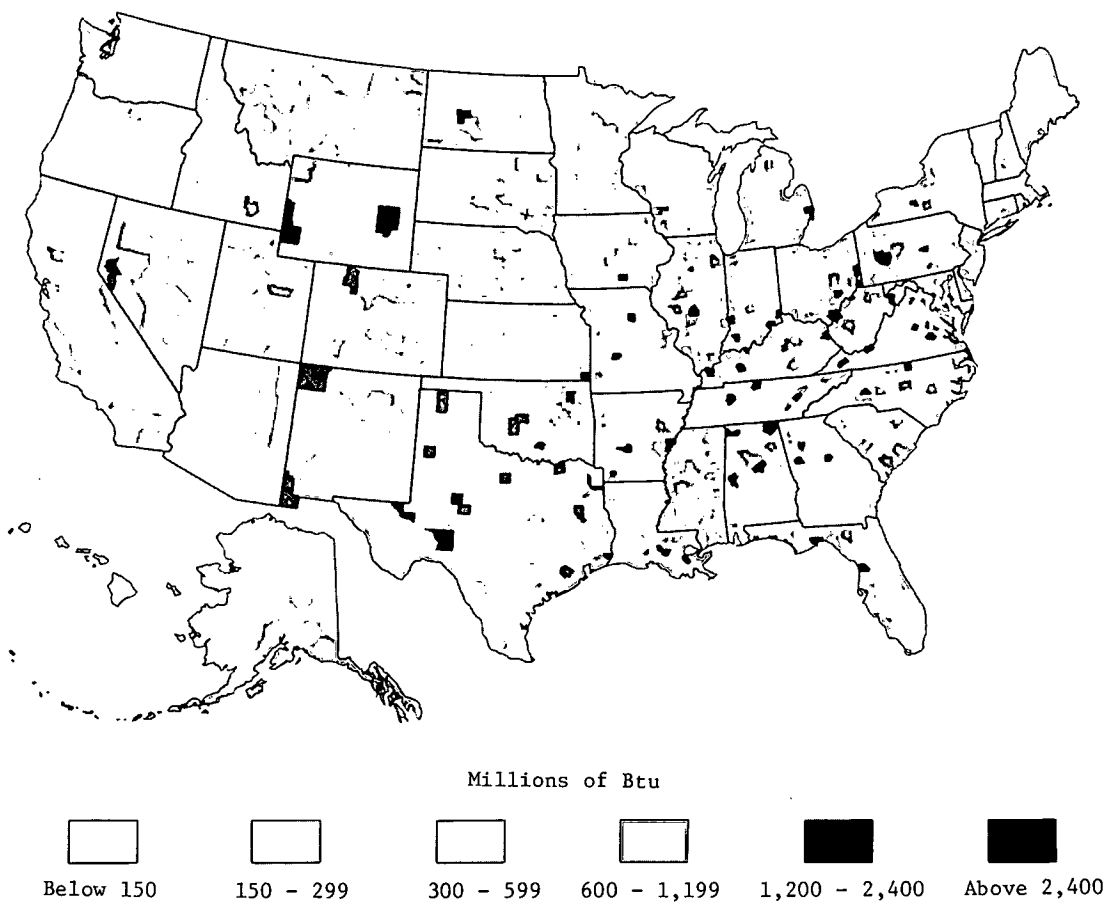


Figure 3. U.S. fuel use per capita.



Fuel extraction wage rates, both in coal and in oil and gas, were about 25 percent above the national average in 1972; and by 1977, the differential had risen to 45 percent. None of the other industries shown did as well, although wage rates for the railroads rose 9 percent (derived from 149.8/136.9) relative to the U.S. average. Perhaps increased coal hauling was a factor. In contrast, relative wage rates in air transportation rose 2 percent, those in trucking fell 3 percent, and those in public school teaching fell 4 percent. (All are measured relative to U.S. average wage rates.) Of course, caution must be exercised in interpreting such statistics, for changes in composition may be involved. For example, if relatively more low-paid than high-paid jobs are eliminated in a declining industry such as the railroads (porters rather than engineers, for example), then measured average wage rates will increase.

Table 7 presents some parallel information. It shows labor and proprietor income for coal mining and for oil and gas extraction in the major producing states (40). In all cases, income generated in those industries increased considerably faster than did income produced in all U.S. industries.

Some informed speculations can be based on comparisons of tables. Tables 6 and 7 yield the following measures of income growth in fuel extraction relative to income growth in all industries over the period 1972-1977:

Industry	Proprietor and Labor Income	Labor Income
Coal	1.51	1.56
Oil and gas	2.06	1.47

Table 4. Production of petroleum, natural gas, and bituminous coal and lignite by state, 1978.

Region and State	Production (10^{12} Btu)[a] Petroleum	Natural Gas	Bituminous Coal and Lignite	Total
New England				
Connecticut	0.0	0.0	0.0	0.0
Maine	0.0	0.0	0.0	0.0
Massachusetts	0.0	0.0	0.0	0.0
New Hampshire	0.0	0.0	0.0	0.0
Rhode Island	0.0	0.0	0.0	0.0
Vermont	0.0	0.0	0.0	0.0
Mid-Atlantic				
New Jersey	0.0	0.0[c]	0.0	0.0
New York	2.9	10.9[c]	0.0	13.8
Pennsylvania	22.6	93.6[b]	1732.4	1 848.6
East North Central				
Illinois	138.0	1.0[b]	1081.3	1 220.3
Indiana	26.7	0.2[c]	517.2	544.0
Michigan	201.8	151.0	0.0	352.8
Ohio	85.8	101.3[b]	965.4	1 152.6
Wisconsin	0.0	0.0	0.0	0.0
West North Central				
Iowa	0.0	0.0	12.1	12.1
Kansas	327.1	871.8	13.9	1 212.8
Minnesota	0.0	0.0	0.0	0.0
Missouri	0.6	0.0	113.6	114.2
Nebraska	33.6	2.9[b]	0.0	36.5
North Dakota	140.4	29.8[b]	320.9	491.0
South Dakota	5.2	0.0	0.0	5.2
South Atlantic				
Delaware	0.0	0.0	0.0	0.0
District of Columbia	0.0	0.0	0.0	0.0
Florida	274.3	52.6[b]	0.0	327.0
Georgia	0.0	0.0	7.5	7.5
Maryland	0.0	0.1	106.0	106.1
North Carolina	0.0	0.0	0.0	0.0
South Carolina	0.0	0.0	0.0	0.0
Virginia	0.0	8.4[c]	656.2	664.6
West Virginia	12.2	151.6	1871.6	2 035.3
East South Central				
Alabama	111.9	58.4[b]	456.8	627.1
Kentucky	33.1	62.1[b]	2905.3	3 000.5
Mississippi	228.5	108.8	0.0	337.3
Tennessee	3.5	0.3[b]	254.0	257.8
West South Central				
Arkansas	120.1	109.0	14.2	243.2
Louisiana	3098.4	7376.3	0.0	10 474.6
Oklahoma	871.7	1809.4	114.6	2 795.8
Texas	6234.4	6680.5	433.6	13 348.5
Rocky Mountain				
Arizona	2.3	0.2[b]	257.9	260.4
Colorado	212.3	187.4	312.7	712.4
Idaho	0.0	0.0	0.0	0.0
Montana	175.2	47.5	657.4	880.2
Nevada	8.1	0.0	0.0	8.1
New Mexico	483.7	1215.8	277.7	1 977.2
Utah	177.5	58.9	231.2	467.5
Wyoming	652.5	341.8	1273.0	2 267.3
Far West				
Alaska	2661.6	207.2	16.9	2 885.7
California	2003.9	319.7	0.0	2 323.6
Hawaii	0.0	0.0	0.0	0.0
Oregon	0.0	0.0	0.0	0.0
Washington	0.0	0.0	107.3	107.3

[a] U.S. totals are petroleum, 1349.9; natural gas, 20 058.5; bituminous coal and lignite, 14 710.7; total, 53 118.9. Small differences in totals occur between this table and Table 3. Coal difference represents anthracite production, which is concentrated in Pennsylvania. Natural gas difference occurs between sources and may involve Btu scale factor differences.
[b] Estimated from 1977 value and 1978 total for states in this group.

Table 5. Regional U.S. shares of total coal production, 1972-1978.

Region	Major States	Share of U.S. Total 1972	1974	1976	1977	1978
East Atlantic	Pennsylvania, West Virginia, Virginia	0.395	0.364	0.350	0.319	0.297
East Central	Illinois, Indiana, Ohio, Kentucky	0.497	0.484	0.449	0.439	0.420
West	Montana, North Dakota, Texas, Wyoming	0.108	0.152	0.201	0.251	0.283

Note: Regions are defined by combining the "standard" U.S. Bureau of the Census divisions. Atlantic refers to Mid-Atlantic plus South Atlantic; East Central refers to East North Central plus East South Central; and West refers to West North Central plus West South Central plus Rocky Mountain plus Far West.

Table 6. U.S. relative wages and employment in selected industries and years, 1929-1977.

Item	1929	1950	1972	1975	1977
Wages and salaries per full-time equivalent employee relative to U.S. value (all industries)					
All industries	100.0	100.0	100.0	100.0	100.0
Coal mining	97.8	107.1	128.2	147.2	146.4
Oil and gas extraction	141.4	128.1	124.8	138.8	143.8
All manufactures	108.1	109.9	107.8	109.9	112.3
Railroad transportation	122.5	124.7	136.9	141.8	149.8
Local-interurban passenger transportation	111.9	108.7	85.1	85.8	84.8
Air transportation	183.8	134.3	159.2	157.7	162.1
Trucking and warehousing	90.9	114.5	124.8	117.3	120.8
Public education	101.2	92.2	105.7	102.8	101.9
Employment (000s)					
All industries	35 338	48 527	72 348	74 374	79 508
Coal mining	622	469	159	210	240
Oil and gas extraction	159	259	258	316	365
All manufactures	10 428	15 101	18 548	17 730	19 171
Railroad transportation	1 845	1 373	567	523	523
Local-interurban passenger transportation	410	352	253	244	245
Air transportation	2	86	329	345	366
Trucking and warehousing	252	572	1 089	1 067	1 168
Public education	1 082	1 536	4 577	4 998	5 121

Table 7. Labor and proprietor income, 1972-1977.

Industry and Region	Income ($000 000s) 1972	1975	1976	1977	1977/1972
United States, all industries	746 506	950 902	1 049 209	1 163 252	1.558
Coal mining					
United States	2 099	4 457	4 443	4 946	2.356
Pennsylvania	405	800	771	834	2.059
West Virginia	641	1 110	1 229	1 294	2.019
Illinois	170	292	343	382	2.247
Indiana	45	84	100	119	2.644
Ohio	148	312	308	332	2.243
Kentucky	325	933	804	933	2.871
North Dakota	5	10	13	17	3.400
Montana	3	16	18	22	7.333
Wyoming	9	30	54	85	9.444
Oil and gas extraction					
United States	2 963	5 781	7 870	9 516	3.212
Louisiana	553	901	1 144	1 371	2.479
Oklahoma	365	676	934	1 122	3.074
Texas	1 112	2 272	2 981	3 629	3.263
Colorado	81	182	245	303	3.741
Wyoming	67	168	224	289	4.313
Alaska	25	107	129	173	6.920
California	258	462	595	678	2.628

These results suggest that proprietor income grew considerably more in oil and gas extraction than in coal mining, with proprietor income growing at a lesser rate than labor income in coal mining and at a higher rate than labor income in oil and gas extraction. (Composition changes over time may also be involved.)

If we compare U.S. growth in output with growth in employment by using Tables 3 and 6, we obtain the following:

Industry	1977/1972 Output	Employment	Employment/ Output
Coal	1.10	1.51	1.37
Oil and gas	0.87	1.41	1.62

Employment increased considerably more than output. This could be interpreted as supporting the depletion hypotheses that (a) new output can be obtained only by considerably expanding inputs and (b) output may decline even if inputs are increased. However, there are alternative explanations. In oil and gas, much of the increase in employment may represent exploration and development of new supplies. Typically, there is a considerable time lag between discovery and full development in oil and gas production (6-10 years appears typical). In the case of coal, the differential is concentrated in eastern production, based on these comparisons of 1976 to 1972 levels [Table 4 and (36, p. 88)]:

State	1976/1972 Output	Employment	Employment/ Output
East			
Kentucky	1.19	1.38	1.16
West Virginia	0.88	1.20	1.36
Pennsylvania	1.13	1.38	1.22
Illinois	0.89	1.29	1.45
West			
Montana	3.19	2.92	0.92
Wyoming	2.82	2.67	0.95

The difference may reflect the different impacts of health and safety rules and of union power and strikes on the respective regions.

Fuel extraction accounts for roughly 1 percent of U.S. employment and earnings, if one applies the data in Tables 6 and 7:

Factor	Percentage of U.S. Total 1972	1977
Employment	0.0058	0.0076
Labor and proprietor income	0.0068	0.0124

However, (a) fuel extraction is of much more importance in many of the major fuel-producing states, and (b) multiplier effects from the expansion of fuel production should ripple through the local, state, and regional economies. On the first point, the share of fuel extraction in all labor and proprietor earnings is shown here for seven major fuel-extracting states in 1972 and 1975 (40-41):

State	1972	1975
Pennsylvania	0.0100	0.0168
Montana	0.0078	0.0169
Texas	0.0296	0.0443
Louisiana	0.0532	0.0630
Oklahoma	0.0483	0.0685
Wyoming	0.0661	0.1115
West Virginia	0.1319	0.1667

On the second point, a statistical analysis compared growth in state per capita income for those seven major fuel-extracting states to that for all other states from 1972 to 1975. It was concluded that per-capita income grew by 4 percent more in the former than the latter states (42).

That 4 percent growth should be distributed among (a) wage rate increases for those in fuel extraction in 1972, (b) increased wage rates for new workers who moved into fuel extraction between 1972 and 1975, and (c) multiplier effects. It is likely that much of the increase falls under the heading of multiplier effects. By using the data on fuel-extraction share of earnings in the seven major fuel extraction states, I distributed the 4 percent increase as 0.6 percent to wage increases for those in fuel extraction in 1972, a maximum of 1.5 percent in increased wage rates for new workers (obtained only if those workers had no wages in 1972), and a minimum of 1.9 percent to multiplier effects. (For the seven states of interest, fuel extraction averaged 0.05 of total state earnings in 1972, and wage rates in fuel extraction, relative to other wages, increased by roughly 15 percent from 1972 to 1975. These magnitudes yield the 0.6 percent increase to workers in fuel extraction. Then, because the fuel extraction earnings averaged 0.07 of all earnings in the seven states in 1975, relative to 0.05 in 1972, it follows that the maximum amount of new income attributable to fuel extraction is 1.5 percent, occurring only if all new workers were previously unemployed.)

For the long term, it seems likely that energy development will tend to be concentrated in the West; new coal, oil, and gas deposits and discoveries appear concentrated in the western region, as are shale oil and geothermal energy resources. Solar energy seems likely to be most economical in the desert Southwest and southern Florida, though some observers see bright prospects further north (43-44). And there is the possibility of oil and gas production off the East Coast, but, at this writing, prospects do not appear encouraging.

The concentration of new energy development in the West, and to a lesser degree in the South, should lend some impetus to sunbelt growth. I have argued that oil and gas price controls may well have accelerated Rocky Mountain energy resource development and somewhat retarded that of Texas and Louisiana because of the distribution of old and new production. With the re-

laxation of controls, we may get a temporary reversal of those trends; western coal may not compete as well with more plentiful supplies of oil and gas as it does with eastern coal. Further, western coal development may be slowed somewhat by air pollution regulations, noted earlier, and by the imposition of relatively heavy severance taxes in some western states (taxes taking a share of the value of minerals production). Similar constraints have been placed on Alaskan oil production (45). Nevertheless, the long-term thrust seems favorable to western expansion.

Both Steven McDonald (46) and William Miernyk (47) see massive regional shifts induced by changing energy relations, with stagnation in the East, some growth in the Southwest, and major growth in the Rocky Mountain region. I believe the predicted direction of change is accurate, but the magnitude of the shift seems likely to be overstated because energy is only one among many location factors. Given the current interest in energy, it is easy to overstate its importance in general and its effect on location in particular.

State and Regional Consumption Relations

Table 8 (21, p. 27) presents estimates of Btu consumption, dollar expenditures on energy, and price indexes for energy for the household sector and for all sectors of the economy—including government and business sectors—as well as households. The household sector use of energy includes private consumer spending on fuel for automobiles and motorcycles and for private airplane and boat use, as well as for residential heating. However, residential heating is the major factor explaining the regional differentials in Btu use by households. Note the decline in use as we move in a southwestward direction from New England. In addition to greater Btu use as a function of geography, there is some reinforcement of the pattern because energy prices tend to decline in a southwestward direction also. Higher energy use in the Northeast, reflecting the influence of a nastier climate, occurs despite the higher prices; if prices were lower, energy consumption would be higher. The upshot of both higher consumption and higher prices was that, in 1972, there was a considerable spread in household spending per capita between regions, with the greatest spread ($86) occurring between the Far West and New England. At the state level, Massachusetts' spending per capita ($299) exceeded California's ($208) by $91, and Vermont's spending ($353) exceeded Hawaii's ($168) by $185, the maximum amount. I estimated earlier that energy prices rose by 20 percent in real terms between 1972 and 1977, with most of the increase occurring early in that period. It follows that the Massachusetts-California differential should have increased by $18 per capita in 1972 dollars. In 1979 prices, that translates into $30 per capita. Given roughly three persons per family (based on census data) and assuming no change in consumption (obviously somewhat overstated), a family would gain an additional $100 annually by moving from Massachusetts to California. (This is in addition to the original 1972 differential.) An annuity of $100 per year would be worth somewhere around $1000 to $2000 in value, depending on whether we discount it by a 5 or 10 percent real interest rate, and whether we treat it as a perpetual return. Now it is likely that for most families in Massachusetts, the gain of $1000 is not enough to warrant a move to California. Moving can cost a good deal. But for some families, particularly those thinking of making such a move, the gain could tip the balance in favor of the move. I have assumed that (a) equilibrium held in 1972 and (b) the $91 energy differential between California and Massachusetts was not enough to make the Massachusetts family move because of the cost of the move and benefits obtained in Massachusetts and not in California. However, the full value of the annuitized differential is on the order of $4000 to $12 000 (that is, if we start with $91 plus $18 equals $109, instead of the increment of $18). A dollar amount of that level could be expected to have considerable impact on regional population shifts.

I think it did. I believe that, initially, enough people shifted locations in a southwesterly direction to considerably affect population growth, particularly in California. Much of the energy differential, however, was capitalized into land values. Newcomers bid up the price of California housing; this led to substantial increases in California property values and then in property taxes. The first effect inhibited some of the immigration from other states by reducing the incentives for such movement. The second helped to bring on the passage of Proposition 13. There was less of a shift to Arizona and Florida, probably because of heavier reliance on electricity for air conditioning in those states. (In 1972, household energy expenditures per capita were $14 higher in Arizona and $40 higher in Florida than they were in California.) The effects of Proposition 13 may linger longer than the original source of that change.

The response of industry to energy price changes may rival in importance that of households in regional impacts, but an appealing scenario seems much more difficult to construct. States and regions with access to relatively cheap forms of energy might find that access more valuable after the 1973 price rise; on the other hand, states and regions that learned to economize in energy use because of relatively high prices facing them before 1973 might have been relatively insulated from the price shock.

Table 8. Energy use by households and all sectors, 1972.

Region	Household Use			All-Sector Use		
	Per-Capita Consumption and Expenditures			Per-Capita Consumption and Expenditures		
	Btu (000 000s)	$	Price Indexes (U.S. = 100)	Btu (000 000s)	$	Price Indexes (U.S. = 100)
New England	116.1	297.0	113.7	270.1	514.1	120.5
Mid-Atlantic	103.2	256.7	109.6	291.2	484.9	112.7
East North Central	112.5	256.6	97.4	369.6	512.6	100.9
West North Central	104.4	244.9	96.0	336.8	482.0	98.7
South Atlantic	82.4	238.1	101.4	299.8	480.2	101.0
East South Central	85.1	223.7	92.6	385.8	483.2	90.9
West South Central	88.6	222.9	89.5	565.4	519.3	82.6
Rocky Mountain	95.5	232.0	98.6	403.6	514.0	94.0
Far West	86.9	211.5	97.3	322.9	443.2	90.7
United States	97.7	243.0	100.0	351.5	490.1	100.0

Table 9 presents information that helps to clarify the relation. The first two columns show industrial use of energy per man-hour in manufactures as of 1972, first in terms of Btu per man-hour and then in terms of dollars per man-hour (21, 48). For simplicity, I have identified manufactures with industry in this discussion (that identification can occasionally cause difficulty, as in the case of the entries for Wyoming). Wide variations in industrial Btu use per man-hour in manufactures occur with lowest levels in New England and highest levels in the energy-producing states. The spread is reduced considerably when dollars per man-hour are compared. Thus, Louisiana manufactures use 20 times as much energy per man-hour as do Connecticut manufactures; however, the dollar differential is on the order of five to one, reflecting the much lower price of energy in Louisiana than in Connecticut.

Table 9. Industrial use of energy relative to employment in manufactures and growth in manufactures by state.

Region and State	Industrial Use of Energy per Man Hour in Manufactures, 1972		Ratio of Employment in Manufactures to Population		Change in Ratio
	1000 Btu/ man-h	$/ man-h	1972	1977	1977/1972
New England					
Connecticut	202.5	0.36	0.1302	0.1303	1.0006
Maine	438.0	0.55	0.1001	0.0976	0.9751
Massachusetts	205.5	0.36	0.1035	0.1052	1.0165
New Hampshire	188.0	0.31	0.1177	0.1191	1.0117
Rhode Island	170.2	0.30	0.1233	0.1365	1.1066
Vermont	166.3	0.37	0.0837	0.0896	1.0711
Mid-Atlantic					
New Jersey	241.5	0.42	0.1118	0.1063	0.9506
New York	287.2	0.37	0.0872	0.0814	0.9337
Pennsylvania	752.5	0.69	0.1204	0.1138	0.9454
East North Central					
Illinois	479.0	0.47	0.1129	0.1101	0.9754
Indiana	941.7	0.66	0.1342	0.1327	0.9889
Michigan	575.2	0.56	0.1204	0.1211	1.0055
Ohio	769.2	0.65	0.1254	0.1253	0.9989
Wisconsin	471.3	0.49	0.1095	0.1146	1.0472
West North Central					
Iowa	759.4	0.65	0.0775	0.0842	1.0865
Kansas	1367.9	0.79	0.0631	0.0736	1.1665
Minnesota	721.1	0.77	0.0802	0.0851	1.0620
Missouri	413.3	0.45	0.0923	0.0910	0.9856
Nebraska	844.3	0.60	0.0565	0.0580	1.0264
North Dakota	1031.1	1.15	0.0167	0.0236	1.4106
South Dakota	802.8	0.70	0.0272	0.0315	1.1577
South Atlantic					
Delaware	977.2	1.20	0.1263	0.1163	0.9212
District of Columbia	422.3	0.50	0.0226	0.0216	0.9552
Florida	413.1	0.54	0.0468	0.0443	0.9466
Georgia	390.2	0.41	0.1011	0.0968	0.9578
Maryland	780.5	0.98	0.0614	0.0569	0.9276
North Carolina	245.6	0.30	0.1448	0.1410	0.9741
South Carolina	378.2	0.40	0.1319	0.1321	1.0013
Virginia	386.8	0.39	0.0804	0.0779	0.9686
West Virginia	2177.8	1.42	0.0688	0.0669	0.9726
East South Central					
Alabama	984.9	0.73	0.0937	0.0955	1.0193
Kentucky	729.7	0.74	0.0802	0.0819	1.0217
Mississippi	758.1	0.49	0.0918	0.0963	1.0482
Tennessee	479.0	0.54	0.1205	0.1178	0.9779
West South Central					
Arkansas	1002.1	0.48	0.0920	0.0975	1.0603
Louisiana	3907.2	1.78	0.0483	0.0514	1.0648
Oklahoma	887.8	0.63	0.0532	0.0579	1.0892
Texas	1870.5	0.87	0.0642	0.0699	1.0891
Rocky Mountain					
Arizona	906.0	0.98	0.0499	0.0488	0.9781
Colorado	909.6	0.55	0.0551	0.0551	1.0011
Idaho	1003.6	0.99	0.0580	0.0628	1.0821
Montana	2039.2	1.56	0.0345	0.0318	0.9218
Nevada	1508.3	1.93	0.0178	0.0237	1.3295
New Mexico	3169.9	1.80	0.0237	0.0270	1.1382
Utah	1922.2	1.18	0.0528	0.0587	1.1114
Wyoming	7258.6	4.43	0.0220	0.0222	1.0092
Far West					
Alaska	2967.0	2.70	0.0249	0.0253	1.0154
California	456.7	0.45	0.0750	0.0781	1.0417
Hawaii	451.2	1.38	0.0304	0.0260	0.8566
Oregon	524.2	0.45	0.0842	0.0862	1.0231
Washington	716.7	0.54	0.0656	0.0715	1.0899

To develop some notion of the effect of changed conditions on heavy versus light users of energy, manufacturing employment in 1977 was compared to that in 1972, eliminating the effect of population growth by comparing manufacturing employment per capita in 1977 to that in 1972. Presumably, population growth brings growth in all industries; eliminating that effect leaves a pure measure of relative importance of manufactures. The information used and the results appear as the last three columns of Table 9. The strongest growth occurs in the West South Central region, where all of the states show a 1977-to-1972 ratio above 1.06. This may well reflect the availability of intrastate natural gas to those states. Other patterns are not so clear-cut. However, regions that include energy-producing states and New England appear to be stronger in manufactures in 1977 than in 1972; the Atlantic seaboard seems to lose the most ground. Regional values for the change in the employment to population ratio are as follows:

Region	Change in Ratio of Employment in Manufactures to Population (1977 ratio ÷ 1972 ratio)
New England	1.0169
Mid-Atlantic	0.9428
East North Central	0.9977
West North Central	1.0525
South Atlantic	0.9599
East South Central	1.0092
West South Central	1.0829
Rocky Mountain	1.0323
Far West	1.0413
United States	0.9908

Perhaps both parts of the initial hypothesis hold; manufactures did best in 1977 in those states that were at the extremes of energy availability in 1972; in-between states, primarily on the Atlantic seaboard, did the worst, perhaps in part because of their dependence on imported oil.

Combined Production and Consumption Effects on Population Growth

I conclude my discussion of state and regional impacts by speculating on the combined location effects of energy price changes on both producers and consumers of energy. I base this speculation on measures of population change, as presented in Table 10 (49), which compares annual growth from 1972 to 1977 with that from 1970 to 1972, thus attempting to pick out the impact of higher energy prices in the later period. In Table 10, the first two columns show the annual growth rate in each period. Entries in those columns are labeled r; thus, for the second column, $(1 + r)^5$ equals the ratio of 1977 to 1972 population. The U.S. annual growth rate for each period was then employed as the base value to develop indexes of annual growth, appearing in the last two columns. In effect, we are saying that if the U.S. annual growth rate is 0.0077 (so that next year's population is 1.0077 times this year's) and if New England's annual growth rate is 0.0023 (so that its next year's population is 1.0023 times this year's), then New England's index of annual growth can be defined as $1.0023/1.0077 \times 100$, which equals 99.46. The last two columns then can be used to compare population growth before and after the 1973 energy price rise. The basic hypothesis is that the forces causing the shift to the sunbelt that were at work in 1970-1972 would continue at the same rate in

Table 10. Measures of state population change, 1970-1972 and 1972-1977.

Region and State	Annual Growth Rate of Population Over Period (r)		Index of Annual Growth (U.S. = 100) $\frac{1+r(\text{state})}{1+r(\text{U.S.})} \times 100$	
	1970-1972	1972-1977	1970-1972	1972-1977
New England				
Connecticut	0.0079	0.0018	99.56	99.42
Maine	0.0170	0.0112	100.46	100.35
Massachusetts	0.0094	-0.0005	99.71	99.19
New Hampshire	0.0241	0.0187	101.17	101.09
Rhode Island	0.0115	-0.0071	99.93	98.53
Vermont	0.0179	0.0098	100.55	100.21
Mid-Atlantic				
New Jersey	0.0125	-0.0005	100.02	99.18
New York	0.0036	-0.0049	99.14	98.75
Pennsylvania	0.0047	-0.0020	99.25	99.04
East North Central				
Illinois	0.0058	0.0000	99.36	99.24
Indiana	0.0088	0.0017	99.66	99.40
Michigan	0.0077	0.0026	99.55	99.49
Ohio	0.0033	-0.0004	99.11	99.20
Wisconsin	0.0121	0.0055	99.99	99.78
West North Central				
Iowa	0.0106	-0.0003	99.83	99.20
Kansas	0.0047	0.0051	99.25	99.74
Minnesota	0.0094	0.0050	99.72	99.73
Missouri	0.0075	0.0023	99.52	99.46
Nebraska	0.0147	0.0043	100.24	99.66
North Dakota	0.0129	0.0059	100.06	99.82
South Dakota	0.0105	0.0026	99.82	99.50
South Atlantic				
Delaware	0.0208	0.0038	100.84	99.62
District of Columbia	-0.0026	-0.0171	98.52	97.54
Florida	0.0403	0.0284	102.76	102.06
Georgia	0.0155	0.0130	100.31	100.52
Maryland	0.0159	0.0045	100.36	99.68
North Carolina	0.0136	0.0114	100.13	100.37
South Carolina	0.0185	0.0136	100.62	100.59
Virginia	0.0124	0.0151	100.01	100.73
West Virginia	0.0145	0.0070	100.22	99.93
East South Central				
Alabama	0.0111	0.0094	99.88	100.17
Kentucky	0.0134	0.0090	100.11	100.13
Mississippi	0.0088	0.0115	99.65	100.38
Tennessee	0.0187	0.0109	100.63	100.32
West South Central				
Arkansas	0.0219	0.0132	100.94	100.55
Louisiana	0.0132	0.0096	100.09	100.19
Oklahoma	0.0144	0.0132	100.20	100.54
Texas	0.0180	0.0203	100.56	101.25
Rocky Mountain				
Arizona	0.0528	0.0318	104.00	102.40
Colorado	0.0350	0.0207	102.24	101.29
Idaho	0.0290	0.0257	101.65	101.78
Montana	0.0157	0.0123	100.34	100.45
Nevada	0.0440	0.0350	103.13	102.71
New Mexico	0.0291	0.0203	101.66	101.25
Utah	0.0316	0.0239	101.91	101.60
Wyoming	0.0209	0.0325	100.85	102.46
Far West				
Alaska	0.0408	0.0460	102.82	103.80
California	0.0114	0.0141	99.91	100.64
Hawaii	0.0301	0.0187	101.76	101.09
Oregon	0.0222	0.0169	100.98	100.91
Washington	0.0013	0.0137	98.92	100.59

the 1972-1977 period; then, any changes occurring in the latter period relative to the former could be tied to changed energy relations. Of course, this abstracts from and neglects other forms of change. Carrying out the comparisons, I believe there is some support for the basic hypothesis. In Table 10, Alaska, Wyoming, Texas, Oklahoma, Louisiana, and Montana all show a higher index in 1972-1977 than in 1970-1972. California's index also increases, and Arizona's and Florida's decline. All the states of the Northeast and most of the states of the North Central region show a decline in the index. Of course, factors other than energy price changes are at work; the increased index for Washington probably reflects the revival of Boeing production more than the availability of inexpensive hydropower. And the decline in the Hawaii index may involve a decline in the real level of defense expenditures, as well as a possible decline induced by higher air and ocean transportation costs.

The growth indexes at the regional level have the following values:

Region.	Index of Annual Growth (U.S.=100) $[1+r(\text{Region})]/[1+r(\text{U.S.})] \times 100$	
	1970-1972	1972-1977
New England	99.88	99.46
Mid-Atlantic	99.34	98.93
East North Central	99.44	99.36
West North Central	99.68	99.55
South Atlantic	100.78	100.68
East South Central	100.13	100.24
West South Central	100.47	100.89
Rocky Mountain	102.30	101.68
Far West	99.96	100.71
United States	100.00	100.00

All regions east of the Mississippi show a decline in the growth index in the later period relative to the earlier; three of the four regions west of the Mississippi show an increase. The Rocky Mountain region surprisingly shows a decline, but this seems due to the sharp decline for Arizona, hypothesized as explainable by the strong reliance on electricity for air conditioning and by declines in Colorado and Nevada, perhaps explainable by the importance of tourism to those states and the negative impact of higher energy prices on the tourist industry.

On the whole, then, I see the pattern of results as supporting the basic hypothesis; this indicates that further analysis along these lines would be worthwhile.

Relations at the Local Level (Effects on Settlement Pattern)

In addition to state and regional impacts, a number of changes at the local level should be generated by higher energy prices.

A surprising amount of fuel extraction occurs within the boundaries of SMSAs; thus, the percentages of U.S. fuel extraction earnings (wages and proprietor income) that were obtained within SMSAs (defined as of 1970) have been estimated as follows (42):

Year	Industry	
	Coal	Oil and Gas
1950	30.6	52.0
1970	22.3	55.0

These values were obtained after accounting for employment in administrative offices, warehouses, and research laboratories; they purport to show percentages of earnings attributable to production workers only. Of course, the SMSA consists of a set of counties surrounding a central city and thus contains a considerable amount of rural territory. However, the proximity of so much fuel extraction to urban centers might be explained as follows. First, extraction near a metropolitan center may be more economical than at remote locations, either because of direct meeting of metropolitan demand or because of advantages conferred by transportation and market facilities located in metropolitan areas. Second, the extractive activity may itself have helped an urban area grow large enough to receive the official designation of SMSA. Consequently, energy-producing centers should show faster growth than other localities situated

in the same region during a period of real increases in energy prices.

Metropolitan areas with 1970 fuel extraction earnings comprising more than 5 percent of all earnings included these coal centers—Wheeling and Charlestown, West Virginia, and Johnstown, Pennsylvania—and these oil and gas centers—Midland and Houston, Texas; Tulsa; Bakersfield, California; and New Orleans. In addition, Pittsburgh, Oklahoma City, Dallas, and Denver obtained more than 1 percent of their earnings from fuel extraction. Hence, I would predict faster growth for those metropolitan areas than for other SMSAs in the same general locale. Of course, strip-mined coal parallels oil and gas production as a capital-intensive industry so that direct employment effects of increased energy production are likely to be modest. But some of the results presented earlier suggest that multiplier effects may yield a fair amount of indirect employment increases.

On the consumption side, it seems plausible that higher costs of the journey to work will tend to move residences closer to work places. One likely pattern is greater centrality, with increased urban densities and a decline in sprawl. Alternatively, central-city firms may relocate to suburban nodes of development by moving closer to workers. Albert and Banton develop a model expressing just this process (50). However, recently there has been much central-city revival, sometimes described as gentrification; this activity furnishes empirical support for the initial hypothesized pattern. But it is possible that both patterns will emerge, in conjunction. Both may increase the viability of mass transit, particularly transit that depends on high-density corridors.

However, higher energy prices should also set some countertrends in motion. It seems plausible that higher fuel costs will speed up the growth of small places relative to large ones because of a shorter journey to work and, hence, lower fuel costs. This should reduce the viability of mass transit investment in many large SMSAs.

Further, as noted earlier, high rates of inflation seem likely to speed the shift from larger to smaller places. Insofar as inflation is an indirect response to higher energy prices, we can place some responsibility on energy.

In detail, my thesis is as follows. The cost of living tends to increase with size of place, and it is also higher in the North than in the South. Hence, wage rates for the same work should increase with settlement population size and should be higher in the North than in the South to compensate for the higher living costs. However, in an inflationary period, income taxes tend to increase faster than money wages; with higher money wages, workers automatically move into higher tax brackets. It can be hypothesized that the acceleration in taxes is stronger the higher the initial level of income, which would tend to progressively increase the attractiveness of small places relative to large and of the South relative to the North, given the existence of compensatory money differentials for cost-of-living differences.

A detailed inspection of taxes paid at various levels of income, applying the federal income tax rates in effect over the last 10 years, supports the hypothesis of accelerated tax increases with income level. I would expect this result to be a factor in recent population shifts. Given the recent increase in the rate of inflation, I would expect even stronger impacts on population distribution and a speeding up of recent trends. This is a sobering prospect because much of that movement seems unnecessary in real terms; it appears artificially induced by our tax system and, therefore, seems to involve wasted motion.

SOME APPLICATIONS TO STATE HIGHWAY TRANSPORTATION AND FINANCE

This section applies some of the information and arguments of the preceding sections to state transportation and focuses on highway finance issues. It seems clear, from inspection of data on highway finance, that there has been considerable erosion in real motor fuel tax collections and, for many states, in total highway revenues. It might be argued that our highway system is good enough and that current levels of funding, relative to 1972, are adequate. I have my doubts. I suspect that not only are investment opportunities being neglected, but also that some disinvestment in highway plant has been occurring. Mandated improvements in fuel economy and the current shift to smaller cars may exacerbate the financing problem. Given the arguments in the preceding section of this paper, I believe a case can be made for higher state motor fuel taxes, despite the unpopularity of higher taxation, as indicated by Proposition 13. But increased motor fuel taxes might be tied to lowered income or property taxes as a way of increasing their palatability. Let me flesh out the argument with some statistics. (Those statistics should also be of use in related investigations.)

Table 11 compares motor vehicle fuel consumption and number of motor vehicles registered (excluding motorcycles) for 1972 and 1977, by state, and Table 12 translates those data into per-capita levels (52, 53). The U.S. levels for those measures are as follows:

Factor	1972	1977	1977/1972
Motor fuel (gal 000 000 000s)	110.1	124.5	1.131
Motor vehicles (000 000s)	118.5	143.8	1.213
Motor fuel per capita (gal)	528.5	575.4	1.089
Vehicles per capita	0.569	0.664	1.167

Table 13 shows gasoline tax rates as of 1977, the ratio of those rates to 1972 rates, and the ratio after accounting for inflation (23, 52). The first ratio is labeled a comparison in money terms and the second a comparison in real terms (or deflated values). It is clear from the comparison that tax rates have not kept pace with inflation. Because other motor fuel taxes (on diesel fuel and liquefied petroleum gases) are generally tied to gasoline taxes, the same conclusion holds for those fuels.

In Table 13, only Hawaii's deflated tax rates increased between 1972 and 1977; most other states had their real gasoline tax rates fall to roughly three-fourths of the 1972 level.

The regional averages for gasoline taxes (obtained by simple averages over the states in the region) were as follows:

Region	Gasoline Tax (cents/gal) 1972	1977	Deflated 1977 Level, Tax on 1972 Base	Deflated 1977 Level, Relative to 1972
New England	8.75	9.58	6.61	0.76
Mid-Atlantic	8.00	8.33	5.75	0.72
East North Central	7.30	7.70	5.31	0.73
West North Central	7.21	8.07	5.56	0.77
South Atlantic	8.33	9.00	6.21	0.75
East South Central	7.75	8.00	5.52	0.71
West South Central	6.75	7.00	4.83	0.72
Rocky Mountain	7.06	7.56	5.21	0.74
Far West	7.02	8.30	5.73	0.80

Table 11. Comparisons of motor fuel consumption and vehicle registrations, 1972 and 1977.

Region and State	Consumption			Registrations (excluding motorcycles)		
	Quantity (gal 000 000s)		Ratio	Quantity (000s)		Ratio
	1972	1977	1977/1972	1972	1977	1977/1972
New England						
Connecticut	1 423.2	1 508.4	1.060	1 860.4	2 089.7	1.123
Maine	559.1	627.0	1.121	564.8	718.7	1.272
Massachusetts	2 423.9	2 559.5	1.056	2 821.4	3 519.6	1.247
New Hampshire	408.6	464.5	1.137	436.2	563.2	1.291
Rhode Island	403.3	416.2	1.032	536.3	669.3	1.248
Vermont	243.5	260.2	1.069	261.3	320.4	1.226
Mid-Atlantic						
New Jersey	3 451.1	3 665.4	1.062	3 858.6	4 407.4	1.142
New York	6 330.8	6 440.0	1.017	7 006.5	7 730.3	1.103
Pennsylvania	5 552.0	5 802.8	1.045	6 311.3	8 101.8	1.284
East North Central						
Illinois	5 423.9	5 981.4	1.103	5 643.9	6 861.1	1.216
Indiana	3 114.8	3 386.0	1.087	2 908.5	3 586.0	1.233
Michigan	4 834.5	5 288.4	1.094	5 010.5	5 986.1	1.195
Ohio	5 443.7	6 095.5	1.120	6 224.3	7 504.3	1.206
Wisconsin	2 318.2	2 617.7	1.129	2 378.8	2 667.1	1.121
West North Central						
Iowa	1 847.3	2 036.2	1.102	1 917.1	2 221.9	1.159
Kansas	1 493.0	1 597.3	1.070	1 691.5	1 892.8	1.119
Minnesota	2 232.8	2 424.5	1.086	2 368.1	2 813.3	1.188
Missouri	2 905.1	3 190.3	1.098	2 618.2	3 052.7	1.166
Nebraska	986.6	1 073.5	1.088	1 080.9	1 207.7	1.117
North Dakota	457.3	512.7	1.121	463.6	580.4	1.252
South Dakota	507.8	543.8	1.071	462.6	560.7	1.212
South Atlantic						
Delaware	306.1	336.3	1.099	323.0	373.9	1.158
District of Columbia	259.8	246.1	0.947	259.5	260.7	1.005
Florida	4 222.8	5 030.1	1.191	4 836.0	6 095.8	1.261
Georgia	2 984.2	3 380.0	1.133	2 959.5	3 496.3	1.181
Maryland	1 884.3	2 125.1	1.128	2 130.5	2 587.2	1.214
North Carolina	2 991.9	3 447.2	1.152	3 220.8	4 079.3	1.267
South Carolina	1 547.6	1 808.7	1.169	1 497.4	1 857.6	1.241
Virginia	2 613.9	3 040.3	1.163	2 602.8	3 256.8	1.251
West Virginia	827.3	983.2	1.188	873.6	1 136.4	1.301
East South Central						
Alabama	1 958.4	2 354.2	1.202	2 227.3	2 673.6	1.200
Kentucky	1 781.4	2 082.8	1.169	1 967.6	2 449.7	1.245
Mississippi	1 318.5	1 477.4	1.121	1 249.2	1 494.0	1.196
Tennessee	2 324.0	2 822.5	1.215	2 293.6	2 996.2	1.306
West South Central						
Arkansas	1 256.4	1 480.5	1.178	1 070.3	1 422.8	1.329
Louisiana	1 836.6	2 299.1	1.252	1 942.3	2 421.5	1.247
Oklahoma	1 838.2	2 132.0	1.160	1 887.2	2 296.4	1.217
Texas	7 627.2	9 426.9	1.236	7 315.7	9 489.1	1.297
Rocky Mountain						
Arizona	1 244.2	1 520.5	1.222	1 301.9	1 554.2	1.194
Colorado	1 390.6	1 596.3	1.148	1 679.7	2 162.9	1.288
Idaho	495.1	595.5	1.203	549.8	717.6	1.305
Montana	510.3	570.6	1.118	584.1	725.5	1.242
Nevada	415.8	517.0	1.243	399.0	548.8	1.375
New Mexico	755.9	912.1	1.207	710.8	907.1	1.276
Utah	675.4	802.1	1.188	740.5	908.5	1.227
Wyoming	335.8	446.6	1.330	273.6	376.0	1.374
Far West						
Alaska	181.5	265.7	1.464	148.8	257.5	1.731
California	10 734.5	12 241.8	1.140	12 852.2	14 958.0	1.164
Hawaii	281.6	337.0	1.197	447.4	521.2	1.165
Oregon	1 331.8	1 577.3	1.184	1 496.1	1 776.4	1.187
Washington	1 763.9	2 126.4	1.206	2 242.1	2 894.9	1.291

Not surprisingly, when we compare 1977 with 1972, there is a falling off of real state motor fuel tax receipts in almost all states (Alaska, Hawaii, and Wyoming are exceptions) and a reduction in total state highway receipts in the majority of cases. Table 14 documents this by presenting the ratio of deflated 1977 to 1972 values for motor fuel tax receipts and for total state highway receipts; it also exhibits deflated highway receipts per capita for the two years and the 1977 to 1972 ratio for those per-capita values (23, 52).

Only 10 states show an increase in per-capita deflated receipts between 1972 and 1977 and, in most cases, those increases are nominal. In 7 of the 10 cases, the increases are under 2 percent. In contrast, 19 states show decreases in per-capita deflated receipts of 20 percent or more. The distribution of cases by region is as follows:

Region	Deflated State Highway Receipts per Capita, 1977 Relative to 1972					
	>1.020	1.0-1.02	0.9-0.999	0.8-0.899	0.7-0.799	<0.7
New England	1	1	0	0	0	4
Mid-Atlantic	0	0	0	0	0	3
East North Central	0	0	0	1	4	0
West North Central	1	1	4	0	1	0
South Atlantic	0	1	4	2	2	0
East South Central	0	1	1	2	0	0
West South Central	2	1	0	1	0	0
Rocky Mountain	0	1	1	4	1	1
Far West	0	1	1	0	0	3

The Northeast and Great Lakes regions appear to suffer the greatest reduction in deflated receipts per capita.

Motor vehicle fuel efficiency is increasing over time,

Table 12. Comparisons of motor fuel consumption and vehicle registrations per capita, 1972 and 1977.

Region and State	Consumption (gal/person) Quantities 1972	1977	Ratio 1977/1972	Registrations Quantities 1972	1977	Ratio 1977/1972
New England						
Connecticut	462.1	485.3	1.050	0.604	0.672	1.113
Maine	544.9	577.9	1.060	0.550	0.662	1.203
Massachusetts	418.2	442.7	1.058	0.487	0.609	1.250
New Hampshire	527.9	547.1	1.036	0.564	0.663	1.177
Rhode Island	416.2	445.1	1.070	0.553	0.716	1.293
Vermont	529.3	538.7	1.018	0.568	0.663	1.168
Mid-Atlantic						
New Jersey	469.6	500.1	1.065	0.525	0.601	1.145
New York	344.7	359.3	1.042	0.381	0.431	1.131
Pennsylvania	466.4	492.4	1.056	0.530	0.687	1.297
East North Central						
Illinois	482.4	531.9	1.103	0.502	0.610	1.216
Indiana	589.3	635.3	1.078	0.550	0.673	1.223
Michigan	536.4	579.3	1.080	0.556	0.656	1.180
Ohio	507.7	569.6	1.122	0.581	0.701	1.208
Wisconsin	512.2	562.8	1.099	0.526	0.573	1.091
West North Central						
Iowa	640.5	707.3	1.104	0.665	0.772	1.161
Kansas	658.3	686.7	1.043	0.746	0.814	1.091
Minnesota	575.9	609.9	1.059	0.611	0.708	1.159
Missouri	612.0	664.5	1.086	0.552	0.636	1.153
Nebraska	645.7	687.7	1.065	0.707	0.774	1.094
North Dakota	721.3	785.1	1.089	0.731	0.889	1.216
South Dakota	746.8	789.3	1.057	0.680	0.814	1.196
South Atlantic						
Delaware	536.1	577.8	1.078	0.566	0.642	1.136
District of Columbia	345.5	356.7	1.032	0.345	0.378	1.095
Florida	574.8	595.1	1.035	0.658	0.721	1.096
Georgia	630.5	669.6	1.062	0.625	0.693	1.108
Maryland	465.5	513.4	1.103	0.526	0.625	1.188
North Carolina	573.1	623.9	1.089	0.617	0.738	1.197
South Carolina	575.7	628.9	1.092	0.557	0.646	1.159
Virginia	548.6	592.1	1.079	0.546	0.634	1.161
West Virginia	460.9	528.9	1.148	0.487	0.611	1.256
East South Central						
Alabama	556.2	638.0	1.147	0.633	0.725	1.145
Kentucky	538.8	602.3	1.118	0.595	0.708	1.190
Mississippi	584.4	618.4	1.058	0.554	0.625	1.129
Tennessee	570.7	656.5	1.150	0.563	0.697	1.237
West South Central						
Arkansas	625.7	690.5	1.104	0.533	0.664	1.245
Louisiana	491.3	586.4	1.193	0.520	0.618	1.189
Oklahoma	698.1	758.4	1.086	0.717	0.817	1.140
Texas	657.3	734.8	1.118	0.630	0.740	1.173
Rocky Mountain						
Arizona	633.8	662.2	1.045	0.663	0.677	1.021
Colorado	588.2	609.5	1.036	0.711	0.826	1.162
Idaho	655.8	694.9	1.060	0.728	0.837	1.150
Montana	712.7	749.8	1.052	0.816	0.953	1.169
Nevada	780.1	816.7	1.047	0.749	0.867	1.158
New Mexico	702.5	766.5	1.091	0.661	0.762	1.154
Utah	599.3	632.6	1.056	0.657	0.716	0.090
Wyoming	970.5	1100.0	1.133	0.791	0.926	1.171
Far West						
Alaska	558.5	652.8	1.169	0.458	0.633	1.382
California	525.9	559.1	1.063	0.630	0.683	1.085
Hawaii	345.1	376.5	1.091	0.548	0.582	1.062
Oregon	609.5	663.8	1.089	0.685	0.748	1.092
Washington	516.1	581.3	1.126	0.656	0.791	1.206

Table 13. Comparisons of gasoline tax rates in money and real terms, 1977 and 1972.

Region and State	Gasoline Tax 1977 Level (cents/gal)	1977/1972 (money terms)	Deflated 1977 1972 (real terms)
New England			
Connecticut	11.0	1.10	0.76
Maine	9.0	1.00	0.69
Massachusetts	8.5	1.13	0.78
New Hampshire	10.0	1.11	0.77
Rhode Island	10.0	1.25	0.86
Vermont	9.0	1.00	0.69
Mid-Atlantic			
New Jersey	8.0	1.00	0.69
New York	8.0	1.00	0.69
Pennsylvania	9.0	1.12	0.78
East North Central			
Illinois	7.5	1.00	0.69
Indiana	8.0	1.00	0.69
Michigan	9.0	1.29	0.89
Ohio	7.0	1.00	0.69
Wisconsin	7.0	1.00	0.69
West North Central			
Iowa	7.0	1.00	0.69
Kansas	8.0	1.14	0.79
Minnesota	9.0	1.29	0.89
Missouri	7.0	1.00	0.69
Nebraska	9.5	1.12	0.77
North Dakota	8.0	1.14	0.79
South Dakota	8.0	1.14	0.79
South Atlantic			
Delaware	11.0	1.37	0.95
District of Columbia	10.0	1.25	0.86
Florida	8.0	1.00	0.69
Georgia	7.5	1.00	0.69
Maryland	9.0	1.00	0.69
North Carolina	9.0	1.00	0.69
South Carolina	9.0	1.12	0.78
Virginia	9.0	1.00	0.69
West Virginia	8.5	1.00	0.69
East South Central			
Alabama	7.0	1.00	0.69
Kentucky	9.0	1.00	0.69
Mississippi	9.0	1.12	0.78
Tennessee	7.0	1.00	0.69
West South Central			
Arkansas	8.5	1.13	0.78
Louisiana	8.0	1.00	0.69
Oklahoma	6.5	1.00	0.69
Texas	5.0	1.00	0.69
Rocky Mountain			
Arizona	8.0	1.14	0.79
Colorado	7.0	1.00	0.69
Idaho	9.5	1.12	0.77
Montana	8.0	1.14	0.79
Nevada	6.0	1.00	0.69
New Mexico	7.0	1.00	0.69
Utah	7.0	1.00	0.69
Wyoming	8.0	1.14	0.79
Far West			
Alaska	8.0	1.00	0.69
California	7.0	1.00	0.69
Hawaii	8.5	1.70	1.17
Oregon	7.0	1.00	0.69
Washington	11.0	1.22	0.84

with congressionally mandated increases in fuel economy and a considerable switch to smaller cars. Data in Table 12 suggest reduced fuel consumption per vehicle, in line with the trend. (Compare the 1977 and 1972 ratios.) Figure 4 exhibits the trend in terms of the recent past (18). Projections of future miles per gallon are as follows (54):

Year	Predicted Miles per Gallon	Fuel Efficiency Indicator 1977/Predicted
1977	13.9	1.00
1980	15.0	0.93
1985	18.0	0.77
1990	22.2	0.63

At this point, it is worthwhile to pull together three key growth factors to yield predictions of 1980 and 1985 motor fuel consumption, by state. Those predictions can be of use for planning purposes; admittedly, some of the assumptions used are subject to refinement, but I believe the numbers that emerge can be a useful first step.

The three growth factors were (a) fuel economy in miles per gallon, (b) population growth, and (c) growth in vehicle registrations per capita. Fuel economy data are presented above; population growth data appear in Table 10; and vehicle registration data appear in Table 12. Annual growth rates were derived from data in Tables 10 and 12 and are assumed to hold to 1980 and 1985. It was also assumed that this annual growth rate

Table 14. Comparisons of deflated motor fuel tax receipts and total state highway receipts, 1972 and 1977.

Region and State	Deflated 1977/1972 Motor Fuel Tax Receipts	Deflated 1977/1972 Total State Highway Receipts	Deflated State Highway Receipts, per Capita, in 1972 Dollars 1972	1977	1977/1972
New England					
Connecticut	0.803	0.701	108.6	75.4	0.695
Maine	0.776	0.725	119.0	81.6	0.686
Massachusetts	0.863	1.130	60.7	68.8	1.133
New Hampshire	0.826	1.111	125.1	126.7	1.013
Rhode Island	0.920	0.615	60.0	38.2	0.638
Vermont	0.742	0.617	181.1	106.4	0.588
Mid-Atlantic					
New Jersey	0.832	0.616	104.9	64.8	0.618
New York	0.709	0.575	73.3	43.2	0.589
Pennsylvania	0.871	0.630	114.5	72.8	0.636
East North Central					
Illinois	0.778	0.845	80.3	67.9	0.845
Indiana	0.764	0.775	81.2	62.4	0.769
Michigan	0.964	0.786	79.2	61.4	0.776
Ohio	0.779	0.701	81.1	56.9	0.702
Wisconsin	0.796	0.738	76.9	55.2	0.718
West North Central					
Iowa	0.813	1.009	104.4	105.5	1.011
Kansas	0.986	0.803	123.7	96.9	0.783
Minnesota	0.999	1.078	82.7	87.0	1.051
Missouri	0.976	0.936	72.3	67.0	0.926
Nebraska	0.784	0.959	99.8	93.7	0.939
North Dakota	0.968	1.016	126.5	124.8	0.987
South Dakota	0.886	0.937	129.6	119.8	0.925
South Atlantic					
Delaware	0.958	0.993	144.5	140.8	0.974
District of Columbia	0.857	0.936	83.6	85.3	1.020
Florida	0.819	0.997	82.4	71.4	0.866
Georgia	0.795	1.031	65.7	63.5	0.967
Maryland	0.895	0.813	101.3	80.6	0.795
North Carolina	0.800	0.904	85.5	73.0	0.854
South Carolina	0.944	1.029	62.2	59.8	0.961
Virginia	0.966	1.024	104.8	99.6	0.950
West Virginia	0.848	0.747	228.8	165.0	0.721
East South Central					
Alabama	0.853	1.057	85.8	86.5	1.009
Kentucky	0.943	1.012	157.9	152.7	0.967
Mississippi	0.896	0.854	129.4	104.4	0.807
Tennessee	0.837	0.918	86.6	75.3	0.869
West South Central					
Arkansas	0.912	1.154	86.6	93.6	1.081
Louisiana	0.867	1.279	96.4	117.5	1.219
Oklahoma	0.823	0.918	94.5	81.3	0.860
Texas	0.866	1.106	66.3	66.4	1.001
Rocky Mountain					
Arizona	0.987	1.031	97.2	85.7	0.881
Colorado	0.821	0.972	88.4	77.6	0.877
Idaho	0.993	1.086	128.2	122.6	0.957
Montana	0.999	0.922	180.2	156.3	0.868
Nevada	0.896	1.166	121.6	119.4	0.982
New Mexico	0.869	0.837	116.8	88.4	0.757
Utah	0.846	0.774	113.9	78.4	0.688
Wyoming	1.055	1.182	229.8	231.5	1.008
Far West					
Alaska	1.321	1.148	450.2	412.6	0.916
California	0.792	0.720	75.0	50.3	0.671
Hawaii	1.415	1.097	89.0	89.0	1.000
Oregon	0.808	0.758	120.7	84.2	0.697
Washington	0.916	0.746	140.0	97.6	0.697

would hold for each of the years from 1977 to 1980 and from 1980 to 1985. The realism of this assumption is open to question for states with high registrations per capita because they could approach a saturation level in vehicle ownership before 1985. Wyoming had the highest listed registrations per capita in 1977, with 0.926. Mechanically applying its growth factor yields a forecast of 1.19 vehicles per capita, which could be above the saturation level. (It is my impression, however, that Wyoming has considerable truck registration, perhaps in part for legal convenience, so that its levels of registration must be treated with some caution.)

Once the annual growth factors for each state were developed, they were combined as follows: 1980 scale factor = $(0.93)(1+p)^3(1+v)^3$ and 1985 scale factor = $(0.77)(1+p)^8(1+v)^8$. Annual population growth rate is denoted by p and annual growth rate for vehicle registrations per capita by v.

Table 15 shows the population and vehicle registration growth rates, (1+p) and (1+v), respectively; it also shows the 1980 and 1985 scale factors obtained by combining the three growth factors. These scale factors indicate the predicted motor fuel consumption in the given year, relative to the 1977 level. From Table 15, it seems clear that predicted growth is hardly pronounced. In fact, 11 states show declining levels of fuel consumption in 1985 relative to 1977, and 21 show less than 10 percent growth.

If these predictions are combined with a continued erosion in real gasoline tax rates, then real taxes collected and, most likely, all highway revenues will be lower in 1985 than in 1977 for all states. (Recall that in the 1972-1977 period, real gasoline tax rates fell to about 0.7 of their 1972 level.)

It seems to me, then, that a good case can be made for increased motor fuel taxes. I fear we may incur very real economic losses if continued disinvestment occurs in the highway network, and I think that outcome is quite possible. Thus, in an interview with former U.S. Secretary of Transportation, Brock Adams, this dialogue occurred (55):

Q: Your department acknowledged that highways are falling apart today faster than they can be rebuilt or replaced. Do we have more highways than we can afford to keep up?
A: Not if we shift our money away from building a great, new highway system and put it into repairing what we already have. Right now, we do not have the money to repair all the roads, and the old system of having the states pay for repairs has come to the point where governors say they can't do it, either.

Secretary Adams was also asked if he advocated a higher federal gasoline tax, and he replied that he had tried for an increase of five cents per gallon in 1978, but Congress would not approve it (55). That inaction

Figure 4. Current and expected future trends in U.S. fuel economy.

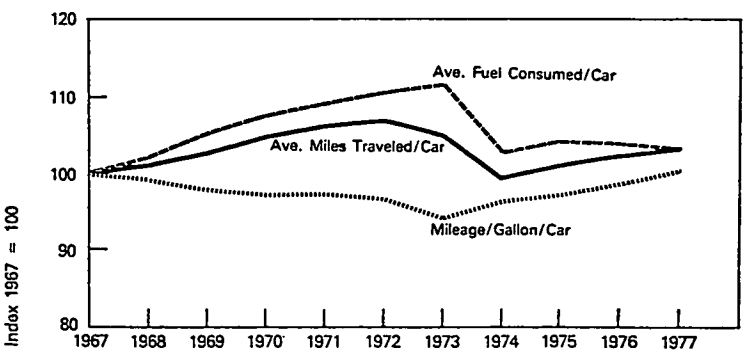


Table 15. Growth factors and predictions for 1980 and 1985 of motor fuel consumption relative to 1977.

Region and State	Growth Factors (1 + growth rate, 1972-1977)		Predicted Motor Fuel Consumption Relative to 1977	
	Population Factor	Vehicle Registration Factor	1980	1985
New England				
Connecticut	1.002	1.022	0.997	0.927
Maine	1.011	1.038	1.075	1.132
Massachusetts	1.000	1.046	1.062	1.097
New Hampshire	1.019	1.033	1.084	1.159
Rhode Island	0.993	1.053	1.062	1.098
Vermont	1.010	1.032	1.051	1.067
Mid-Atlantic				
New Jersey	0.999	1.028	1.007	0.953
New York	0.995	1.025	0.987	0.901
Pennsylvania	0.998	1.053	1.080	1.148
East North Central				
Illinois	1.000	1.040	1.046	1.052
Indiana	1.002	1.041	1.055	1.076
Michigan	1.003	1.034	1.035	1.024
Ohio	1.000	1.039	1.040	1.039
Wisconsin	1.005	1.018	0.996	0.925
West North Central				
Iowa	1.000	1.030	1.016	0.975
Kansas	1.005	1.018	0.995	0.922
Minnesota	1.005	1.030	1.031	1.014
Missouri	1.002	1.029	1.020	0.984
Nebraska	1.004	1.018	0.994	0.920
North Dakota	1.006	1.040	1.064	1.103
South Dakota	1.003	1.036	1.044	1.047
South Atlantic				
Delaware	1.004	1.026	1.015	0.973
District of Columbia	0.983	1.018	0.933	0.776
Florida	1.028	1.018	1.069	1.115
Georgia	1.013	1.021	1.028	1.005
Maryland	1.004	1.035	1.045	1.051
North Carolina	1.011	1.037	1.072	1.124
South Carolina	1.014	1.030	1.058	1.087
Virginia	1.015	1.030	1.064	1.102
West Virginia	1.007	1.047	1.089	1.173
East South Central				
Alabama	1.009	1.028	1.038	1.031
Kentucky	1.009	1.035	1.061	1.093
Mississippi	1.012	1.025	1.035	1.025
Tennessee	1.011	1.044	1.092	1.181
West South Central				
Arkansas	1.013	1.045	1.103	1.214
Louisiana	1.010	1.035	1.062	1.096
Oklahoma	1.013	1.027	1.046	1.054
Texas	1.020	1.032	1.087	1.167
Rocky Mountain				
Arizona	1.032	1.004	1.034	1.022
Colorado	1.021	1.031	1.082	1.154
Idaho	1.026	1.028	1.091	1.179
Montana	1.012	1.032	1.059	1.089
Nevada	1.035	1.030	1.126	1.282
New Mexico	1.020	1.029	1.077	1.137
Utah	1.024	1.017	1.051	1.068
Wyoming	1.032	1.032	1.125	1.281
Far West				
Alaska	1.046	1.067	1.292	1.852
California	1.014	1.016	1.019	0.982
Hawaii	1.019	1.012	1.019	0.983
Oregon	1.017	1.018	1.031	1.013
Washington	1.014	1.038	1.084	1.159

paralleled the congressional vote on a gasoline tax increase in 1975, when an increase was also rejected. No doubt, tax increases pose political difficulties. But, drawing on the first section of this paper, in large part the difficulties seem a matter of perception. In the longer run, even motor fuel use has some responsiveness to price; thus, on the basis of statistical analysis, Greene found a highway gasoline price elasticity of -0.336, which means that a 10 percent increase in price leads to a 3.36 percent decrease in use of gasoline (56). This suggests that we would be better off with such a tax increase: There would be some long-term reduction in energy use.

The Energy Policy and Conservation Act of 1978 calls for the establishment of state energy conservation plans that will yield 5 percent reductions in all energy use for each state in 1980. The use of pricing, in the form of tolls or of higher motor fuel taxes, is conspicuously absent from the transportation components of those plans. Those transportation programs have been classified and the expected energy savings in 1980 totaled for each grouping (as of November 1978) (57).

Of the 35 programs listed, eight account for 85 percent of the nationally expected savings. The programs, the energy savings in 10^{12} Btu, and the savings as a percentage of the U.S. total can be summarized as follows:

Program	1980 Energy Savings (10^{12} Btu)	Percentage of U.S. Total
55-mph enforcement	52.44	12.5
Automobile inspection and maintenance	22.43	5.4
Right turn on red	6.85	1.6
Carpool-vanpool	114.85	27.4
Transit measures	45.35	10.8
Driver education	49.66	11.8
Code review	25.00	6.0
Urban system planning	40.43	9.6
All other programs	62.23	14.9

The other programs include waste-oil recycling, bicycles, truck freight movements, gasohol, radial tire promotion, and conversion of highway dollars to public transit. Most of the states projected the bulk of their energy savings from the carpool-vanpool program. However, several states put heavy reliance on other programs as indicated by the following: driver education—Pennslyvania, Illinois, Indiana, Iowa, and Kentucky; transit measures—Kansas, Alabama, and Tennessee; automobile inspection—New Jersey, Minnesota, and Wyoming; and urban system planning—Florida.

Some idea of the relative importance of the transportation programs in the states' conservation efforts is given in Table 16, which shows the ratio of 1980 expected energy savings to 1977 vehicle registrations (in million Btu per vehicle). Considerable variation occurs, with the District of Columbia, Wyoming, Florida, Nebraska, and New York apparently strongly reliant on the transportation programs, while New Mexico, Ohio, West Virginia, Oklahoma, and California show little or no reliance on those programs. These transportation program data are the bases for several critical comments.

First, the numbers shown are likely to be preliminary and rough approximations, at best. For example, Pennsylvania attributed almost half its estimated savings to driver education, which seems rather optimistic given very low estimates for that program by other states.

Second, the use of carpools and vanpools is inhibited by a variety of government regulations whose initial purpose appears to have been to limit competition. Carl Rappaport of the U.S. Department of Transportation noted the following (58):

> Numerous legal and regulatory constraints, originally promulgated to protect the transit industry, now inhibit the development of vanpools even in low-density markets which cannot support conventional transit service. Insurance and workers compensation requirements appropriate to employer-employee relationships are inappropriately applied to pools of coworkers and/or neighbors. Prohibitions against jitneys and group-ride taxis virtually eliminate potentially energy-efficient modes of transportation in many areas. Entry limitations on taxis prevent expansion of a mode which may be more energy-efficient than the alternatives in many jurisdictions. Economic and safety regulation of energy-efficient modes of commercial transportation indirectly benefits energy-inefficient private transportation by automobiles and trucks.

It seems quite possible that deregulation of local and bus transportation might yield a success story parallel-

Table 16. Comparisons of 1980 energy savings from transportation programs to 1977 vehicle registrations.

Region and State	1977 Vehicle Registration (000s)	1980 Energy Savings (10^{12} Btu)	Million Btu per Vehicle
New England			
Connecticut	2 089.7	12.10	5.79
Maine	718.7	0.13	0.18
Massachusetts	3 519.6	5.92	1.68
New Hampshire	563.2	1.92	3.41
Rhode Island	669.3	0.21	0.31
Vermont	320.4	1.76	5.49
Mid-Atlantic			
New Jersey	4 407.4	15.00	3.40
New York	7 730.3	61.20	7.92
Pennsylvania	8 101.8	40.63	5.01
East North Central			
Illinois	6 861.1	13.94	2.03
Indiana	3 586.0	5.52	1.54
Michigan	5 986.1	30.50	5.10
Ohio	7 504.3	1.90	0.25
Wisconsin	2 667.1	8.91	3.34
West North Central			
Iowa	2 221.9	6.84	3.08
Kansas	1 892.8	9.91	5.24
Minnesota	2 813.3	8.21	2.92
Missouri	3 052.7	9.43	3.09
Nebraska	1 207.7	9.38	7.77
North Dakota	580.4	1.28	2.21
South Dakota	560.7	1.05	1.87
South Atlantic			
Delaware	373.9	0.51	1.36
District of Columbia	260.7	8.26	31.68
Florida	6 095.8	54.21	8.89
Georgia	3 496.3	3.90	1.12
Maryland	2 587.2	17.75	6.86
North Carolina	4 079.3	6.93	1.70
South Carolina	1 857.6	1.90	1.02
Virginia	3 256.8	7.25	2.23
West Virginia	1 136.4	0.03	0.03
East South Central			
Alabama	2 673.6	9.80	3.67
Kentucky	2 449.7	4.00	1.63
Mississippi	1 494.0	1.63	1.09
Tennessee	2 996.2	15.98	5.33
West South Central			
Arkansas	1 422.8	1.84	1.29
Louisiana	2 421.5	3.63	1.50
Oklahoma	2 296.4	0.00	0.00
Texas	9 489.1	0.42	0.04
Rocky Mountain			
Arizona	1 554.2	1.62	1.04
Colorado	2 162.9	6.84	3.16
Idaho	717.6	0.19	0.26
Montana	725.5	3.23	4.45
Nevada	548.8	0.89	1.62
New Mexico	907.1	0.00	0.00
Utah	908.5	1.60	1.76
Wyoming	376.0	5.31	14.12
Far West			
Alaska	257.5	0.88	3.42
California	14 958.0	0.03	0.00
Hawaii	521.2	0.20	0.38
Oregon	1 776.4	1.76	0.99
Washington	2 894.9	8.79	3.04

ing that obtained from the recent deregulation of air transportation.

Finally, energy conservation plans and programs often run the risk of suboptimization, which is another way of saying penny-wise and pound-foolish. If we focus only on the objective of reducing energy use and neglect what we give up when we save energy, we can lose more of other good things, in value terms, than we save in energy. As a case in point, Charles Lave estimates that the 55-mph speed limit costs about $1.3 million per life saved and wonders whether that trade is a bargain (57). Generally, it is likely that the saving varies between states. This suggests that cost-benefit evaluations would give us a better basis for policy. Further, there seems to be a great deal to be said for the application of cost-benefit analysis to energy conservation programs in transportation. I suggest that higher prices (by way of higher motor fuel taxes, in particular) ought to be one of the programs to consider.

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Regulation and Deregulation

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Transportation in the United States is subject to economic and social regulation of bewildering complexity and is administered by a variety of institutions in pursuit of numerous desired ends. This paper describes the nature of current state- and federal-level transportation regulation, especially economic regula-

tion. Because the future of transport regulation has been called into question, the paper also discusses proposals for deregulation and investigates their potential impacts. Finally, issues are raised about the relation of regulatory change to state transportation planning and program administration and to state agencies charged with these duties.

EARLY REGULATION

The foundations of U.S. regulation were established in English common law because the provision of transportation was known as a "common calling," and transportation common carriers were subject to special requirements in the sale of their services. Common carriers were required to serve all at reasonable rates without discrimination. In return, government afforded common carriers special protection and privilege.

With the development of railroads in the United States, the question was raised whether these basic legal tenets and the body of case law that developed about them could deal with the issues generated by a new and rapidly dominant technology. Complaints about the business practices of the new mode were extensive. In several eastern states in the 1830s, 1840s, and 1850s, legislative and special commissions established for this purpose sought to establish maximum rates for the movement of freight and passengers, to require publication of rail rates, and to bar discrimination (1). More significantly, the midwestern Grange states enacted laws in the 1870s to prevent railroad abuses; these laws dealt with maximum rates as well as discrimination among persons, places, and commodities.

Following U.S. Supreme Court interpretation of state regulation and studies by congressional committees, the basic instrument of national regulation of the railroads was established in 1887 with the Act to Regulate Commerce (i.e., Interstate Commerce Act and related laws, Title 49, Subtitle IV, U.S.C.). With changes in transport technology and the conditions of competition in the various transportation markets, regulation was extended by such legislation as the Hepburn Act of 1906, the Panama Canal Act of 1912, the Transportation Act of 1920, the Motor Carrier Act of 1935, the Civil Aeronautics Act of 1938, and the Transportation Act of 1940 (2).

The result was a comprehensive set of regulations of the various modes covering market entry and exit, prices, discrimination, and the general market behavior of many, but not all, transport firms. Institutions to accomplish regulation included the independent federal commissions of the Civil Aeronautics Board (CAB), the Interstate Commerce Commission (ICC), and the Federal Maritime Commission (FMC), plus state and city public service or public utility commissions.

CURRENT REGULATION

In recent years, there have been two major trends that have greatly changed the regulatory atmosphere. First, economic regulation, defined as the control of rates and conditions of service offered by transport firms, has been reduced through the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act) and the Air Transport Deregulation Act of 1978. More importantly, the ICC (and before it, the CAB) has greatly changed the thrust of economic regulation through administration action. Second, social regulation, dealing with health, safety, and environmental protection, has been greatly expanded in all areas (but with particular impact on transport) through such federal legislation as the National Environmental Policy Act of 1969, the Clean Air Act (especially as amended in 1977), the Noise Control Act of 1972, the Resource Conservation and Recovery Act of 1976, the Federal Water Pollution Control Act (and its 1972 amendments), the Clean Water Act of 1977, and numerous acts dealing with transport safety. These acts are supplemented by a great variety of state legislation.

ISSUES IN REGULATION

As with most long-lived institutions, there are major issues about economic regulation. Table 1 (3) lists the pros and cons of these issues in light of the current state of regulation.

The issues concerning social regulation are equally extensive but may be summarized by stating that proponents believe social regulation insufficiently restricts the excessive number of costly and incompatible externalities resulting from transport output. Opponents believe the restrictions are onerous, are overly extensive, stifle productivity and technological change, and represent extreme examples of government red tape.

Certainly the tremendous differences between the claims of proponents and opponents of transport regulation, economic or social, suggest that resolution of these issues is anything but easy. Moreover, various resolutions are likely to have varying impacts on various sectors of the population and other aspects of transport supply and demand. Those who deal with the full scope of transportation in the field of government, or those who deal with transportation as users or providers, should be aware that issue resolution regarding regulation is

Table 1. Summary of arguments for and against economic regulation of transportation.

For Regulation	Against Regulation
1. Will prevent destructive competition (competition is thought to be inherently destructive; without constraints on entry and controls on prices, service in the public interest would not survive)	1. Will result in monopoly profits and inefficient resource allocation
2. Will keep rates stable, nondiscriminatory (among areas, commodities, and different shippers), reasonable, and nonpredatory	2. Will generate excessive costs due to such restrictions (for example, in trucking) as circuitous routing, commodity restrictions, protection of inefficient firms, insufficient competitive pressures, and labor inefficiencies or high returns
3. Will continue services by retaining common carrier obligations, cross subsidizing low-density areas, and preserving national networks of suppliers	3. Will offer the wrong price-quality options (with higher prices and quality of service than competition would ordinarily allow)
4. Will avoid increasing industry concentration	4. Will increase external costs such as energy consumption and highway congestion
5. Will eliminate "fly-by-night" operators	5. Will result in inequities for small entrepreneurs and minority suppliers who become frozen out of various markets
6. Will retain an adequate flow of information	
7. Will maintain safety standards	

likely to affect the operation of such public tools as finance, pricing and taxation, ownership and operation of transport systems, planning and the provision of information, and the organization of government institutions or of industry. The ways in which regulatory issues are resolved can likewise affect all the goals that transportation seeks to achieve (Table 2, 3).

RESEARCH ON IMPACTS OF REGULATORY CHANGE

Fortunately, regulation has been extensively investigated over the years. As background for policy discussion in the legislative field, this section reports the results of some of those investigations as they pertain to potential regulatory changes. The impacts are reported according to a format that uses the 11 transportation goals presented in Table 2. Further, gainers and losers from deregulation are pointed out, and modal impact is described.

Overall Effects of Changes in Economic Regulation

Most studies suggest that deregulation of competitive transportation markets would yield very large net benefits (4, 5). Firms would be expected to compete within and between the modes.

Although the benefits of a program of deregulation are likely to be substantial, neither all benefits nor all costs can be predicted in advance. In particular, the exact consequences of altering the role of motor carrier rate bureaus as forums for fixing prices may not yet have been fully determined. Rate bureaus have been reluctant to divulge needed information that might be used to analyze how far price-fixing activities keep certain motor carrier rates above competitive levels, or whether there may be compensating benefits to shippers. To date, only partial answers have been available, such as those of researchers examining intrastate motor carrier rates in the unregulated environment of New Jersey. In that state, it was shown that unregulated rates are higher than expected, perhaps due to the umbrella effect of regulated rate bureau-determined rates (6).

Additional evidence was provided to the ICC in its Ex Parte 297, Sub. No. 3, on the investigation of rate bureau practices by such agencies as the U.S. Department of Justice (DOJ) and the Federal Trade Commission (FTC) and its Bureau of Competition. The ICC is empowered to alter approved rate bureau practices where necessary. The DOJ and FTC, among others, argue that the ICC should act to remove the rate bureaus' antitrust immunity. [U.S. Senator Edward M. Kennedy (D.-Mass.), chairman of the Senate Antitrust and Monopoly Subcommittee, conducted hearings in 1977 and 1978 on freight rate competition in the motor carrier industry in general and on rate bureau practices in particular. The testimony of ICC Chairman Daniel O'Neal was quite instructive about ICC procedures (or lack thereof) to determine whether rate bureau practices are beneficial.]

The results of an ongoing analysis sponsored by the U.S. Senate Judiciary Committee should shed further light on the substantial costs to the shipper of motor carrier rate bureau practices. This study uses data collected by rate bureaus.

Even if this new study and the previous evidence are not totally conclusive on the exact level of benefits from rate bureau reforms, nonetheless, change appears beneficial. Presumably, the burden of proof should be on those who argue for retaining current regulations. It should be easier to quantify the purported benefits of the existing regulated situation—if benefits exist—rather than the potential benefits of proposed deregulation. Moreover, there are measurable administrative costs to the regulatory process. On the other hand, the benefits of price fixing to the shipper under status quo policies do not seem to have been demonstrated by those advocating continued regulation.

Following are capsule descriptions of impacts of reduced economic regulation of transportation. [These descriptions are based on an unpublished memorandum written for the National Transportation Policy Study Commission in June 1978 by Professor Ernest Williams, who is not responsible for my interpretation of his views given here.]

1. Efficiency. Competition in most transport markets should be sufficient to ensure rates at or below cost plus a reasonable profit, thus providing protection for the shipper. Allocative efficiency among modes can-

Table 2. Summary of national transportation goals and their primary characteristics.

Goal	Characteristics
1. Adequate service	Would mean comfortable, convenient, fast, accessible, and reliable service to all
2. Appropriate rates and prices	Refers to reasonable fares, rates, and costs for rider, shipper, and providers of transportation
3. Economic efficiency	Would maximize service for each transportation dollar (inputs), administrative effectiveness, intergovernmental cooperation, and promote competition among modes
4. Energy conservation and development	Would conserve and develop transportation fuel and would provide movement of energy for other uses
5. Environmental protection and enhancement	Would relate to concern for aesthetics; noise, air, and water protection; and historical site preservation
6. Safety	Would see that operators, passengers, and pedestrians are safe from personal injury and crime; goods are safe from damage; vehicle design and insurance are appropriate
7. Employment	Would provide transportation employment opportunities, job protection, access to all employment opportunities, and fair labor-management relations
8. Industry promotion and protection	Would provide protection for each mode against unfair competition and would maximize private-provider participation
9. Regional and urban development	Would encourage economic development and coordinated land use and transportation development
10. Equity	Would see to the impartial treatment of modes, users, and regions
11. Defense	Would assist in national and civil defense efforts and in international relations

not be secured, however, unless changes in government financing are also adopted so that market freedom is founded on neutral public policies with respect to rights-of-way. Competition is expected to eliminate inefficient carriers or cause them to reform their practices. These benefits will not necessarily flow to communities or routes where traffic volume will support only one or several carriers. Nor is freedom to abandon likely to result in so large a reduction of rail kilometers as efficiency criteria require. As major transport inputs are procured in markets characterized by a measure of market power, the most efficient allocation of resources between transport and other sectors of the economy cannot be ensured without appropriate antitrust-type enforcement.

Results become speculative when one recalls that regulation that the U.S. Congress takes away can also be reimposed; hence, the responses of large regulated carriers (especially railroads) and of the regulatory agencies are likely to be cautious. It seems that most railroads did not benefit from the pricing freedom that Congress believed it had granted in the 4R Act. Moreover, railroads and other carriers find a proportion of their traffic tendered by organizations much larger than themselves and equipped with strong bargaining power and wider alternatives than smaller shippers.

2. Adequate service. With regulations adjusted to permit carriers the freedom to price within wide limits, various service-rate packages presumably would be offered. Such action would afford shippers a broader choice.

3. Appropriate rates and prices. If the assumption of constant or declining returns to scale and to route density holds for all modes and if common costs are insignificant, rates should move to a close approximation of cost in all substantially competitive markets. Wherever the opposite prevails, some development of the type of discrimination that the Act to Regulate Commerce [Interstate Commerce Act, Section 1 (49 U.S.C. Section 10701)] and the Elkins Act sought to control may be expected in view of unequal bargaining power between buyers and sellers of service. [The recodified Interstate Commerce Act incorporates the Elkins provision for forfeiture of three times the amount of rebates or concessions for six years from the time of action (49 U.S.C. Section 10701).] For this reason, enforcement of improved antitrust rules and regulations will be required with deregulation by using the mechanisms that now apply to other sectors of the economy.

4. Energy conservation. Deregulation has been expected to induce a shift of traffic to more fuel- and labor-efficient modes by the adjustment of pricing. The combined impact of constrained capital inflow to the rail industry since 1906 and the massive public investment in the Interstate highway system since 1956 has altered the cost relations between these modes in such a way that much more modest expectations are in order, absent a massive upgrading of the rail plant. The propostion that railroads are more fuel efficient in their current state than motor carriers for the kinds of hauls performed today by motor carriers is at issue.

The proposition that freedom from entry and route controls will greatly improve the round-trip loading of motor vehicles, hence their fuel efficiency, may not give adequate account to the imbalance of traffic flows and the degree of use of specialized vehicles dedicated to particular commodities that have one-way flows. As with much else, there are few facts on which to decide the issue.

5. Environment. The impact here is as uncertain as in the case of energy conservation. Sharp rate competition in the marketplace, however, might induce less adequate maintenance of vehicles with possible adverse energy and environmental effects. For this reason, strict enforcement of safety standards for certificated carriers should be part of deregulation proposals.

6. Safety. The problem exists of enforcing safety regulation with a shifting population of carriers under severe competitive pressure. Enforcement of hours of service, vehicle standards, and other regulations may be most effective (7).

7. Employment. Absent major intermodal shifts, the impact of regulatory reform on employment is likely to be minimal to the operating forces. With certain activities of rate bureaus curtailed and with rate making decentralized to meet competition on the spot, carriers may require more staff for marketing, rate-making, agency, and customer-contact purposes. The changed character of rate making will render some existing employee skills superfluous and will require replacement by different types. The Class B ICC practitioner will lose business, for example, but lawyers may profit from increased litigation before the courts. Shippers may find it necessary to enlarge traffic departments in order to track changing service patterns and rates, although it is also possible that rates would become simplified without such a detailed regulatory apparatus.

8. Industry promotion. The advantage, in the short run, is likely to go to smaller organizations that can readily adjust to change. In the less-than-truckload (LTL) business and in railroading, the longer run should see concentration of volume in the hands of fewer carriers with broader territories (reflecting possible economies of scale), increased bargaining powers, and improved capital flow.

9. Urban and regional development. Rural and sparsely populated areas may gain from better service (perhaps at higher rates more reflective of costs), and high-density intercity markets may also gain from continued good service at reduced rates closer to costs.

10. Equity. If by equity is meant equal access to service and to comparable rates by all shippers, regardless of size and location, adverse results are anticipated. If equity means equal opportunity to compete for traffic, some carriers will lose due to failure or inability to adjust to changed circumstances, which is the responsibility of carrier management.

11. Defense. Increased price-service options should benefit the U.S. Department of Defense, as it does other shippers.

12. Gainers. Large shippers clearly stand to gain. They will obtain automatically the right to intercorporate hauling, the right to back-haul for hire without regulatory proceedings, and bargaining power in accord with the traffic volumes at their disposal. It is also likely that shippers in general will benefit from improved service, availability of capacity in peak periods, and generally lower rates. Carriers with flexible managements should be able to capitalize on rate and route freedom to enlarge and balance traffic volume—even though their margins may be reduced—with the possible exception of certain railroads tied to territories and route patterns by fixed infrastructures.

13. Losers. Because the cross subsidy inherent in current rate structures will disappear, branchline points and points of small traffic generation will be forced up to rates more closely aligned with costs. Under reformed procedures, small carriers will require improved cargo clearinghouse support, perhaps by using enlarged alliances to expand joint territorial contact. Carriers will tend to move into a better position to use the economies of owner-operators than in the past, which might result in a relative loss for organized labor, at least in the short run. The increase of car-

rier freedom may abridge the existing rights of certain shippers who lack bargaining power. For this reason, antitrust rules should apply to prevent predatory behavior by carriers or shippers.

Modal Impacts: Railroads

Changed Rate Regulation

Possible rate regulation changes that could apply to railroads are (a) establishment of an expanding no-suspend zone of reasonableness, with rates outside the zone subject to review on grounds of alleged predation or market power and rates inside the zone reviewed by agencies enforcing U.S. antitrust statutes; (b) extension of certain motor and water carrier rate exemptions to railroads; (c) allowance of rail contract rate making on terms equivalent to those available to other modes; (d) permitting easier abandonment of branchlines; (e) elimination of ICC car service orders and car rental rates; and (f) alteration of rate bureau practices. Evidence concerning impacts of the first four of these rail regulatory charges follows.

Creation of a No-Suspend Zone of Reasonableness

Permitting an increasing no-suspend zone enhances economic efficiency by allowing rates to respond to changing market conditions and to tend toward marginal cost in the long run in markets not characterized by inordinate market power or externalities. [Potential negative efficiency consequences of allowing rate freedom might exist in cases of market power.]

A recent U.S. Department of Transportation (DOT) study indicated that rail rates are typically below variable costs on forest products, crushed and broken stone, miscellaneous mixed shipments, fresh vegetables, fruits and nuts, grain mill products, and gravel (8). According to this study, such rates range from 80 to 100 percent of system variable cost. To the extent that these rates also fall below marginal cost, permitting some upward rate freedom would enhance efficiency. The same study predicts that allowing some rate flexibility would result in a savings of $250 million to the railroad industry.

The Association of American Railroads (AAR) has calculated an additional savings to the railroad industry that would result from rate freedom through avoidance of the time lag inherent in any rate case before the ICC; the savings would have totaled $2.2 billion between 1967 and 1975 (9). DOT, in its recent 504/901 study, also cites reduction of regulatory lag as an important saving associated with a no-suspend zone. [The 504/901 study is a reference to sections of the 4R Act that mandated the study.]

Raising rates on those commodities for which rates are currently below variable cost would, according to DOT, both increase operating revenues for the railroads and result in either some diversion to other modes or a reduction in movement of the affected commodity (8).

The question of identifying the scope of rail monopoly power is an important aspect of rail deregulation proposals. In a recent congressional symposium that addressed this question, it was asserted that given shippers' opportunities for transportation and product substitution, rail-captive traffic is constantly changing and eroding. The symposium report cites growth in competition to rail for coal (e.g., through mine-mouth generation, other modes, and the use of other energy sources), grain, automobiles, and pulp board as examples of eroding rail market power (10).

A question that must be posed with regard to any no-suspend zone is whether it is wide enough to permit efficient pricing in general and at peak and off-peak times in particular. The 4R Act allowed more rate flexibility for demand-sensitive rates, but a requirement for a 30-day notice of publication and subsequent court challenges by shippers prevented any real demand-sensitive pricing. DOT has estimated that variation in demand for produce movements between California and Chicago for rail service is more than 600 percent. [The ICC acted on March 22, 1979, to deregulate rail carriage of fresh fruits and vegetables in Ex Parte No. 346 (Sub. No. 1), Rail General Exemption Authority—Fresh Fruits and Vegetables.] Peak off-peak variations in demand should be considered in determining the exact level of a no-suspend zone.

Another reasonable prediction as to the likely impacts of rate freedom on rates and service is as follows: Rates in markets with excess capacity would first be driven below average cost and some excess capacity would be eliminated. Where more than one railroad competes in a market, discriminatory rates would cease. Rates would tend to go down on high-valued goods and rise on low-valued goods. To the extent that railroads maintain any market power, rates would tend to be higher, and more capacity would be shed than under a competitive environment (11).

DOT predicts that there could be some short-run deterioration in rail safety because rate flexibility will allow the railroads to lower some rates below average cost and to begin a process of disinvestment where excess capacity now exists (8). Once disinvestment is complete, improved economic conditions resulting from regulatory reform should provide more resources for facilities and maintenance. As a result, safety may be improved.

A recent article illustrated the potential conflict between goals of energy efficiency and economic efficiency. It predicted that deregulation of rail and truck freight operations, although enhancing economic efficiency, may have the net effect of increasing energy use (12). With regard to rail rate freedom in particular, the example was cited of the shipper who, faced with lower rail rates or improved service, would opt for better service in the form of more frequent smaller shipments. Thus, although the optimum shipment size would decrease, the energy required to fill the shipper's transportation needs would increase (12). It was also noted that (a) total logistics costs as well as energy consumption are probably close to being optimized now and (b) for-hire transportation is not an area with great potential for fuel savings (12).

Extending Exemptions to the Railroads

DOT commented on the ICC proposal to exempt fresh fruits and vegetables from rail rate regulation. DOT asserted that the development of monopoly rates (the only potential negative consequence) would not be possible because the commodities in question would be subject to direct motor carrier competition. This lack of potential for rail-monopoly pricing would apply not only to fresh fruits and vegetables but to any commodity now exempt for motor carriers.

With regard to the impact that extending the exemption to railroads would have on rates, DOT predicts that, if the exemption were extended, railroads would offer contract rates to shippers for those who prefer rate stability. Shippers not opting for contract rates would be subject to the prevailing rates reflecting market conditions at the time. In either case, efficiency would

be enhanced, and shippers would have access to more price-service options.

Rail Contract Rates

According to the DOT 504/901 report, permitting railroads to offer contract rates would reduce shipper uncertainty over future rates; thus, service would be tailored more nearly to the needs of particular shippers. Further, DOT predicts that rail contract rate making would help solve the problem of regulatory imbalance, as competing motor carriers and water carriers are currently able to negotiate long-term contracts (9).

In a recent ICC proceeding on rail contract rates, DOT predicted that implementation of this policy would lower the railroads' cost of doing business, provide rate-service options more economical to shippers, and thus be anti-inflationary.

Eased Rail Branchline Abandonments

In addition to the several rate-related policies discussed here, policies could be recommended to alter the standard for abandonment approval and to expedite abandonment proceedings. The standard could be altered by requiring that carriers not be obliged to offer uneconomical service. In terms of rail branchlines, branchlines that are or become uneconomical would either be abandoned or operating losses and a return on investment would be the responsibility of various levels of government or of shippers in the affected community, not the carrier. Further, proceedings could be expedited, and a subsidy program might compensate carriers for losses incurred pending a decision on abandonment.

Easing rail abandonments would enhance direct economic efficiency. Railroads would be able to shed uneconomical branchlines, which would increase the prospects for financial viability of the affected rail firms.

The following are estimates of the cost savings to railroads that would result from abandonment of all uneconomical branchlines. Four categories of cost savings are relevant: (a) revenue accruing from the sale of land and salvageable assets, (b) savings in rehabilitation costs that would occur if uneconomical lines were retained, (c) annual savings in operating losses that would occur if lines were retained, and (d) savings in legal and administrative costs associated with abandonment proceedings.

The DOT 504/901 study estimates that legal and administrative costs to a carrier for each abandonment application can exceed $50 000 (9). By expediting the proceedings and altering the standard for approval, the cost per application should decrease, which may encourage railroads to pursue abandonment on nonviable lines.

Another study on the potential benefits of large-scale branchline abandonments calculates cost savings based on an estimate of 56 482 km (35 301 miles) of nonviable lines. Such abandonment would imply, according to the simulation, a saving of $1.5 billion from the sale of land and salvageable assets; a saving in foregone rehabilitation costs of $2 billion; and an annual saving in operating costs of between $138 and $303 million (13). Disinvestment of these lines implies an annual saving to the railroads of between $450 and $600 million. These savings would double the railroads' net return on investment (13).

A different study predicts that, if the rail network is rationalized, additional light-density lines will become nonviable, and, by the year 2000, a total of 120 000 km (75 000 miles) of rail network will have been abandoned, assuming no subsidy for continued operations is provided (14). An abandonment program of this magnitude would imply a much larger saving than that estimated here.

The Federal Railroad Administration (FRA) estimated that as of 1971, 33 600 km (21 000 miles) of low-density lines were uneconomical, which means a saving of $105 million in salvage value and an annual saving of between $29 and $42 million in operating costs if the lines were abandoned (8).

A subsequent DOT study produced higher savings estimates. For an estimated 40 800 km (25 500 miles) of light-density lines outside the Northeast region projected to be abandoned, DOT estimated an annual saving in operating costs of $150 million; this amounts to 18 percent of the net income of railroads outside the Northeast. The value of the track and facilities of these lines was estimated at $640 million (8).

In summary, the estimates of branchlines that would be abandoned and the cost savings that would result vary widely. The route kilometers affected by a liberal abandonment policy range from 33 600 to 120 000. Estimates of annual operating cost savings range from $29 million to $303 million; salvage value estimates vary from $105 million to $1.5 billion; and savings in rehabilitation costs are estimated to be $2 billion.

An additional impact on economic efficiency of rail abandonment policy depends on the question of subsidy of lines that are retained. One author raises the issue of cross subsidy among levels of government. Any external benefits from continued service on nonviable lines accrue largely to local areas, although the bulk of subsidy for continued service is federal. Subsidizing uneconomical lines only at the federal level rather than requiring users and direct beneficiaries to share financial responsibility would have a negative impact on equity (15).

The impact of more abandonments on rail rates is uncertain. If increased abandonment results in consolidating traffic on fewer lines, such that economies of use are realized, rates may go down (11, p. 23). On the other hand, if abandonment is accompanied by upward rate flexibility, shippers may be willing to pay higher rates to retain service on low-density lines, and fewer abandonments may be necessary. What is most relevant is not that rates would increase or decrease, but that railroads would no longer be forced to operate lines where rates are below cost.

The question of whether some low-density lines have the potential to become economically viable depends on railroad cost characteristics and the elasticity of demand for transport of the affected commodities. If demand is relatively inelastic, raising rates might generate increased revenues for railroads. Conversely, if demand is relatively elastic, raising rates would result in lower revenues. It has been observed that it is mostly bulk commodities that originate on branchlines, and processed or finished goods originate on main lines. Service advantages of shipping by truck rather than rail are much less important to shippers of bulk commodities than to shippers of processed and finished goods. Therefore, the demand for rail service by shippers of bulk would tend to be less elastic (i.e., bulk-commodity shippers would be less inclined to shift to motor carriage than shippers who valued the service advantages associated with motor carriage), and increased rail rates on some low-density lines might generate sufficient revenues to continue service (13, pp. 93-96).

For shippers who do shift from rail to truck as a

result of rail abandonment, an issue is whether they face higher or lower costs following the shift. It should be noted that motor carriage offers service advantages over rail. Even where truck rates are higher, it does not necessarily imply that shipper's total logistics costs rise as a result.

Case studies of rail abandonments offer mixed evidence of rate impacts. A study of the impacts of Midwest abandonments following the 4R Act revealed that in the majority of cases the truck rate substituting for abandoned rail service was lower than the rail rate at nearby grain elevators (16). Only two of the 40 elevators affected by the abandonments closed as a direct result of abandonment. An AAR review of a number of retrospective abandonment studies also found that many shippers were forced to switch to motor carrier transportation to cut their operating costs (17). A DOT abandonment study supports this finding. With regard to grain elevators in particular, large grain subterminals were constructed near high-density rail lines; following abandonment, grain was trucked to these subterminals and shipped in unit trains. The lower freight costs associated with unit trains more than paid for constructing the new subterminals plus the trucking costs (8, p. 166).

This evidence does not imply that costs to all shippers will go down as a result of easier rail abandonment policies. Some shippers clearly will be faced with higher transport costs that may result in firms going out of business. The evidence does suggest, however, that there is considerable potential for lower costs for perhaps the majority of affected shippers as a result of rail rationalization.

Where truck rates are so much higher than rail that a shipper cannot afford to use truck service and continue in business, some shipments would be eliminated with easier abandonment policies. There is considerable evidence, however, that instances of lower-cost truck service have resulted from rail abandonment, with resulting expansion of affected businesses.

DOT has made predictions of which industries would be most affected by eased rail abandonment. Agriculture was considered the most affected. Lumber and wood products would be moderately affected, and affected to lesser degrees would be food and kindred products, chemical and allied products, and petroleum and petrochemical products (8, p. 161). As to specific impacts on costs of the affected commodities, DOT estimated that costs to receivers of grain will increase, and the increase will be passed along to consumers. The effect on the costs of agricultural limestone may become prohibitive for those who lose rail service. The impact of higher feed costs on livestock production, however, would not exceed 0.5 percent of the total costs (8, pp. 168-169).

Evidence suggests that little impact on local employment results from low-density rail abandonments. In a review of a number of retrospective rail line abandonments, AAR found that the highway network in rural areas allows workers to commute substantial distances to new employment opportunities and that low-density abandonments have had no significant impact on employment (17).

A report of the National Transportation Policy Study Commission on current transportation issues in the United States cites the employment impacts of rail abandonments as potentially not serious except in those communities with a concentration of rail employees, and even in those communities decreases in rail employment are likely to be compensated by increases in trucking employment (18).

In a study of the economic effects of rail abandonments on selected communities, it was reported that only 2 of 10 communities studied perceived significant short-run impacts on employment (19).

A DOT study of employment impacts of eased rail abandonment policies likened the impact to that of deregulation generally. Calculations indicated that 1700 jobs would be affected at a total payroll bill of $32 million. Employees affected would enjoy labor-protection provisions. These estimates of employees affected do not take into account any resulting increases in employment in trucking (8, pp. 163-164).

Increased rail abandonments may have implications for community growth and economic development. However, the AAR's review of recent abandonment studies indicated that abandonment of branchlines has had little or no impact on economic development of the affected communities (17). A survey of 71 abandonments in Iowa revealed little effect on employment and business or community growth (13, p. 141). In another survey of 10 abandoned communities, even in those instances where the price of products increased as a result, residents continued to buy products locally at higher prices rather than purchase goods in other rail-served communities. Although some firms changed their plans and did not locate in the affected communities, almost all of the communities surveyed added one or more firms after the termination of rail service (19, pp. 59-60).

A study done by the Public Interest Economics Center (PIEC), Washington, D.C., found that, in considering both the direct impact on fuel consumption by rail and motor carriers and the indirect impact on demand for more or less energy-intensive transportation equipment as a result of modal shifts, the impact of rail abandonments on energy consumption was insignificant (20).

A survey of 71 abandoned lines in Iowa found mixed impacts on fuel consumption depending on whether truck service was substituted only for branchline service or whether longer-haul truck service was used. Fuel consumption increased when grain was trucked greater distances following abandonment. In instances where grain was shipped to the same market as before abandonment, fuel consumption decreased significantly (21). Truck transportation is often more efficient than rail for short-haul movements such as those involving branchline operations. Other things being equal, trucks are more fuel efficient for shipments of less than 119 Mg (132 tons) and distances of less than 24 km (15 miles) (18, p. 83).

There are three major potential sources of environmental degradation associated with rail abandonments: air emissions, noise pollution, and the increased need for highway maintenance and construction. PIEC found that the change in fuel consumption resulting from abandonment was insignificant, and it concluded that any impact on air emissions must also be insignificant (20, p. 134). With regard to noise pollution, PIEC found that neither truck nor rail noise present health hazards. Further, the noise levels emitted by both modes are similar, and, therefore, any shift from rail to truck as a result of rail abandonment would have no significant impact on noise pollution (20, p. 132). PIEC's findings suggest that the impact on the environment of increased highway maintenance and construction would also be insignificant. Usually truck traffic changes are not expected to be great enough to warrant increased highway maintenance or construction (20, p. 130).

Modal Impacts: Trucking

The impacts of trucking deregulation are highly con-

troversial. Nonetheless, evidence suggests that regulatory reform will be largely beneficial to trucking interests (through improved productivity) and to users (yielding more price-service options). Reform will not be detrimental to competing modes if these modes, especially railroads, are simultaneously deregulated and if financing, pricing, and taxation reforms are also enacted.

Efficiency

The American Trucking Associations (ATA) argue that deregulation would increase the number of truckers handling the same amount of freight, thereby creating excess capacity and using more fuel. Evidence on freight demand elasticities does not support this view (22).

Efficiency gains from regulatory reforms include the increased ability of truckers to fill backhauls. Studies show that regulated trucking firms do travel some distance empty (23, 24), but the extent of empty backhauls may be less than commonly believed. AAR data reveal that for long-haul truck movement, both regulated and unregulated trucking is usually filled (e.g., about 90 percent of the time). As 100 percent loaded movements would be impractical, these figures support the view that deregulation might not yield great and immediate efficiency gains to all truckers by filling empty backhauls.

The AAR data may permit studies of commodity flows by direction, so that analyses could show the potential for using fewer vehicles to handle the traffic in particular corridors. Data from the continuing traffic study of rate bureaus may also facilitate such analyses. [Sen. Kennedy's Judiciary Committee staff has contracted with various rate bureaus to provide an analysis of the data from the rate bureaus' continuing traffic study.]

Rates and Prices

Following the exemption from regulation of particular agricultural commodities, rates declined (e.g., frozen fruits and vegetables by 19 percent, fresh poultry by 33 percent, and frozen poultry by 36 percent) with reduced stop-off charges as well (25, 26). Evidence from Canada shows higher rates in those provinces with stricter regulation (27).

An examination of the rates of return of various types of trucking may show where future competition might bring rate decreases by applying a zone-of-reasonableness concept. The average return on equity for carriers of general commodities in 1977 was 16.36 percent. A rate reduction of 0.4 percent could reduce this to the new ICC standard of a 14 percent rate of return on equity. Long-haul carriers with very large revenues (more than $10 million/year) showed returns of 21.14 percent on equity in 1977, which includes the nationwide carriers of LTL freight. Rate reductions of 1½ percent would have been required in 1977 to reduce this return on equity to 14 percent. Higher returns are evident in certain regions (e.g., southern, midwestern, southwestern, and Rocky Mountain ICC regions). Regulatory reform may provide relatively greater rate reductions in these regions (28).

A study conducted with data from New Jersey (a state with unregulated intrastate motor carriers) found that large shipping firms received discounts of between 9.7 and 15.2 percent of the applicable interstate tariffs when they dealt with non-ICC-regulated intrastate carriers, and smaller shippers received discounts of between 8.5 and 11.4 percent. The regulated tariffs may serve as a floor even for nonregulated firms because 70 percent of the regulated carriers and 45 percent of the nonregulated carriers used the Middle Atlantic Tariff or used it as a base for negotiations (6). Nonetheless, the New Jersey intrastate firms had better operating ratios (88.11) than the ICC-certificated sector (95.92). [Operating ratio is defined as operating costs divided by operating revenues.] The unregulated firms were smaller and more nonunion than the ICC-regulated firms (6, Table 46).

New rate-making freedom should result in rates based more on costs associated with distance, weight, volume, and direction versus the current structure of rate setting by commodity type. Separate charges for pickup, delivery, and line haul would be expected, and easily damaged goods would experience increased rate differentials.

Safety

Policies for motor carrier regulation have been discussed that allow eased entry into certificated motor common and contract carriage and provide regulated carriers with pricing freedom within an expanding zone of reasonableness to be established by Congress. On the one hand, these policies open the highways to new truckers and other common carriers, thereby increasing the risk of accidents and, accordingly, the incidence of personal injury and property damage. On the other hand, new rate freedom is likely to intensify price competition—a goal of deregulation—but it is also likely that some carriers, if pressed financially, will be tempted to "cut corners" in the area of safety. More safeguards to life and property on the highways of the nation may be needed. Highway fatalities for 1978 exceeded the 50 000 mark, and the early experience in 1979 shows further increases are in store (29).

Motor carrier safety regulation and its enforcement are duties of DOT. [The authority of DOT derives from Section 204 (a) of the Interstate Commerce Act, 49 U.S.C. 304 (a), which was transferred to it when the agency was created on October 15, 1966.] There is some evidence that the Bureau of Motor Carrier Safety (BMCS) does not have the personnel or funds to enable it to enforce these regulations effectively. For example, at one of the largest unannounced roadside inspections conducted by DOT on I-80 near Berwick, Pennsylvania, on August 7-11, 1978, on inspection of 676 vehicles, it was found that 352 (52 percent) had to be placed out of service for one or more violations. The principal defect was brakes. In addition, 371 driver hours-of-service violations were detected and 25 drivers placed out of service; 63 percent of all exempt and 55 percent of all authorized for-hire vehicles and drivers were declared out of service (30).

A year earlier the U.S. General Accounting Office (GAO) reported to Congress (31) that

> In view of the limited accident data being obtained, the continuing infrequence of safety inspections, and the high ratios of trucks taken out of service after inspection, little assurance exists that most motor carriers are operating in compliance with federal safety regulations.

Drivers affirm that federal safety standards are not being enforced and that exempt carriers lead the industry in violations. In a survey of about 10 500 of the nation's truck drivers, nearly half of the exempt carriers who violate the BMCS hours-of-service rules do so by using multiple log books (32.7 percent), by regularly misrepresenting logs (44.94 percent), and by regularly driving beyond the 10-h limit (45.98 percent). At the other end of the scale, corresponding figures

for company-employed common carrier drivers were 1.87 percent, 4.27 percent, and 2.48 percent, respectively (32).

In an effort to come to grips with an existing national transportation problem and to mitigate any possible effects of the new regulation policies proposed, new policies could condition the right of motor carriers to operate (as distinguished from the existing requirement to obtain operating authority) on demonstration of adequate insurance protection. Collection could be a cooperative federal and state effort financed in part by sharing the proceeds of the federal heavy-vehicle use tax. Noncertificated motor carriers and other modes could be subject to similar requirements.

Energy

Fuel savings from less regulation of trucking have been estimated at 3.5 million m^3/year (22 million bbl/year). Most gains accrue to private carriers and regulated LTL carriers. There is relatively little fuel saving by regulated full-truckload carriers (33).

Adequate Service

Within New Jersey, 97 percent of shippers reported that intrastate (unregulated) service was as good or better than regulated interstate service (6). Following deregulation, entry into the interstate LTL business may occur by such small intrastate firms, by newly expanded freight forwarders, and by expansion and merger of existing LTL interstate firms. These actions will result in less interlining. Regarding the stability of the industry, the New Jersey study found that the average age of unregulated intrastate firms was 18.43 years (6). A study of the exempt (agricultural) trucking sector found no more frequent exit from that industry than for similar industries (33). Another study found that the average age of exempt livestock trucking firms was 18 years (33, p. 38). Thus, fears of excessive turnover in a deregulated environment should not be realized.

On the other hand, monopoly should not occur either. Most studies have shown constant returns to scale, although economies may exist in the LTL sector for short hauls (34).

Service to small communities may improve with deregulation (35).

Employment

The average compensation for regulated trucking firms (often using union drivers) is substantially above that for nonregulated firms, as shown below (4, p. 231; 36):

Class	Average Driver Compensation		
	Regulated ($)	Nonregulated ($)	Percentage of Excess
Old Class I ($1-5 million/year annual revenues)	11 099	8 504	30.5
Old Class II ($300 000-$1 million)	10 033	7 566	32.6

At least one study suggests that Teamsters Union members have gained from existing regulatory policies (37).

Industry Promotion

Regulated trucking firms own certificates that have scarcity value. The ATA estimates their value may approximate 15 to 20 percent of the annual revenues of the firms that own them (4, p. 57). In 1972, operating rights of carriers with more than $1 million in annual revenues were carried on their books at values of more than $300 million, which may underestimate the market value (4, p. 5). Household goods certificates were estimated to be worth $60.8 million in 1977 (38). The value of these certificates can be expected to decline as new entry is permitted.

Modal Impacts: Intercity Bus

Rates and Entry

The ICC was given authority to regulate the intercity bus industry by the Motor Carrier Act of 1935 and currently regulates bus entry, operations and route changes, exit, and fares. In 1948, the Reed-Bulwinkle Act made joint fare setting by rate bureaus legal and not subject to antitrust restriction. These acts are the basis for most of the current regulation of intercity buses. It should be recognized that intercity bus firms often derive substantial revenues from package-express and charter operations, in addition to common-carrier passenger service.

Problems in the industry that suggest regulatory change are as follows:

1. Very little intraindustry service competition exists,
2. The industry appears unable to achieve past rates of return under existing regulation (between 1960 and 1970, intercity buses showed a very stable rate of return averaging about 13 percent, the highest and most stable rate for passenger carriers),
3. Cross subsidy has been widely used by bus companies to continue to provide service that loses money in one area but makes a profit on overall operations,
4. Intraindustry rate competition has been discouraged by tariff-filing requirements and certain rate bureau practices, and
5. More than 1750 communities have lost bus service over the past 10 years.

Federal legislation in 1978 (Surface Transportation Assistance Act) sought to aid the industry by authorizing (but not appropriating) funds for rural intercity bus service and terminal development, repealing the excise tax on buses and bus parts, and providing an exemption from the federal fuel tax of 1 cent/L (4 cents/gal).

Deregulation Policies

In the long term, deregulation would suggest complete reform of intercity bus rates and rate bureau practices, entry (subject to compliance with safety, insurance, and financial standards), and exit.

Interim, but less vigorous, policies would be (a) increased rate flexibility, including an expanding no-suspend zone of reasonableness to be established by Congress; (b) easier entry of new carriers, or carriers offering new service on existing routes, with an increased burden of proof on protestants; and (c) federal, state, and local cooperation to subsidize shortfalls for certain uneconomic routes where benefits exceed costs. Such interim policies could give established carriers the opportunity to adjust their operations to become fully competitive. They would also permit new entrants who are financially fit and can demonstrate safe operations.

There have been no large-scale studies to date of anticipated impacts from intercity bus deregulation.

Prior to the 1970s, few bus companies, their competitors, or their riders challenged the ICC's authority to regulate rates, routes, entry, and exit. Inflation, the National Railroad Passenger Corporation (Amtrak), and a general decline in the intercity bus industry have changed that situation. A variety of studies have recently been completed or commissioned.

Adequate Service

Regulatory reform of the intercity bus industry will probably improve service characteristics through more intraindustry competition. Whether service will become more accessible to all is debatable, especially in the rural market.

The intercity bus industry is dominated by two carriers, Greyhound and Trailways. Each has coast-to-coast networks. Together they operate approximately 65 percent of all U.S. intercity bus passenger kilometers and more than 80 percent of those operated by Class I carriers (39). Most of their rural intercity routes feed into the crosscountry network. Two schools of thought exist regarding the impact of deregulation on service. Concern has been voiced that, when the large carriers drop the most unprofitable low-density routes (as they almost certainly will when given the chance), communities affected will be left with no public transportation. It has also been argued that carriers will seek to serve only the densest passenger routes, or to provide only charter and package-express service that may yield higher returns than common carrier passenger service under existing regulations. Other observers contend that profit in the bus industry is not dependent on economies of scale, and smaller carriers, providing specialized service over a limited route, may well be profitable (40). In the latter case, deregulation would allow easier entry of these small carriers, with no loss (and perhaps an increase) of service as large carriers leave the markets. A series of small networks might well provide better regional service than the existing networks geared to long-distance travel. Both the smaller and larger carriers, if given increased freedom to offer a variety of price and service options, can become more responsive to consumer demand.

Policy recommending limited subsidization of service (on terms similar to those aiding rail branchlines or essential, small community air service) could prevent mass abandonment of unprofitable routes in the interim and, at the same time, remove the need for private carriers (or other passengers through cross subsidy) to bear the losses.

Economic Efficiency

Again, it is expected that economic efficiency should improve under regulatory reform. The proposed interim policy to provide subsidy on unprofitable routes will prevent large carriers from abandoning uneconomic low-density routes, while relaxed entry and rate regulations should encourage entry of other firms that can provide profitable service. There is some concern by private intercity bus firms that federally subsidized carriers now may be competing unfairly. It should be noted that intercity bus firms are eligible for federal funding (at state and local option) under Section 18 of the Federal Public Transportation Act of 1978.

Energy Conservation and Safety

Buses are, on the average, from two to seven times as fuel efficient as alternative modes (although comparisons based only on averages may be misleading) (41, p. 18). To the extent that regulatory reform encourages bus use at improved load factors, energy conservation will be favored. Similarly, bus safety records have been impressive (39). But recent projections (41, p. 108) have demonstrated that demand elasticity for intercity bus is very low on most routes (i.e., those with no direct competition). As a consequence, little impact on energy conservation or safety is expected through diversion from modes that are less energy efficient or less safe.

Regional Development

Of the 15 000 communities served by common carriers of passengers (air, bus, and rail), some 14 000 are served only by bus. A 1978 report offers a tentative conclusion, based on financial records of bus firms and consideration of the types of markets they serve, that service to rural communities does not appear to be less profitable than service to large cities (42, p. 19). Thus, simplified procedures for entering and leaving intercity bus markets should result in stable or increased service to rural regions not served by other modes.

Equity

Although intercity buses have been responsible for only about 2 percent of total intercity passenger kilometers since 1970, figures show that up to 1976 they handled more than 50 percent of total intercity passengers carried by public carriers (41, pp. 22-23). Analysis by income and age reveals concentrations of student, retired, and low-income bus ridership not encountered in other modes (whose limited routes or high fares make them inaccessible to these groups). Changed regulation could strengthen the bus industry by allowing it to continue to offer a service not provided by other public transport modes.

Environmental Protection

Buses compare very favorably to railroads (39, p. 328) and other passenger modes in terms of environmental disruption. However, compared to electrified rail, they do produce quantities of nitrogen oxides (40, p. 153).

Modal Impacts: Air Carriers

The deregulation of air cargo and passenger services occurred too recently to determine longer-term consequences. Earlier predictions included expected effects ranging from a loss of $660 million/year to a gain of $1189 million/year on trunk air carrier profits (as the elasticity of demand varied from -0.7 to -2.5 with a 16 percent fare reduction) (43). Deregulation's effects on the number of flights is unclear because low and flexible fares generate more passengers but higher load factors. Other predictions include an erosion of union power and the improved health of smaller short-haul air carriers relative to long-haul carriers in densely traveled markets (43).

Regarding loss of service to small communities, DOT (1976) and the CAB (1975) predicted little change. However, the Air Transport Association predicted substantial reductions in service (1975) (4, p. 235).

Rail Mergers

Yet another area of regulatory policy that might well be revised is that of corporate mergers. Under Section

5(2) of the Interstate Commerce Act as amended in 1940, mergers between railroads must have ICC approval. The ICC must consider several factors in its decisions:

1. Effect of the merger on adequate transportation service,
2. Effect on the public interest of the inclusion or exclusion of other railroads in the territory of the proposed merger,
3. Total fixed charges resulting from the proposed merger, and
4. Effect on labor.

The ICC has discretion to weigh the relative importance of these considerations and to consider other matters such as antitrust. [Mergers approved by the ICC are immune from antitrust laws, but the ICC must consider the competitive consequences of a proposed merger and determine that the probable adverse competitive results are outweighed by probable transportation and public interest benefits.]

It has been argued that the ICC interpretation of Section 5 of the Interstate Commerce Act has hindered railroad restructuring (8, p. 78). In attempts to maintain adequate service, the ICC has imposed protective conditions on merger packages to minimize the effect of merger on other parties (44). These conditions dilute the potential benefits of a merger and make restructuring less attractive. For example, during a 1950 merger proceeding involving the Detroit, Toledo and Ironton Railroad Company and others, several railroads alleged the merger would deprive them of traffic and jeopardize their financial position and ability to serve the public. The ICC imposed six conditions on the merger, limiting the merged roads' ability to alter premerger traffic patterns. These, known as Detroit, Toledo and Ironton Conditions or Standard Routing and Gateway Conditions, have been imposed on most mergers since 1950 (44).

It is also said that the ICC's failure to reach merger decisions in a reasonable length of time hinders needed rail restructuring. Between 1955 and 1972, the total time from initial filing with the ICC for merger, acquisition, or control of two or more Class I railroads to final authorization ranged from six to 108 months (44).

Title IV of the 4R Act added new rail merger procedures, as follows:

1. The U.S. Secretary of Transportation conducts the initial analysis of the impact of the proposed merger on shippers, consumers, labor, and geographical regions;
2. Public interest is the standard for ICC approval as opposed to the Interstate Commerce Act standards listed above;
3. Once an application that has been reviewed by the Secretary is presented to the ICC, it is directed to make a decision based on the public interest tests without concerning itself with inclusion applications (9, p. 126); and
4. Strict time limits have been specified for both the Interstate Commerce Act Merger Procedures (31 months total) and the 4R Act Expedited Railroad Merger Procedures (24 months after the ICC's receipt of the Secretary's recommendations).

Deregulation Recommendations

In accordance with the 4R Act goal of encouraging voluntary, privately initiated railroad restructuring, strengthened rail merger policy guidelines would prevent potential efficiency gains from being jeopardized by uneconomic conditions placed on merger agreements. Specifically, economic analysis could be used to weigh the benefits of rationalization against possible costs to shippers and labor, and mergers could be subject to the antitrust policies applicable to other sectors of the U.S. economy.

Impact Analysis

Impacts would be expected in several areas. These would include economic efficiency, service, and equity.

Corporations may consider merger in order to improve financial strength and profitability through changes in operations, to gain access to capital, and to expand service. In many cases a carrier can achieve gains in efficiency only through investment. Such investment may upgrade or establish links between merged properties or redesign yards to accommodate traffic changes. If mergers are not burdened by involuntary inclusion of uneconomic assets and restrictions and if the process can be concluded in reasonable time, a merger is more likely to achieve the potential economies inherent in the consolidation process (45). [The Rail Services Planning Office has concluded that, although paralled mergers offer opportunities to reduce excess physical plant, increase traffic density, and reduce unit costs, end-to-end mergers generally provide potential for greater long-term advantages with fewer risks than most parallel mergers.]

There are several potential impacts on service. On the positive side, mergers that could improve service to the public are more likely to be initiated if there is reasonable assurance that few involuntary inclusions or uneconomic conditions will be imposed by the ICC (45, p. 47). On the other hand, if merger is used as a tool for resolving the marginal railroad problem, certain services of marginal carriers may be jeopardized by the merger (45, p. 39).

One potential difficulty in compressing the merger decision time period from 31 months is that, as proceedings evolve, they can become greatly complicated through the filing of inconsistent applications and petitions for inclusion. If the ICC is required to dispose of these petitions and applications within a shorter time limit, affected parties may be deprived of full opportunity to present their positions (10, p. 144).

Mergers—Motor Carrier

Section 5(2) of the Interstate Commerce Act authorizes motor carriers to consolidate or merge with ICC approval, if the proposed action is found to be just, reasonable, and in the public interest. Two basic criteria are used by the ICC to determine whether consolidation is in the public interest: (a) the anticipated public benefits available from unification and (b) the effect on competing carriers. The impact of proposed mergers on competing truckers is controversial, but the ICC generally appears supportive of trucking mergers (46). [If merging firms have less than $300 000 gross operating revenues for a 12-month period prior to merger, no ICC approval is required.]

To comply with the congressional mandate of controlled entry, the ICC has taken the position that the service to be performed after merger should be no greater than each carrier could have performed separately by means of interchange agreements. If the merged route authorization is greater than the prior combined route structures, a new competitive service has been created. For a new service, the ICC must decide if benefits to the shipping public are greater

than adverse impacts on protesting truckers before a merger approval is granted (46, pp. 112-113).

New service does not automatically mean a merger will be denied, but the ICC's position has caused restrictions to be placed on some motor carrier mergers that lessen the service and profit potential of merger (46, p. 165). [Three of the more severe restrictions are (a) gateway restrictions to prevent route authorization conversions, (b) nonauthorization of tacking, and (c) overall commodity and place restrictions based on a vendor's route dormancy.]

Deregulation Recommendations

In the near term, the ICC could strive to eliminate restrictions that lessen the potential gains from motor carrier mergers. There are at least two methods of achieving this goal and meeting the existing congressional mandate of entry control. First, a strict burden of proof could be required for protesting carriers who claim that restrictions are needed to protect their ability to meet common carrier obligations (46, pp. 165-166). Second, where there is conclusive proof of extensive damage to competing carriers, merger applicants should be required to make short-term indemnity payments to protestants, permitting a reasonable time to adjust to the new competitive situation (46, pp. 165-166).

Impact Analysis

Impacts are expected in the areas of service and employment. The primary advantage of trucking consolidation (particularly end-to-end) lies in reducing the amount of interlining required and in improving service through reduced handling, less chance for theft and damage, quicker hauls, improved scheduling, and faster tracing (46, p. 60). With less restriction on merger agreements, the potential for service improvement increases.

Because the motor carrier industry is still growing, mergers may not eliminate overall employment opportunities. One transportation labor leader has said, "In the long run, mergers create jobs" (46, p. 96).

Long-Run Merger Policies

In the long run, transportation mergers for all modes could be subject to reformed antitrust laws to increase efficiency. Such antitrust policy should consider, to the extent they are measurable, gains in technical efficiency that result from a merger. These gains would be weighed against any losses in the allocative efficiency associated with potential monopolization of a market in such a way that mergers would be unlawful only where the costs exceeded the benefits. (Current antitrust law does not weigh benefits against costs in assessing mergers.)

The statute affecting the legality of corporate mergers, Section 7 of the Clayton Antitrust Act, condemns mergers whose effect may be substantially to lessen competition or tend to create a monopoly. The category of mergers most relevant to the transportation industry is that of horizontal mergers, that is, those affecting one market. Section 7 has been interpreted by the courts to strike down horizontal mergers creating market shares of as little as 5 percent (47).

A recent review of antitrust, which generally supports more vigorous enforcement, cites the counterproductive impacts of federal antitrust action with respect to mergers. It is suggested that federal antitrust resources would be more productively spent on monopolization or trade-practice cases than on mergers (48).

Subjecting transport mergers to DOJ rather than ICC authority would eliminate the need for prior approval of mergers. To subject transportation mergers to market-share standards may not be appropriate as an indicator of potential market dominance in freight transportation, as discussed in a PIEC paper on the benefits of rail deregulation (20, p. 30).

End-to-end mergers, which do not reduce competition in a particular market, represent potential gains in technical efficiency to the affected carriers, with little, if any, potential for increased market power (45). For this reason, an efficient antitrust policy with respect to transportation would presume legal most predominantly end-to-end mergers.

The impact of predominantly parallel mergers (as contrasted to end-to-end mergers) would be mixed. Parallel mergers may result in cost savings to carriers but may increase market power by reducing the number of carriers in the affected market. A key aspect of any DOJ actions on transportation mergers would be definition of the relevant market. Intermodal and intramodal competition, geographical competition, and potential for product substitutability are but some of the factors to be addressed in any determination of potential market power gains resulting from a merger. An efficient antitrust policy would weigh any efficiency losses (i.e., restrictions in output that may result from a merger) against potential efficiency gains. This is particularly relevant for railroad mergers, where merging two carriers may leave only one rail firm in a particular market, though no lessening of competition would result (when considering competition from other modes), and important cost savings may result from the merger.

Past mergers have provided trucking companies with access to markets otherwise blocked by ICC entry restrictions. As entry is freed, motor carriers may prefer internal growth as a more cost-effective means for expansion. In the LTL sector of trucking there may be potential for both scale economies and for monopolization if artificial barriers to entry persist. It is important that antitrust policy not preclude service advantages associated with large terminal networks that may result from trucking mergers. At the same time, incumbent LTL carriers should not be permitted to monopolize markets through merger, although new entrants are barred from the market through regulatory restrictions.

INTERMODALISM

Numerous federal regulations have been passed by Congress during the past 70 years that affect intermodal ownership and operation. The list includes the Interstate Commerce Act (restricts rail ownership of other modes), the Panama Canal Act of 1912 (restricts rail-controlled water operations), the Motor Carrier Act of 1935 (limits intermodal acquisitions of motor carriers), the Transportation Act of 1940 (modifies Motor Carrier Act provisions to apply only to rail carrier acquisitions of motor carriers and restricts rail and pipeline participation in water carriage), and the Federal Aviation Act of 1958 (restricts surface carriers from engaging in direct air carriage).

Each restriction resulted from an attempt by Congress to protect a particular mode from domination by more established modes of transportation. In most instances congressional directives provided agencies with wide latitude. On a number of occasions, without success, the regulatory agencies have asked Congress

for specific clarifying legislation (49).

As a result, federal agencies have recently taken the inititative to further the concept of intermodal cooperation and coordination within the context of existing regulation. In early 1978, the ICC approved a single-rate barge-rail tariff agreed on by a railroad and a barge firm in Iowa. These two firms joined together voluntarily and designed an innovative tariff to save Iowa shippers 60-80 cents/m^3 (2-3 cents/bu) in transporting grain to New Orleans (50). Also in 1978, a Memorandum of Staff Agreement was signed by the managing directors of the ICC and the Federal Maritime Commission (FMC) "to establish cooperative internal procedures...in intermodal matters in which each agency has an interest" (51).

In early 1979 the ICC released proposals concerning deregulation of intermodal services, requesting shipper and carrier comments before a legislative package is presented to Congress. The ICC hopes that such proposals will encourage the participation of carriers in joint intermodal services. The proposals encompass (a) the repeal of the section of the Interstate Commerce Act that "prohibits common control or ownership of railroads and water carriers operating through the Panama Canal" (52) and (b) the end of regulations over barge and intercoastal tariffs so that such carriers "could establish through routes and joint rates with regulated carriers of other modes...and could provide substituted service for other surface carriers." In this proposal, deregulation of rate and tariff filing is tied to deregulation of carriers concerned with intermodal operations. This would not be necessary. Simply deregulating rates and tariffs could result in added efficiency with no added costs and yield easily quantifiable economic data on the effects of single-filed tariffs in intermodal movements (52, p. 21).

Probably the most progressive intermodal ownership policy of any agency is that adopted by the CAB in cases involving surface carrier participation in air freight forwarding. The CAB's policy has been evolutionary but with the expressed goal of protecting competion, not competitors. This evolution has been possible because, unlike the Interstate Commerce Act, the Civil Aeronautics Act does not contain specific provisions that demand congressional approval for modification (49, p. 98).

For example, piggyback service, which involves trailer-on-flatcar (TOFC) or container-on-flatcar (COFC) movement, is the most widely used form of domestic intermodal transportation. Although loaded trailers were moved on flatcars by rail as early as 1926, modern piggyback service did not begin until the late 1950s. According to AAR data, piggyback traffic between 1970 and 1978 (as a percentage of total rail carloadings) rose from 5.3 percent to 7.9 percent, though in 1974 this constituted only about 1 percent of the total intercity freight volume (39, p. 295). In recent proceedings, the ICC has settled on these basic conditions for rail control of motor carrier service:

1. Trucking may be performed to and from but not between specified key points or major traffic centers,
2. Operations must be limited to service at stations on the rail line,
3. Truck traffic must be connected with a prior or subsequent rail haul, and
4. Traffic must move on rail rates and rail billing (49, p. 59).

Although designed to ensure that any rail-contracted truck operation will be substituted service and traffic will not be taken from competing trucking companies, the first two of these conditions inhibit TOFC service by limiting the potential of all-railroad-supplied TOFC to only those areas surrounding established railroad stations and by requiring a ramp at every key point.

Deregulation Policies

Regulatory reform could eliminate federal impediments to intermodalism in general and, at the same time, promote effective joint rates and through service within and among modes with the following policies:

1. Remove federal impediments to common ownership and to intermodal coordination and cooperation (although some restraints on common ownership may be necessary to preserve competition),
2. Adopt common definition of "through bill of lading,"
3. Eliminate differences between CAB, ICC, and FMC regulations affecting through rates, and
4. Further standardize cargo liability laws.

Impacts

Service is likely to improve under policies encouraging more extensive transport integration. In the event of poor TOFC service by intermodally controlled firms, independent truckers offering superior service could enter the affected market. With fuller cooperation between modes, options available to shippers would be increased. Thus, their ability to customize shipments according to need at prices reflective of costs would be improved.

It is probable that extensive transportation integration would lower consumer transportation prices. An example, already cited, is the savings experienced by Iowa shippers who use rail and barge under a single-rate tariff. Policy recommending a common definition of "through bill of lading" for federal agencies should significantly improve the opportunities for additional intermodal cooperation with similar reduction in rates.

In a 1975 study by Reebie Associates for the Federal Railroad Administration (FRA), it was estimated that a national intermodal network could save consumers up to $163 million in transportation charges by 1985. However, these savings are heavily dependent on the effect that increased intermodalism will have on existing modes, equipment needs and use, and pricing policies (39, p. 444). Three factors have been noted that might limit the efficiency of increased intermodal traffic (especially TOFC): (a) overcapacity (both subsequent service problems and equipment shortages) related to an imbalance of traffic flows, (b) unclear impact on existing carload rail traffic and resulting rail revenues, and (c) unestablished impact on need for both intermodal equipment and other car types (39, pp. 298-299).

To the extent that encouragement of intermodalism would reduce modal discrimination in existing U.S. statutes, the recommended policies of the National Transportation Policy Study Commission would result in greater equity among modes. Three examples of modal discrimination in existing regulation are (a) Section 5(2)(b) of the Interstate Commerce Act that applies only to rail carriers seeking to integrate with existing motor carriers, (b) Section 5(14)-(16) that apply only to rail carriers and pipelines seeking to engage in water carriage, and (c) Section 408 of the Civil Aeronautics Act that applies only to surface carriers attempting to engage in direct air carriage (49, p. 187).

Protection of newer industries from competition has been a key to the interpretation of regulations limiting

intermodal ownership. Recently, however, there has been more active concern with protection of competition, even if that means losses for individual firms.

For example, trucking has traditionally opposed regulatory change to permit rail entry into motor carriage on the grounds that railroads might combine pricing and service changes to weaken the trucking industry. Experience with two western railroads and their trucking subsidiaries would tend to disprove this theory. Santa Fe Industries and Southern Pacific Transportation Company, both rail holding companies, are significant factors in western trucking operations. In their 40 years of operation, there has been no evidence that railroad involvement in motor carriage had damaging repercussions on trucking (49, pp. 163-164).

On the other hand, without the protective shield of federal legislation, there seems little doubt that several smaller, less profitable firms would be eliminated or relegated to rather limited types of carriage where their service has been shown to be inferior to that of the larger integrated companies (49, p. 166).

Intermodal cooperation, especially piggybacking has been consistently opposed by affected labor unions. Increased use of containerization tends to lead directly to reduced employment as capital expenditures (in the form of containers or trailers and the special equipment needed to move them) are substituted for labor.

The Federal Maritime Administration has examined the relation between containerization and unemployment at U.S. ports. The most severe drop in longshore employment between 1960 and 1976 was at the Port of New York, the largest container port in the world. Overall, since the introduction of the container to the shipping industry in the late 1950s, there has been a steady increase in labor productivity (50 percent between 1967 and 1975) but a decrease in longshore employment (23 percent between 1960 and 1976), according to the U.S. Maritime Administration's Office of Manpower.

Deregulation policies could be a preliminary step to formation of a broad national intermodal network. Studies of energy savings from such a system have been conducted. Annual savings of 300 million L (75 million gal) of fuel (0.4 percent of the predicted total consumption for intercity freight transportation) were forecast due to diversion of traffic to more fuel-efficient TOFC operations (39, p. 444). However, other, less extensive intermodal coordination may have little impact on energy consumption.

Again, speaking specifically about the easing of piggyback restrictions, any resulting reduction in intercity trucking operations would improve the levels of pollution, congestion, and safety performance (39, pp. 444-445).

INNOVATION

Innovative changes in transportation are affected by a variety of factors, including market structure, demand characteristics, capital availability, labor relations, and government regulation. Some argue that the pace of innovation is not as rapid as it should be, due in part to the impact of economic regulation. Although there has been no definitive analysis of the relation between regulation and innovation (53), recent examples suggest that regulation can adversely impact the implementation of new techniques and technology, especially for railroads. [The Office of Technology Assessment recognized the need for such an analysis in its 1979 list of 30 priorities. Priority 13 is to assess (a) the impact of technology on the movement of goods and (b) the degree and manner in which federal policy can be expected to inhibit or promote the development and use of technology.]

Implementation is only half of the innovative process. Research and development are perhaps more crucial than implementation. Here, federal funding is a key concern rather than federal economic regulation.

Control of rail rate changes is believed to be a major impediment to innovation. The ICC decides whether proposed rates are "just and reasonable" based on historical average costs. Such costs do not reflect the savings available through innovation. By prohibiting a carrier from adopting lower rates that could generate a traffic increase necessary to justify an innovation, the ICC may have prevented some innovative changes (39, p. 114).

One frequently cited example of how economic regulation can distort investment decisions involves the introduction of 90-Mg-capacity (100-ton-capacity) rail freight cars. Carriers wished to use the larger cars even though standard-sized cars were adequate. Carriers wanted to reduce rates to major shippers to reflect the economies of bulk handling but feared ICC action against rate reductions.

The case of Big John grain-hopper cars is a striking example of the way in which regulation can delay introduction of an innovative technology. In 1961, the Southern Railway Company published tariffs for new Big John grain cars that were 60 percent below previous rates. Complaints from competitors delayed approval until 1962. The decision was subsequently reviewed and reversed by the ICC, initiating a series of court battles. Four years after the initial petition, rate reductions for Big John grain traffic were approved (39, p. 116). Aside from deterring one specific innovation, time delays such as this entail frustrations and costs that may discourage management from attempting to introduce new technology in the future.

Some investigators believe that the introduction of unit trains in the East was delayed by at least five years by the regulatory process (54). Cost studies of unit-trainload shipments of coal, grain, and iron ore indicated that substantial cost savings were possible over conventional operations. To introduce the service, lower rates were needed to induce shippers to maintain the larger inventories and to provide the loading facilities required by unit loads. On the basis of prior regulatory policy, carriers assumed that, if lower rates were offered for this service in one area, similar rate reductions would be required by the ICC in other areas, conceivably resulting in net revenue loss. Thus, there was no incentive to introduce cost-based rates for unit-train operations until demand increased to the point where service was profitable regardless of uniform rate requirements (39, p. 115).

Rate regulation is but one factor that inhibits innovation. Railroads are restricted in their ownership of other transportation modes; pipeline, water, and motor carriers are not. None, however, may acquire airlines. The ICC has the power to approve or reject railroad ownership of truck lines. This policy may have slowed the development of domestic piggyback service compared to the large-scale introduction of this service in Canada, which is unhampered by such restrictions (9, p. 51). The same policy may inhibit the large-scale use of two promising future innovations: specialized intermodal rolling stock and automated intermodal terminals.

The long history of economic regulation may have shaped the philosophy of rail management about innovation. Some argue that regulation, by transferring competition from marketplace to courtroom, has fostered

a management concerned more with legal maneuvering than with innovative change in equipment or procedures. Further, the attitude of labor may well have been influenced by regulation (55, 56).

Deregulation Possibilities

A case can be made that almost any regulation impacts technological change by impeding or forcing innovations or by channeling the course of such change. A revised federal policy would be to minimize regulatory impediments to innovation by assessing the extent to which the regulation (existing or proposed) inhibits or promotes the development and use of innovative technology. The gains or losses to innovation would thus be added to the calculus of regulatory benefits and costs.

Impacts

Relaxation of regulatory constraints on innovation may positively affect the pace of technological change and the variety of services available. Carriers able to reflect the costs of new technology in their rates have greater incentive to discover and meet the demand for new services (4, p. 91). As an example, expansion of intermodal services like TOFC and COFC is possible.

With greater freedom and more incentive to innovate, carriers are likely to choose methods that permit cost reductions. Thus, a positive impact on efficiency is expected, ensuring that future innovations are in society's economic interest (4, p. 92). As a consequence of improved efficiency, a positive impact can be expected on user fares or rates and on costs for providers of transportation.

Railroads may have the most to gain because evidence indicates that they are more inhibited by regulation than other modes. Increased innovation in the rail sector could lead to technological thrusts in competing modes—another spur to increase efficiency and service for the entire transport system.

Greater automation of railroad yard operations, monitoring, and control processes can be expected to reduce the labor force now required for those tasks. On the other hand, deregulation may create new employment opportunities in transportation as rates fall, if transport demand is elastic with respect to price.

SOCIAL REGULATION

Safety

Transportation safety has long been a government concern. As in all situations involving socially unacceptable risks, government regulation of transport safety has taken three basic forms, following designation of an agency to oversee the specific risk or accident cost reduction (57).

1. The agency can produce and disseminate safety information. This has rarely been used exclusively in transportation problems but has often been a complementary measure to mandatory standards (e.g., seat belts).
2. The agency can impose penalties, fees, insurance requirements, or quotas to deter the creation of unsafe conditions and the manufacture of unsafe products. The Federal Aviation Administration's (FAA's) establishment of quotas at peaks to control the concentration of air carriers over busy airports is one example.
3. The agency can promulgate mandatory standards. This has been the primary approach of the agencies designated to solve transportation safety problems from rail car brakes, seat belts, and commercial air carrier instrumentation.

Deregulation Possibilities

In the long term, regulatory policies involving transportation safety would best be cost-effective relative to other life-saving programs, with objectives that are clearly stated and enforcement that is strict, effective, and applied equally for all modes and carriers. "It is by no means clear that we should always be increasing our spending exponentially to shave the last few percentage points off the risks we happen to care most about at the moment" (58).

Specific recommendations that will lead to these goals are

1. Retain DOT's central role in safety regulation and enforcement;
2. Provide federal matching funds to states for enforcement with penalties for ineffective enforcement;
3. Share costs among all levels of government, carriers, users, and others who benefit;
4. Increase penalties for carriers who do not maintain standards for rail cars, trucks, tracks, and so forth (for example, federal prosecutors in Wisconsin have begun to levy misdemeanor charges on executives of trucking firms for alleged safety violations, with possible felony charges for false statements) (59);
5. Tie certification of regulated carriers to verification of safety regulation compliance;
6. Require all certificated motor carriers to obtain insurance at levels sufficient to require on-site inspections by insurance firms;
7. Emphasize better maintenance of roads and bridges; and
8. Encourage training of local police and firefighters to deal with transportation accidents involving hazardous materials.

Impacts

There have been few government or private studies that have dealt with the balance of costs and benefits of existing or proposed transportation safety regulations. A well-documented analysis of the cost-effectiveness of 37 highway safety countermeasures was prepared by DOT in 1976. The National Highway Safety Needs Report (60) ranked the countermeasures by cost of implementation, fatalities forestalled, and cost-effectiveness over 10 years. Because of the methodology developed in the report, motor vehicle safety regulations have been scrutinized more than those of other modes. Other DOT studies include some mention of the costs and benefits of safety regulation (61, 62).

The FRA notes that, since May 1978, DOT has been conducting a zero-based review of its safety regulations and in December 1978 proposed a full-scale revision of its freight-car safety standards (63). The most troublesome problem in rail safety, deferment of track maintenance, has yet to be approached in a cost-benefit study, though FRA's A Prospectus for Change in the Freight Railroad Industry reports a $4.15-billion accumulation of deferred maintenance over the past 10 years (63, p. 24). Recent FAA proposals to broaden controls on air traffic (64) and DOT proposals to revise regulations governing truck drivers' hours of service (65) have been met with cost-benefit arguments by industry spokespersons (66).

GAO estimated the costs of vehicle safety regulations administered by the National Highway Traffic

Safety Administration (NHTSA) to be $40/automobile in 1966, rising to $246/automobile in 1973 and $386/automobile in 1974 (the 1974 figure includes $122/automobile for the seat belt-ignition interlock system). Cumulative costs between 1966 and 1973 were $13.4 billion ($2.9 billion for 1973 alone). GAO concluded that in the earlier years these costs were well spent when measured against lives saved (67).

Later estimates include that of a 1976 NHTSA survey, which showed that automobile manufacturers claimed an average $368 of added cost per vehicle resulting from safety standards (62, p. 10). Congress' Joint Economic Committee found costs of $666/automobile in 1978, or $7 billion in total for safety and environmental features (68). NHTSA claims costs of only $250/automobile for safety equipment, or 5 percent of the overall price (4, p. 41).

Revised safety regulation policies could have a mixed impact on service. Enforcement of track, road, bridge, and vehicle maintenance standards should improve reliability and speed but may discourage carriers from serving less-used routes (e.g., to small communities) because carrier costs increase to meet the standards.

Generally, it has been assumed that increased safety is directly related to increased expenditures, which eventually affect rates and fares. On the other hand, a DOT proposal to revise locomotive, track, and signal standards is expected to both reduce regulatory burdens and improve rail safety (63).

Revised policies will probably have a mixed impact in this goal area. The trucking industry has estimated that DOT's plan to limit duty tours of drivers to 12 h would cost 73 private fleets $74 million, including higher labor and equipment costs (66). But studies of the automobile industry's response to the additional standards required since 1967 show that the ratio of net profit to net worth for the three major automobile manufacturers has not declined (General Motors Corporation averaged more than 15 percent/year), indicating the economic strength of the companies during this period of automobile regulation (62, p. 27).

Relations between safety policies and energy conservation are often unclear. An exception is the policy of supporting strict and effective enforcement that, if applied to the 88-km/h (55-mph) national speed limit, may have a direct positive impact on fuel conservation in reducing motor fuel consumption by 1 to 2 percent (69). Nonetheless, the cost-effectiveness of the national speed limit has been repeatedly challenged (70).

Revised safety policy requires that cost-effective standards and regulations be applied equally for all modes and carriers.

Energy

Energy is both an input to the transportation system and a commodity transported. Energy deregulation is likely to have a great impact on the transportation system. Today's U.S. energy policy is extremely complex. Adding to the complexity is the fact that foreign policy considerations play a major role in energy policy. Regulations affect energy supply, demand, and distribution. Prices at which old or new domestic crude may be sold are specified. A system involving entitlements equalizes costs to refineries to compensate for the varying controlled prices of domestic and foreign petroleum. Prices of gasoline, kerosene-based jet fuel, and aviation gasoline are controlled.

Deregulation Possibilities and Impacts

Impact predictions include the following:

1. Ending the petroleum-refining entitlements program would discourage consumption of imported oil (5, p. 798);
2. Ending ceiling prices on crude oil would permit additional U.S. production of about 1.1 million bbl/day by 1985 as producers respond to price incentives (5, pp. 816-817);
3. Eliminating price controls would inhibit producers from withholding products from the market solely to await the possible future end of price controls (5);
4. Welfare gain from ending too much consumption of petroleum at regulated (low) prices could equal $1.5 billion (5);
5. Decontrolled gasoline prices might rise 3.7 cents/gal higher by 1980 than if gasoline controls were maintained (71);
6. Deregulated gasoline prices might lead to increases of about 0.2 percent in carbon monoxide and other emissions (71, pp. IV20-IV29);
7. Deregulated gasoline prices that increase in the free market would reduce demand by 21 000 bbl/day for each cent/gal increase (71, p. IV57); and
8. The administrative costs of energy regulation that could be saved if regulation were eliminated equaled $50 million in 1977 (5, p. 82).

Transportation is the largest consumer of petroleum (using 50 percent of total petroleum but only 25 percent of total energy consumed in the United States in a year). The automobile consumes 80 percent of the petroleum used by transportation. Thus, it is important to consider the extent to which deregulation of energy markets will produce price responses that in turn affect vehicle use and ownership. Such responses, or price elasticities, are important because, if consumers' responses are elastic with respect to price, overall price changes will elicit large changes in driving behavior. If consumers' responses are inelastic when fuel prices rise, the consumption of motor fuels will not fall, even with large price increases (72).

Various analyses of energy price versus automobile ownership and use are available. One report shows ranges of price elasticities for gasoline, jet fuel, and diesel fuel at short-run and long-run intervals, at 1972 and 1975 price levels, and for the automobile, truck, jet air, and rail modes (73). The figures were virtually all inelastic, more so in the short run. Demands for truck and rail diesel fuel were especially inelastic and in most cases very close to zero. In the long run, jet fuel purchases were shown to be slightly elastic at 1975 prices.

Another study reports a gasoline price elasticity of -0.2054 and predicts that a new five cents/gal federal fuel tax imposed in 1979, and increased at five-cent increments each year to reach 50 cents by 1988, would save 1 million gal of fuel per day by 1988, or 14 percent of what would otherwise have been consumed. The author's sensitivity analysis showed that a 1 percent decrease in gasoline sales due to voluntary conservation or unemployment would reduce his computed elasticity figure to -0.1624, although he believes voluntary programs have contributed very little to overall conservation (74).

Annually, NHTSA reports estimates of the impacts of its fuel economy standards. In at least one case, proposed standards were too stringent to be met by the vehicle producers according to the NHTSA timetable, so the standards were relaxed (69).

Production of energy involves safety risks. Estimates of these risks have proved to be very controversial. When considering the risks inherent in producing energy by various sources, as well as in transporting

the energy, wide variations in predicted impacts are possible. One recent study reported the risk of wind-generated energy to be several times greater than that of nuclear power (75, 76). The wind figure was high because the machinery must be fabricated and installed, and back-up generating capacity provided. Another estimate of energy risk is that of the Rasmussen Report (77). It gives the chance of a nuclear power station disaster at one in a thousand million. Obviously, recent problems at the Three Mile Island nuclear facility will call these estimates into question.

Energy deregulation would be expected to favor the private development of U.S. energy resources. Given relatively free energy markets, but transportation markets constrained with existing regulatory structures, the expectation would be for hastened development of U.S. coal resources, rapid dieselization, and the introduction of synthetic petroleum plants in the northern Great Plains during the 1990s. The impacts of energy deregulation would suggest substantial movement of coal by rail, which implies possible bottlenecks and new investment needs, as well as consequences to the communities through which the traffic will pass. Bottlenecks on the U.S. inland waterway system are also possible as the result of increased movement of energy resources.

Although deregulated energy policies will stimulate new patterns of energy movement in the United States, largely through private market responses to price signals, deregulated transport policies should increase the likelihood that these new movements can be accommodated by private U.S. transportation systems. Thus, any community disruption associated with coal movement by rail could be assessed to shippers, whose payments would compensate these communities. Proper user fees that vary with peak demand could allow full reliance on existing systems and mitigate the need for new investment.

Transportation is uniquely dependent on petroleum-based fuels; other sectors of the economy have greater choice among fuel types for meeting their energy needs. Consequently, if higher petroleum prices cause other sectors to use less energy or switch to other fuels (for example, if electric generation relies on coal and nuclear fuel rather than oil-based residual fuel), more petroleum will be available for transportation.

The reliance by other sectors on coal for energy will impose the burden of moving massive amounts of coal on the transportation network, especially on the railroads. A large fraction of this coal is expected to come from mines in the West; this will involve great distances. To ensure adequate service to noncoal shippers, more capacity (and added capital expenditures) will be required.

It is difficult to determine how low-income persons who rely on automobiles would fare in a situation of rising fuel prices, although the U.S. Office of Technology Assessment has found that adverse impacts from deregulation could occur (78).

Deregulating energy prices would cause fuel prices to reflect true economic values more accurately than occurs under regulation. To the extent that more accurate fuel prices resulted, the various transportation modes would more accurately reflect their true costs, and energy policy would not act to subsidize less-energy-efficient modes, as probably already occurs to some extent.

Higher fuel prices should result in less fuel being consumed, other things being equal. There could be a higher rate of diesel engine penetration into the automobile market as a result of fuel and other costs that make these engines preferable to those powered by gasoline. Additionally, it is anticipated by the U.S. Department of Energy (DOE) that less driving will occur. DOE expects that for each 1 cent rise in gasoline prices, demand will decrease by 21 000 bbl/day (71, p. IV16). Air travel will become more energy efficient partly as a result of technological developments spurred by higher energy prices.

Higher petroleum prices will cause other sectors to switch to coal and nuclear fuels to meet part of their needs. This will free petroleum for transportation, which will be dependent on liquid fuels for the remainder of this century. Higher prices also will prove an incentive for the development of syncrudes from coal and shale oil.

Environmental impacts are difficult to assess because of countervailing forces. On the one hand, higher prices should cause less travel, resulting in reduced aggregate emissions. On the other hand, higher fuel prices may increase pressure for relaxing environmental standards (or for not tightening them further) and may encourage misfueling of automobiles designed for nonleaded gasoline—if deregulation enlarges the gap between leaded and unleaded gasoline prices.

Increased oil extraction efforts will have environmental consequences. Greater amounts of drilling and exploration in frontier areas may occur if prices are allowed to reach market levels. The amount of oil production forecast for Alaska will require enlarging the pipeline across Alaska with some environmental damage.

Also, a shift to coal will have serious environmental effects. The extraction, transport, and burning of coal pose environmental problems. To the extent that the use of coal is encouraged because of petroleum price increases, the resulting problems need to be considered as part of the costs of allowing petroleum prices to rise.

Higher fuel prices, to the extent that they reduce travel, may reduce fatalities (73). Fuel conservation measures—such as the 88-km/h (55-mph) speed limit—may have collateral safety value (69, Appendix Q). However, it is possible that some efforts to reduce fuel consumption, such as reducing automobile weight or allowing larger truck sizes and weights, may adversely affect safety. Too, expanded coal consumption will pose safety problems. More grade-crossing accidents would be expected as a consequence of increased unit-train (coal) movements. This problem may be especially acute in the West, where many tracks go through towns and the amount of rail traffic could radically increase.

A major shift to coal and the development of large-scale synthetic fuel industries in areas that are currently sparsely populated may have negative effects on these communities and their residents. The desire to prevent boom-towns effects is prevalent in the West.

Environment

Deregulation would suggest that where environmental regulations are imposed, the free market should be allowed to operate so that prices may adjust to help recover the costs of meeting these regulations from those who create the costs or reap the benefits. Regional differences should be considered. The federal role should include monitoring environmental conditions, mediating disputes, providing information, and facilitating planning. DOT should coordinate such policies as far as they affect transportation. The impacts of existing regulations should be better known so that in the future more cost-effective regulations can be chosen.

Impacts

Air Pollution

On a national basis, levels of pollution generated by urban passenger vehicles have been projected to decline until 1990 and then increase due to increasing travel.

Existing federal efforts (Clean Air Act Amendments of 1977) that will continue to reduce air pollution in the future include vehicle certification, selective enforcement audits, recalls, warranties, inspection-maintenance programs, and transportation control plans. The benefits from all of these are largely unmeasured, but some indications exist of their costs. Certification of vehicles for emissions performance on the production line may cost manufacturers more than $40 million/year; required design features on automobiles add 4 percent to the sticker price (79). According to EPA data, selective enforcement audits cost each domestic manufacturer between $200 000 and $600 000 annually for administrative costs; testing and adjustments add 0.2 percent to the sticker price of automobiles. Also, in recent years, 7 percent of the automobiles of a given model year have been recalled for environmental purposes, with costs to manufacturers averaging up to $30/vehicle.

EPA studies show that inspection-maintenance programs can reduce emissions, from those vehicles covered, by 8 percent to 40 percent, at repair costs averaging between $8 and $20 per failed vehicle (80). Nine inspection-maintenance programs existed throughout the United States prior to 1979 (only New Jersey's was statewide). [Inspection maintenance programs are located in New Jersey and Rhode Island and in seven cities, including Los Angeles, Phoenix, and Cincinnati. Programs are planned soon for Philadelphia, Pittsburgh, and Connecticut and are expected to be required by EPA in most major urban areas by 1982.] As the Clean Air Act mandates establishment of such programs in areas that cannot meet ambient air quality standards by December 31, 1982, an increase can be expected.

Transportation control measures to reduce pollution identified by the EPA include the following:

1. Transit service improvements;
2. Preferential treatment for high-occupancy vehicles,
3. Ride-sharing programs;
4. Parking management (restrictions and/or parking fees);
5. Pricing strategies involving fuel taxes, bridge tolls according to automobile occupancy, or vehicle ownership taxes;
6. Traffic flow improvements (i.e., traffic signalization, or peak-period reversible lanes); and
7. Commercial vehicle control.

Analyses of these measures indicate that regional emission reductions of 1-3 percent might result if they were implemented individually (81). Reductions of up to 9 percent could be expected through a comprehensive approach (81). The average transportation control measure can be instituted for slightly more than $1000/ton of pollutants removed, according to EPA (81).

Noise Pollution

The FAA uses benefit-cost analysis plus considerations of safety and technology in order to test the desirability of its proposed aircraft noise regulations. To determine the effect of its regulations requiring all civil subsonic aircraft to comply with FAR Part 36, the FAA weighed capital and operating costs against monetary measures of the benefits of reduced noise pollution, as they accrue through the duration of the century (82). The FAA concluded that the benefits of its aircraft noise compliance regulations greatly exceed the costs.

The EPA, to regulate surface transportation vehicles, relies on an analysis of cost-effectiveness rather than on benefit-cost analysis. The EPA assesses the benefits of the regulations it considers in terms of reduced population exposure but does not provide a monetary measure of the benefits of reduced noise that can be weighed against the costs.

A fundamental problem for the EPA is determining where the regulatory emphasis should be placed in reducing noise from surface transportation vehicles. Due to constraints imposed by the physics of sound (i.e., sound levels from different sources add logarithmically), the EPA's approach to regulating noise generally recognizes that the noisiest vehicles need to be controlled first but at the same time allows for the complicated and synergistic effects of combined noise sources. Because of these interrelations, EPA gives great weight to the relative economic costs of controlling one source as opposed to another. These costs can be thought of as a measure of the sums necessary to comply with the regulations, and also as a measure of the political acceptability of the EPA's proposals.

Air

According to the FAA, as of 1976 the U.S. fleet consisted of some 2100 large jet aircraft, of which 1600 (about 75 percent) did not comply with FAR Part 36 noise standards. Based on a number of estimates, FAA believes that between 1300 and 1600 of these noncomplying aircraft will remain in service throughout the 1970s and possibly some 50 percent would be in service by 1990, if there were no federal action requiring compliance of all aircraft (82, p. 5). The FAA has estimated that the discounted present value of capital investment needed between 1975 and 1995 to bring all civil subsonic aircraft up to FAR Part 36 standards ranges from $176 million to $2.12 billion, depending on whether the costs are estimated before or after taxes, whether aircraft are modified or replaced, and the assumed prices and discount rate used (82, pp. D42-D44).

The FAA estimates domestic aircraft purchases between 1975 and 1995 would range from $6 to $8 billion (1975 dollars). Compliance solely by modification would result in sales to aircraft manufacturers with a net present value of $295 million, whereas compliance involving replacement and modification would result in sales with a net present value of $1.49 to $1.7 billion (82, pp. D18-D19).

The FAA analyzed the impacts of its compliance program on employment in the aerospace industry from 1977 to 1986. A program involving only modifications of noncomplying aircraft would generate 1900 employee-years of new work. Combination replacement and modification programs would generate new employment in excess of 106 000 employee-years (82, pp. D20-D21).

Airline operating costs depend on the type of modifications or replacement of existing aircraft. The FAA states that the high-bypass turbofan technology now being placed in use has been demonstrated to produce 12-15 percent reductions in fuel consumption and improved noise levels, compared to older aircraft. New but unused technology involving improved materials and aerodynamic efficiency is expected to lead to a further 10-15 percent reduction (82, pp. D14-D15).

If aircraft were modified only in order to comply with FAA noise standards, airlines would experience

negative net benefits and an approximate 1 percent increase in out-of-pocket operating costs due to a 15 percent fuel penalty from added weight. However, if airlines opt to replace aircraft, positive net benefits will accrue due to increased fuel efficiency and likely reductions in crew and maintenance expenses (82, D16).

One bill (H.R. 8729), passed by the House in the 95th Congress to finance replacement or retrofit of aircraft, placed a 2 percent surcharge on domestic passenger air fares and freight waybills; a $2 surcharge per international departure from the United States where fares are less than $100; and a $10 surcharge for international departures where fares are $100 or more. In other bills considered, the ticket surcharge used to finance airport development would include the amount that ticket prices need to be raised to pay for aircraft noise control (H.R. 11986 and S.3279). Some argue—including Alfred E. Kahn, presidential advisor—that, given the airlines' profitability, there may be no need for special financing to retrofit or replace noisy aircraft. Regardless of how the quiet aircraft are financed, noise regulation is likely to increase direct air travel costs in the short run. However, long-run operating savings from the use of quieter, more fuel-efficient aircraft may reduce costs to users of air transport. It should be noted, however, that in the long term airlines would tend to purchase quieter aircraft, regardless of federal noise regulations, because of their lower operating costs.

Reduced population exposure to noise due to compliance with FAR Part 36 will result in benefits of reduced annoyance and reduced hearing loss. The monetary value of these benefits can be inferred from the expected reduction in damage awards from lawsuits and the increase in property values near airports. The FAA estimates that compliance with its noise standards would result in benefits of reduced damage claims during the years from 1979 to 2000 worth from $3.5 to $12.8 billion (with discounted present value ranging from $1.2 to $3.4 billion) depending on the noise reduction strategy. The range of the total increase in the value of property near airports is estimated to be from $92.6 million to $1.14 billion (82, p. D34).

Monetary estimates of costs and benefits of noise reduction can be weighed against one another. Comparing airline capital and operating costs of noise control to the benefits of noise reduction measured in terms of reduced lawsuits and increased property values, the FAA concluded that, even in the least effective case of achieving noise reduction by only modifying aircraft, the benefits are three times the costs. In this case the 1975 present value of costs to achieve compliance equaled $440 million compared to the estimated present value of $1.2 billion in benefits from reduced noise (82, pp. D9, D25). If, however, airlines were to replace rather than modify their JT-3D-powered aircraft, operating savings would offset capital costs in the long run, and in effect there would be a $350 million benefit (82, p. D9). These net savings, when added to the benefits of reduced population exposure (with a present value of $3.6 billion), amount to a total net present value equal to $3.95 billion (82, pp. D9, D25).

Although the FAA's analysis indicates that there are net benefits in complying with its regulations, there is great uncertainty concerning future aviation noise levels. It is uncertain whether air carriers will opt for replacement or modification of the aircraft. Further, growth in aviation and population is not known with precision. Future scenarios with very different levels of aviation activity and population in impacted areas may emerge due to a variety of factors, including regulatory reform, a reversal of recent trends of declining urban population, and increasing fuel prices.

Trucks, Railroads, Buses, and Motorcycles

The Noise Control Act of 1972 requires that any regulations the EPA sets for surface transportation vehicles reflect the degree of noise reduction achievable through application of the best available technology, taking into account the cost of compliance. By cost of compliance, the EPA interprets Congress to mean the cost of identifying what action must be taken to meet the specified levels, the cost of taking that action, and any additional cost of operation and maintenance incurred. The costs of future replacement parts may also be considered. For example, EPA has promulgated two sets of regulations to control noise from medium and heavy trucks. The first includes standards that manufacturers must satisfy before the trucks are sold to motor carrier operators. The second set of standards applies to motor carriers already in use.

Automobiles and Light Trucks

The EPA has not yet identified automobiles or light trucks as noise sources to be regulated. [EPA is required by law to publish noise control regulations within two years of identifying a noise source.] EPA has become concerned that automobile and light-truck noise is becoming an increasingly dominant source of noise as other modes are regulated and there is a shift to diesel and four-cylinder automobiles. Diesel and four-cylinder engines are approximately 5-6 dB(A) noisier than standard-sized eight-cylinder automobiles (83).

The EPA has studies in progress to determine the major sources of noise from automobiles and light trucks. Too, EPA is developing baseline data for 1977 vehicles and is attempting to develop a means of quantifying vehicle operation in an urban environment in order to refine light vehicle noise measurement procedures. EPA is reviewing the results of an impact analysis based on 1977 vehicle data. The outcome of this analysis, the results of a similar analysis for 1978 vehicles, as well as a discussion of various alternatives, will be forwarded to the EPA administrator for a decision on whether to identify light vehicles as a major source of noise. It is expected that, if a regulation were issued, it would be early in 1981 and would become effective with the 1983 model year vehicles.

SUMMARY OF DEREGULATION IMPACTS

Despite the extensive description provided of the impacts of economic and social deregulation estimated by various researchers, it is safe to conclude that much remains to be learned about deregulatory changes. In particular, however, the impact of changes will vary with the staging of those revisions into effect. Such staging in the United States depends not only on Congressional action but also on the action of the states as they amend their regulatory laws and other legislation regarding finance and promotion of the transportation modes.

ISSUES FOR STATE PLANNING AND PROGRAMMING

This paper has brought to light a good deal of research information about the effects of regulatory changes. The monitoring of airline deregulation should produce more facts. However, the exact direction of changed regulation is extremely difficult to foretell. Policy researchers

and those who advise policymakers need to pay close attention to the result of further research in the regulatory field. What, then, should be the reaction of state transportation agencies?

It is reasonable to believe that transport regulation will gradually become less at the national level and that state regulation will be subject to similar pressures and relax rather than increase. The outlook for energy regulation and for social regulation is less certain, but relaxation of federal controls in those fields appears more likely than is the maintenance of the status quo. The general atmosphere in transport markets will thus become more competitive. Special state issues will likely include the following:

1. How to ensure transport safety with new, perhaps less profitable, perhaps smaller, and possibly more, innovative firms;
2. How to analyze and supply subsidies for desired public purposes in the absence of internal cross subsidy by transportation firms;
3. How to produce neutral public policy toward transport rights-of-way and infrastructure;
4. How to plan and allocate public facilities needed by transport firms in the changed markets resulting from deregulation; and
5. How to obtain and distribute information of interest to consumers plus information needed for planning in a fast-moving deregulated atmosphere.

As regulatory changes occur, there will be a transition period as the formerly regulated test their freedom. Shippers, carriers, and public agencies alike will be affected. If Canada serves as an example, the period may be long; it took nearly half a decade for the Canadian railroads to offer innovative rate and service proposals once regulatory restrictions were lifted over a decade ago. State agencies will find that issues will arise gradually as locational and marketing changes proceed from business decisions.

Although complete deregulation may still be visionary and the timing of its elements are uncertain, state officials can well use the interim to learn and to prepare their responses to the issues raised by the prospect of reduced controls.

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Structure of the Nation's Future Freight System

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It is frequently said that the U.S. transportation system is now mature. That is, with the completion of the Interstate highway system and a few major inland navigation projects now under way, the infrastructure is basically in place. Investment in the system over time will merely involve maintenance and replacement.

I believe, by contrast, that the system is a product of the forces that have shaped it over the years and that, if these basic forces change, the system will change in response. The key questions, then, concern the nature of these basic forces that are shaping the system and whether these forces are likely to change in the near future.

Freight transportation is, of course, a derived good. It is only needed to transport goods from the place where they are produced to a place where they can be consumed. There are many intermediate uses of goods by industry; some goods are also used in the building of the productive system, including the transport system, but it is clear that the final use is to enhance the utility of people. This takes place through the operation of the economy.

For purposes of this discussion, I would like to classify the basic forces shaping the system into one of three general categories: economic growth and development, economic regulation, and technology. The basic forces may also be summarized by noting that the operation of the economy is the game that is played, economic regulation states the rules of that game, and the current state of technology furnishes the physical devices with which the game is played. I would like to briefly review how these forces have shaped the U.S. freight transportation system in the past, and I would like to speculate on what changes are likely to occur in these forces that will impact the future freight transportation system of the nation.

ECONOMIC GROWTH AND DEVELOPMENT

The long-term development of the U.S. economy has been characterized by the following trends:

1. Steady growth in population. Since well before its founding, the United States has experienced a continuous growth in population. The rate of urban population growth has been even larger than that for the country as a whole. This has led to specialization in the work force and improved efficiency.
2. Substantial economies of scale in production. A steady decrease in the per unit cost of production as the result of learning and increased efficiency can only be realized if the gains are not eaten up by the increased transport cost of serving the larger hinterland that can now be supplied. Thus, low transport costs make economies of scale realizable.
3. A decline in the share of employment found in agriculture and mining. This is paralleled by an increase in the share used in manufacturing, services, and government. It is a natural consequence of mechanization in the agricultural and mining sector. This has,

of course, also had a big influence on the proportion of the population found in rural areas as opposed to urban centers.

4. Recent trends toward vertical integration, conglomeratization, and internationalization. Vertical integration ties together the elements of the supply and marketing channels for the production of basic goods. Conglomeratization tends to exploit the organizational, financial, and management efficiencies of modern business. Finally, internationalization takes advantage of the differential advantages, trade restrictions, and barriers to trade that exist in various countries in an attempt to make the world into a single marketplace.

If any of these long-term trends change, one would expect that it would have an impact on the transportation system. Looking at the period from 1950 to 1976 (1), for example, the population has increased by 141 percent, employment has gone up 145 percent, and gross national product (GNP) has grown by almost 240 percent. Transportation output and ton kilometers have grown by 181 percent and 218 percent, respectively. Interestingly, transportation output per capita has grown from $179 to $228, although transportation output per dollar of GNP has shrunk from 4.9 cents/dollar to 3.8 cents/dollar. The population has more money to spend but is choosing to use it on goods and services requiring somewhat less transportation.

The percentage rates of growth between 1950 and 1976 in the various sectors of the economy are as follows (1): GNP, 3.26; population, 1.34; transportation output, 2.43; disposable income, 3.8; personal consumption expenditures, 3.7; fixed investment, 3.4; agriculture, forestry, and fisheries, 0.8; mining, 1.9; manufacturing, 3.3; construction, 2.1; communications, 7.5; utilities, 5.1; wholesale and retail trade, 3.9; government, 2.8; and financial, insurance, and real estate, 4.2. The shift from agriculture and mining is clearly apparent. The growth in service industries is most pronounced with communications, financial, utilities, insurance, and real estate, all well above average. The growth in wholesale and retail trade seems to closely parallel the growth in disposable income and personal consumption expenditures. Manufacturing output, however, is growing at a slightly higher rate than GNP. These growth rates also provide some indication as to why transport output per dollar of GNP is falling because communications, utilities, and services contain a relatively small freight cost per dollar of final output in contrast to mining or agriculture.

It is useful to view the forces acting to change the economy from three separate perspectives: (a) international, (b) national, and (c) urban. Each provides a slightly different view of the system as a whole.

The United States has historically been a rather insular country when compared to most other developed countries. That is, the United States—unlike Japan or England, for example—has had a relatively small percentage of GNP involved in foreign trade. The United States is also unlike those developing countries that earn a large proportion of their foreign exchange from the sale of a single basic commodity—for example, Colombia (coffee), Cuba (sugar), or Chile (copper). However, this insularity is changing rather rapidly as the world becomes more interdependent.

U.S. foreign trade statistics for 1978 indicate that a growth rate of approximately 19 percent for imports and 16½ percent for exports has been realized since 1965. There have even been periods when the growth rate exceeded 30 percent/year. The import figures are, of course, affected by the increase in prices for foreign oil. Nevertheless, the imbalance in trade has tended to stimulate the export of goods as well. This trend is expected to continue because the large industrialized population of the United States offers quite an attractive market to foreign countries, and the United States still has considerable amounts of domestic raw materials and trained personnel to draw on for developing exports, not to mention the tremendous agricultural potential that the country offers.

From a national perspective, population, agriculture, mining, manufacturing, and services are distributed quite broadly. However, manufacturing has been heaviest in the Northeast and in the North Central states; agriculture is located predominantly in the Midwest, the South, and the Far West. The production of fuel (particularly petroleum) is centered in the Southwest. The net result is that there are large movements taking place between regions of some products, principally agriculture and fuel, along with some ores. In addition, there is a fairly large bidirectional movement of manufacturing from one region to another. The transportation ton miles by commodity for the economy are shown in Figure 1 (2). (SI equivalents are not given in this paper for data presented originally in reference materials in customary units.) A slightly different picture is presented by looking at revenues instead of ton miles in Figure 2 (2).

Much has been said about the movement of industry to the sunbelt regions (the South and West) in recent years. In these regions, industry can take advantage of the cheap, nonunion labor and energy sources that are available.

In addition to the movement from the Northeast to the South and West, there has also been a shift between the urban and rural areas that reflects the general shift in the economy based on agriculture to one based on manufacturing and services.

Within the urban area there has been a shift from the central cities to the urban fringe. These shifts seem to be taking advantage of the greater freedom in location choice that is possible through the use of improved automobile and truck transportation. There has tended to be a drop in both the population and industrial densities. However, there is still a tendency for industry and population to aggregate in relatively large areas that can serve as regional centers. The production process in today's complex world requires many inputs, and there are still tremendous advantages to establishing production close to the inputs, including skilled labor and markets for the finished goods. These large urban areas tend to offer a huge variety of services and inputs. Those that are not produced within the region are imported for wholesale. The result is an environment in which there are no particular advantages to being in one or another of these locations.

Thus the current picture of freight movement that emerges from this examination is one that is complex and changing with time. Ton kilometers are dominated by the long-haul movements by pipeline, rail, and inland waterway of bulk commodities, petroleum, coal, ores, and agriculture. Truck competes actively with rail in the movement of food and manufactured goods. Bulk movements are declining slowly as a percentage of GNP as the economy shifts from agriculture and mining to manufacturing and services. This shift is leading to a more urbanized population and a lower-density one in which truck movement provides a real service advantage to dispersed populations. Manufacturing is also tending to be more equally distributed among the population, with the growth in both population and industry taking place in the South and West at the expense of the Northeast and Midwest. Freight revenues are dominated by truck movements of manufactured and high-value goods. Air

Figure 1. Domestic freight in billions of ton miles by commodity, 1980.

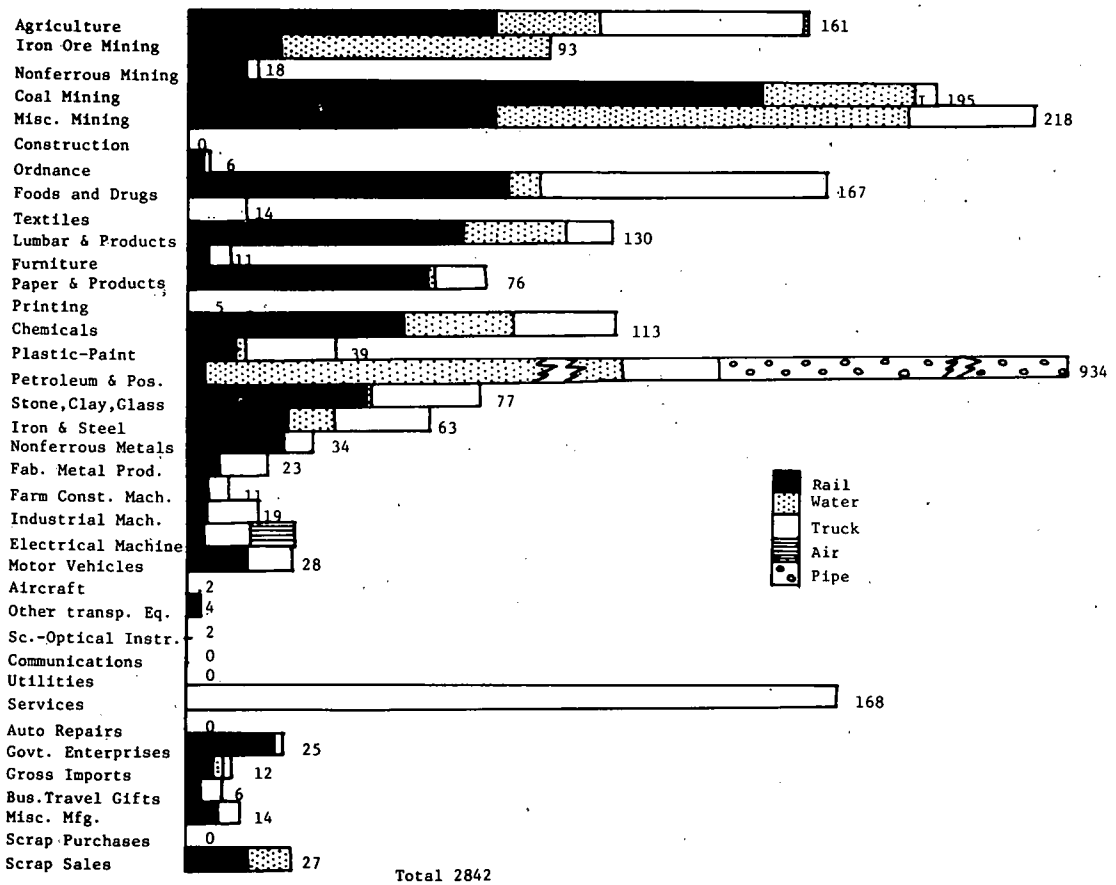
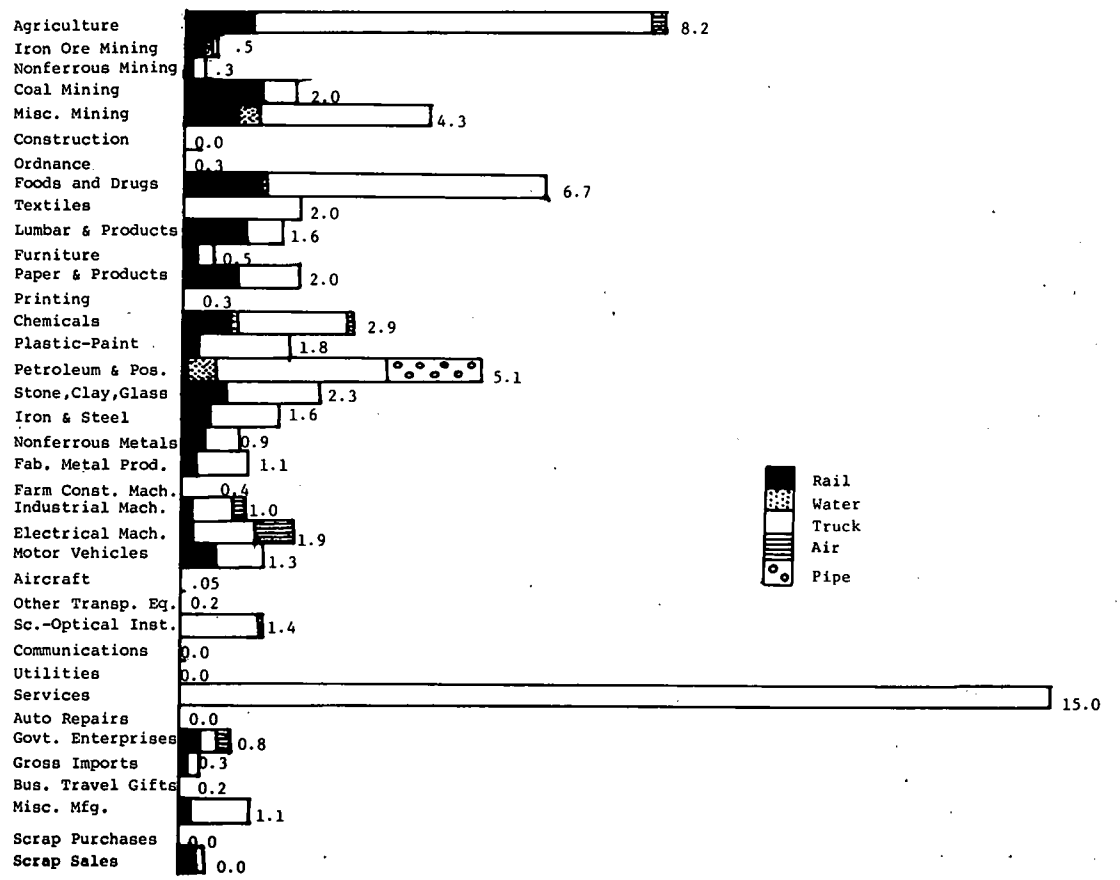


Figure 2. Domestic freight revenues in billions of dollars by commodity, 1980.



also captures a good portion of the revenues. Finally, the rapid increase in foreign trade points to a high revenue potential for those transport modes that can capture a part of the action.

Economic Regulation

For more than 50 years, most of the U.S. freight system has been dominated by the existence of economic regulation. Although some difference exists between modes, the regulatory system has controlled entry, routes and schedules of operation, rate structure and levels, and financial control, including reporting, acquisitions and mergers, service abandonments, operations and operating restrictions generally in the rail, truck, and air modes. Pipeline and barge modes are also partially regulated.

The philosophy behind regulation on the part of the U.S. Congress was the creation of an orderly marketplace without discrimination because of size or location and the provision of an available common carrier system. Underlying the regulatory system is the notion that, if we are going to protect the transportation service provider from the entry of potential competitors, we must make sure that the provider does not charge excessive monopoly prices for services rendered. When the regulatory process was established in the late 1800s and early 1900s, both the carrier and the public felt that economic regulation was preferable to the existing circumstances.

The regulatory process has developed along quasi-legal lines, with case-by-case development of precedents that elaborate the strict wording of the law. There is no grand design for the regulated freight system and no economic criteria by which decisions are made except that services be equitable and nonpredatory.

The nature of the process is such that a new entrant who desires to offer transportation services must prove "convenience and necessity." That is, the potential provider must prove to the satisfaction of the presiding administrative law judge at the required hearing that an existing service is not already being offered. If he fails to prove convenience and necessity, an operating certificate will probably not be granted. The authority to offer service between almost every point in the nation for almost every commodity has already been granted to one or another carrier within each of the modes; thus, it is quite difficult to prove convenience and necessity in most general cases. The proceedings can be long, difficult, and expensive.

The regulatory process has evolved in a manner that provides antitrust immunity to the rate-making process through tariff bureaus. Tariff bureaus, which exist in the rail and truck modes, provide a process whereby carriers and shippers cooperate in the filing of proposed changes to the existing tariffs for subsequent approval or disapproval by the regulatory commission. The rate hearings allow companies (indeed, whole industries) to use the rate-making process to preserve the status quo, that is, to protect against entrants and to ensure that extreme changes will not be made easily.

As a result of this regulatory process, there are very few new entrants in any of the modes except trucking. There have been no new railroads and, until recently, no new regulated airlines. There have been very few new grants of operating authority to regular-route trucking operators. The one place that there has been new entry has been irregular-route trucking. Irregular-route trucking is a very specialized, origin-to-destination, commodity-specific service. The very specialized character of this service enables one to prove convenience and necessity more easily and the Interstate Commerce Commission (ICC) has been receptive to making new grants of authority in this area.

As a consequence, irregular-route trucking, which typically uses owner operators with their low labor costs for full truckload commodity hauling over long distances, has made substantial inroads into the ton miles of freight normally carried by rail. Figure 3 (1) shows this impact on the ton-mile market share from 1960 through 1975. The effect of truck competition (1) is even more apparent when measured in freight revenues (Figure 4). Inland waterway, which is almost totally unregulated, has been growing at slightly more than 2 percent per year over the last 10 years. Pipeline has also grown substantially. The consequence of this is that rail has been the only mode to lose a market share. All the other modes have gained a market share at rail's expense. Whether rail would have been able to hold its own without the regulatory process is not clear. From the preceding section of this paper it is easy to see that such economic changes are not to rail's advantage. However, it is clear that the regulatory process has not offered any protection for rail. On the contrary, it has allowed the other modes, principally truck and waterway, to erode its market base.

Furthermore, the regulatory process is extremely complex. It requires a specialized knowledge of rules, regulations, tariffs, and procedures in order to use the U.S. freight system. It would be extremely difficult to automate the retrieval of tariffs or their application. The businessperson who attempts to use the freight transportation system must search for exceptions and make every attempt possible to influence the process in his or her favor. It is fair to say, however, that any transportation system involving the movement of thousands of commodities between thousands of different points will inherently be a complex process. The same would probably be true for any system of regulation. It is not clear, however, that greater simplicity would result from deregulation.

Thus, the process is complicated, difficult to rationalize, and subject to many exceptions. Economic regulations, however, are the rules by which the U.S. transportation game is being played. If it is decided to change the rules, then the game is also subject to change.

Technology

Transportation is inherently technology rich. It was an early contributor to the larger base of U.S. technology, as well as a recipient of the benefits of this technology. The steam engine, the railroad, the automobile, the zeppelin, and the airplane were all products of technological innovation in the transportation field. The earliest of railroads could carry 100 times the volume at 10 times the speed and at a cost that was probably less than one-tenth that of the horse-drawn wagon. There was, as a consequence, a fantastic reduction in cost per ton kilometer of transport by land. Although there was not the same cost advantage over the canal boat, the increase in both speed and productivity at a lower capital cost also made it an easy replacement for most of the canals of that day. Thus, early transportation technology innovations were extremely productive, multiplying the nation's transport capabilities by several orders of magnitude over output prior to that date.

Technology still sets the standards for how the system works. Innovation in one of any number of components in the existing systems can have substantial impact. New developments in power, propulsion, load support, guidance and control, loading and unloading, vehicle classification, storage of materials, and materials handling can

Figure 3. Ton miles by mode, 1960-1975.

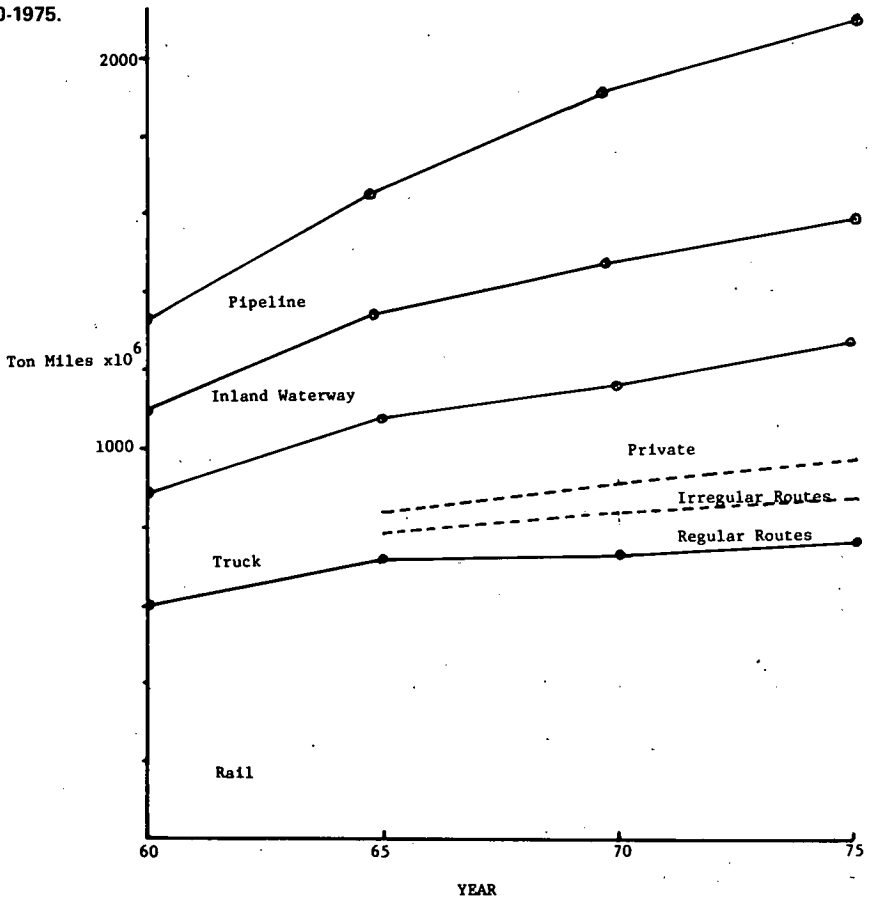
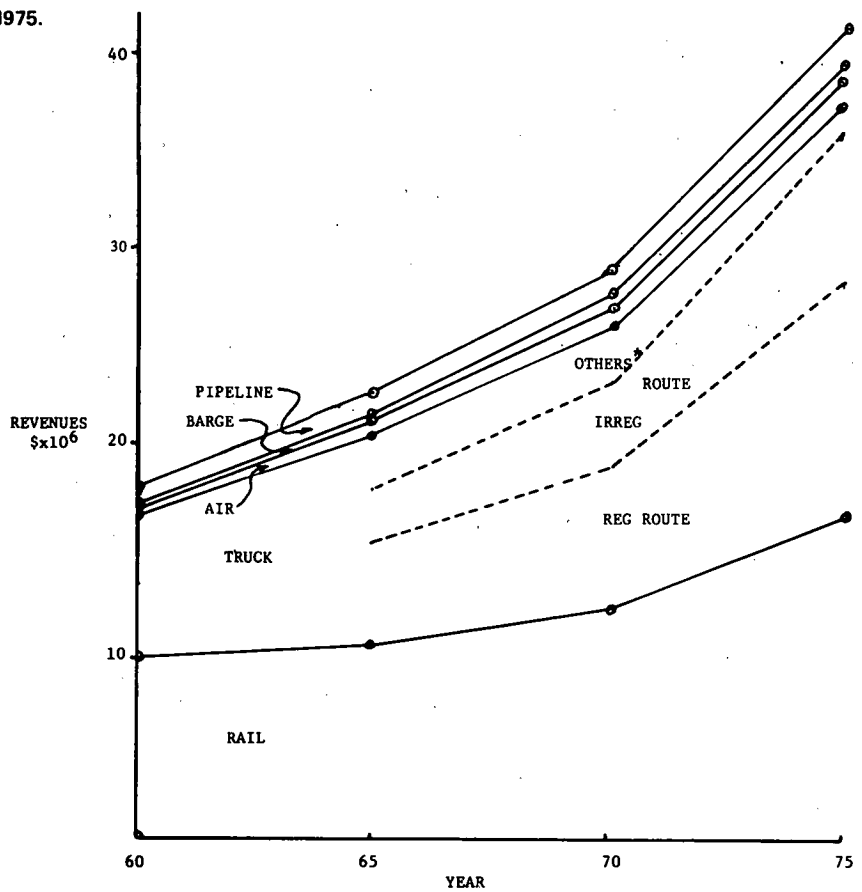


Figure 4. Revenues by mode, 1960-1975.



all influence the economics of system operation. Consequently, they may well influence the way in which the transport system, and indeed the entire economic productive system, is organized.

Although innovations in technology have great appeal to the engineer, it is quite difficult to innovate at the system level. It appears to be almost impossible to develop a whole new mode, at least at this point in time. To be successful, a new mode would have to be built all at once, and because it would divert its traffic from one or another of the existing modes, there would be both institutional and political resistance to its development. Technological innovation at the level of individual components of the system, however, is easier and can have systemwide effects. Frequently these new components can be installed in the current operating system, and their impact on competition with other modes can have systemwide effects. Some innovations that have occurred in the last 20-25 years have included the diesel engine, which replaced steam locomotives, for rail. More recently, the Big John hopper car and the auto-rack car have improved the competitive ability of rail substantially for the commodities that use this specialized equipment.

The development of the diesel engine for trucks and the construction of the Interstate highway system appear to have been what has made modern-day long-haul trucking possible. It is impossible to imagine that small gasoline-powered trucks on a two-lane rural highway could ever have competed with modern-day railroads.

Within the other modes, jet engines for aircraft and navigational improvements for inland waterways are both innovations that have had widespread economic impacts and implications for transport. Likewise, the development of supertankers has made possible the long-distance transport of fuel from the Middle East in economical quantities.

It is clear that the economics of the transportation system greatly influence where a producer's plant can be located. Also, there is a pressure exerted by the demand for services that seems to generate innovations to improve and refine the transport services originally offered. Thus, successful innovations that lower marginal costs from the outset are inherently easier to implement than those with big fixed costs, even if the average costs are lower in the long run. It is important to realize that technological innovations, even those that are considered to be extremely successful, will replace the existing system at a speed of only 10-15 percent/year. Major changes in the system are perceived to take place quite slowly.

Perhaps the most important technological force acting on costs in the transport system has been the use of petroleum-based fuels and internal combustion engines. It is perhaps no chance occurrence that the items cited in this paper as important technological innovations have included a large number of engines. The development of these engines has made possible the use of petroleum fuels with their economical handling and high heat content at constantly declining costs in real terms. It is important to note that, until 1973, the United States and the developed world had never experienced a rise in the real cost for fuel. Learning to cope with this change in a factor of as much importance as fuel may well be one of the most difficult economic lessons to learn in this generation.

In summary, then, technology is important because it establishes the economics of the transport supply process for each of the modal service offerings. If one thinks broadly, this is also where the balance of the institutional structure fits in. That is, this is where institutions, regulations concerning environmental protection, or even wage and price guidelines should be accounted for. Though these factors are not exactly technological, they do help to determine the overall economics of the supply side. If these factors are examined individually, then their cost should be traced to their impact on the supply cost.

A PROSPECTIVE ANALYSIS

If my thesis is correct, the U.S. freight system has evolved over time under the rather steadying influence of the three factors identified earlier: economic growth and development, economic regulation, and technology. If the future is to continue as the past, then there should be essentially no change in the existing freight transport system. But, if the future is to be different from the past, then we can expect the freight system to change as a consequence of the changing forces acting on it.

One can never know the future with certainty. However, some potential future events can be ruled out as highly improbable and others as quite likely. Events that are improbable in the short run may have a substantial cumulative probability of occurrence. Thus, though there may be another Ice Age in front of us, I do not expect that it will become a reality within the next 20 years. Likewise, the probability of a catastrophic occurrence that would change the nature of the entire U.S. freight transportation system seems fairly remote in the short run. By contrast, there are some events that are much more likely to occur and, though we will not know of their occurrence with certainty until they happen, one cannot rule them out as improbable. Though we can never know the future with certainty, the future will be made up of a number of events, most of which are independent and therefore additive. Consequently, planning for the future is a useful exercise in most cases.

I believe that there are a number of changes that could occur to the U.S. freight system with a sufficiently high probability and are worth noting here.

Trends in Economic Growth and Development

I have identified four separate trends in economic growth and development that I feel are likely. These are reduced rate of population growth, accelerated foreign trade, reduced growth rate for southern and western cities, and metropolitan growth and development into the exurbs. The population growth rate that accelerated after World War II has now begun to decline. If the children of this generation, who are now working their way through the school system, also fail to have a large number of children, the decline in the birth rate is likely to accelerate.

The implications of this declining population growth rate for the transport sector are not entirely clear, but they will have to be considered carefully. For the economy, it probably means an older and more affluent population. The decline in school population has already begun. It also means, however, a higher percentage of population in the working force. This will undoubtedly increase per-capita income and with it will come an emphasis on quality as opposed to quantity of output. It also probably means a further increase in the service sectors with an accompanying decline in ton kilometers per dollar of GNP. All of these factors will continue to emphasize the type of service that can be provided by trucking as opposed to that provided by rail.

An acceleration in foreign trade also seems highly probable. Trade from 1974 to late 1977 was depressed for a variety of reasons, and a higher rate of foreign

trade will be required just to catch up. I believe the long-term trend will be higher in general than it has been in the past. However, growth rates as high as 25-30 percent/year could be routinely experienced over the next decade. The development of world markets in raw materials is paralleled right now by markets in manufactured goods, such as automobiles or electronics, and it is hard for any one country to maintain control in a particular area such as the United States has done in the aircraft or computer areas in the past. With the high prices of foreign oil, and indeed of all imports, we must sell abroad to earn the needed foreign exchange to pay for these foreign purchases. To the extent that we do not, the value of U.S. currency drops and the United States becomes more competitive in world markets. Therefore, the process is self-regulating and tends to induce the United States to engage in more foreign trade.

For the transport sector, export-import trade is long-haul and generally lucrative. U.S. carriers, particularly air carriers, can benefit from it. Note that foreign trade is difficult and usually requires bilateral agreements. Moreover, the competition is frequently with a nationalized carrier. It will not always be profitable. The U.S. Merchant Marine has not done well even with its subsidized ship construction and operating differential subsidies. However, the differential wage rate between U.S. mariners and those from Third World countries is closing rapidly, and with the higher technological component usually found in U.S. ships, it is not inconceivable that we could operate a competitive merchant marine. Whether the construction differential subsidy is finally eliminated is largely a political problem. Nevertheless, I believe that we could be competitive over the long term if we are innovative.

I expect these foreign import-export markets to be highly volatile, easily disrupted by political crises, and constantly shifting with changes in currency, new finds of raw materials, and other events. However, the United States is in a potentially good position, geographically (for we are at the center of the Far East-European trade) and in terms of size (because the U.S. has huge markets for foreign products). The United States has both the population and the capability to produce a wide range of products competitively. We have tended to be a bit complacent, however, and have allowed others to get ahead in some areas. I hope that we will use this period while our wage rates are lower to rebuild some of our outmoded capacity and to improve our efficiency in those production areas in which the United States has a natural advantage.

With regard to the domestic economy, I anticipate that there will be reduced growth of southern and western cities. These cities have benefited greatly at the expense of northern and eastern cities, in part because of their good climate, their favorable labor force, and the fact that it is easier to acquire land and to build in virgin territory than to disrupt previously established development. However, this period of accelerated growth will eventually come to an end as the tax rates catch up to meet the payments for schools, water systems, and other municipal services. The environmental movement will also be a factor as it becomes more active in these places. The focus could change back to the North and the East, which are gathering their political power and which are about to become ripe for rehabilitation and renewal. It may well be that as energy prices rise, the North and the East will become more attractive. It is, after all, more energy intensive to cool than it is to heat.

Finally, I expect that metropolitan growth and development will continue right on past the suburbs into the exurbs. Industry can now locate at practically any interchange on the Interstate system and have economic access to most other areas by using either private or common carrier trucking. Full-truckload trucking that is competitive with rail is available by using irregular-route carriers. However, there are still values to belonging to large urban areas. Access to a skilled labor pool, to wholesale warehouses that stock infrequently used but necessary input, and the proximity to regional urban markets appear to continue to exert a centralizing force on new industry locations. Most industries, therefore, will continue to associate loosely with large regional centers. Cities, such as Dallas, Fort Worth, Atlanta, and Miami, are all developing into "super-big" urban areas that stretch over literally hundreds of square kilometers. These centers will represent a consolidation point for many transport carriers. For less-than-truckload trucking, for example, freight will be consolidated out of these large urban centers in exactly the same way that it is now from a large region. For rail it will be necessary to rethink the current consolidation schemes. This will certainly be the case for intermodal service, and it could well be the pattern for carload shipments as well. Because most of the import-export trade traveling by container ship or bulk carrier will come into larger and more concentrated ports, there is considerable opportunity for rail to capture the line-haul movement of import-export trade to inland regional centers.

Changes in Economic Regulation

Whereas changes on the economic front look reasonably predictable, or at least understandable, those in the area of economic regulation appear to be completely up in the air. Exactly what will happen will not be known for another year or two, or perhaps even for another five years. Because the rules of the game (economic regulation) had not changed substantively for 35 or 40 years, Congress decided last year to completely deregulate the air freight system. At the moment, pressure to deregulate the balance of the freight system is growing stronger in Congress. At least one mode (rail) has decided that it wants to be deregulated, although it cannot decide exactly how it should be done. Another mode (common carrier trucking) is convinced that it does not want to be deregulated, although some of the owner-operators working for irregular-route carriers support deregulation, at least in the truckload sector. The ICC has decided that it is going to move administratively to deregulate certain aspects of the freight transportation sector as fast as it can, whether or not Congress approves.

At this time, three basic outcomes are possible: (a) the status quo, (b) partial deregulation, and (c) complete deregulation. Because the situation in the truck and rail modes is somewhat different, we should consider them separately. Because the rail system's situation is much clearer, we will treat it first.

The U.S. railroad system is rapidly approaching a very deep crisis. The solution of the Consolidated Rail Corporation (Conrail) for the bankrupt northeastern carriers does not appear to be working. More railroads are encountering financial difficulty, and no end is currently in sight. Earnings for many of the carriers in the rail industry are not high enough to allow the replacement of capital assets. In short, the railroads are living off of their depreciation. The entire system appears to be "frozen" into providing service for which it cannot generate revenues to cover fully allocated costs. Even after bankruptcy, many railroads are required to continue to operate unprofitable services. Union work rules are onerous, requiring large crews and a day's wages for every 160 km (100 miles) traveled. The management of individual railroad firms has difficulty in making uni-

lateral decisions about such things as equipment, pricing, work rules, and scheduling. Some 70 percent of the revenue comes from shipments that must travel on more than one railroad. Almost 18 percent of the railroad moves involves as many as three railroads. Net income after taxes for Class I railroads as a percentage of net worth was 1.8 percent for the industry as a whole. Freight car use is so bad that frequently a rail car will only get one round trip per month.

It is precisely this inability to manipulate management choices that makes railroads want to be deregulated. They speculate that management initiative has been badly constrained by the regulatory process. In this respect the recent ICC decision to deregulate the fresh fruit and vegetable markets for railroads will be an interesting test case. It may be too little and too late, but complete deregulation of this sector should offer a possible demonstration of the correctness or the falseness of the railroad's thesis that "deregulation is a necessary precondition to proper management."

Congress must, in the final analysis, decide what to do about deregulation. The reason that railroads were regulated in the first place was that they had in many places become a monopoly. However, most knowledgeable transport analysts would argue that railroads are no longer in a monopolistic position. Other modes can offer the same services, frequently at similar or even lower cost. Most legislators are well educated in rail problems because of their recent efforts to draft reform and regulatory acts. They realize that railroads must be free to abandon unprofitable services or they will not have the economic strength to survive. They also know that abandonment is unacceptable to constituencies for the most part, but they have no real desire to nationalize the system. This would put rail unions directly to work for Congress and they would be in a position to use their political strength to exploit the system. However, because the rail debates preceding the passage of the reform and regulatory acts greatly improved the level of understanding of rail problems by most legislators, they know what needs to be done. Legislators are also beginning to be aware of a difference in rhetoric that could be used to explain the situation to their constituency. With the passage of Proposition 13 in California, a public mood to eliminate excessive government interference is widespread in the population. It can be argued that the railroads could solve their own problems if they could only get the government (and particularly the ICC) off their backs. A private-enterprise solution to the problem can be found in a deregulated environment, or so the argument goes. This argument just might work, and it would leave the legislators free to seek deregulation for the railroads with the public's backing. The draft of a rail deregulation bill has been released. The next step is up to Congress. Congress could act soon, but it is even more likely to do so if there is a crisis. It will probably start slowly by holding hearings. Then, if U.S. business leaders do not raise serious objections, deregulation for the railroads might just be a possibility.

Trucking deregulation, however, is quite a different matter. The ICC has already moved to ease entry. Not only are irregular-route certificates being granted almost automatically, but new guidelines proposed by the ICC would switch the burden of proof in most cases from applicants to those who protest the action. However, the trucking industry will not change instantly regardless of what is done. Entry into regular route operations is extremely difficult, expensive, and, as a practical matter, limited to those already within the industry. The principal factor is that the owner-operator still cannot solicit business without an operating certificate, usually does not have the time or the inclination to file for it in most cases, and will not likely file in the future either. A person who continues to drive the truck rather than manage the business will not be able to do both. So, there will be no change in the truckload business until "no certificate" is needed. At that point the owner-operator will be free to solicit business. Perhaps, more to the point, the owner-operator will no longer be willing to pay the irregular-route carrier 25 percent of revenues for use of that carrier's certificate. However, the irregular-route carrier provides a number of services for that 25 percent share of the revenue. To the extent that these services are really costs to the trucking industry, somebody will have to provide them. This suggests that there will be the need for a truckload broker in the system to solicit loads, to secure the billing, and to handle the paper work. Alternatively, owner-operators may go to work for private fleets where it is currently against the law for them to work, or they might work for a contract carrier who, in a deregulated environment, might secure long-term contracts from large shippers.

The regular-route portion of the trucking industry is against deregulation because it is convinced that there will be increased competition both within their business and from the freed-up truckload operators. The two will tend to encroach on their territory and could cause rate wars and price cutting. Some services, however, are currently underpriced (i.e., small shipments), and it is expected that rates on these portions of the market will be increased rather than decreased. The net effect could be bankruptcy for the marginal carrier and an even faster concentration of the industry than currently exists.

Organized labor also plays an important role in the trucking case. The Teamsters' Union does not want deregulation and has made this point perfectly clear to the government. Alfred Kahn, President Carter's inflation expert, has suggested a possible quid pro quo in which the current administration will not push as hard for trucking deregulation if the Teamsters are willing to live with the President's 7 percent wage and price guideline.

It is quite likely that trucking deregulation will not occur right away; one wonders, if rail deregulation comes, can trucking deregulation be far behind? As deregulation in other countries has shown, industry practices initiated in one portion of an industry eventually spread to all portions of that industry. This suggests that floating rates, contract prices, and other practices typical in deregulated environments would eventually spread to the trucking industry, regardless of whether it was deregulated.

The implications of a complete deregulation of the trucking industry for the transportation industry and, in particular, the railroads are still being debated. Rail carload service and full-truckload trucking appear to be locked in a death struggle. Truckload costs are now almost equal to those for rail for all except the longest moves. Unless rail is deregulated, it cannot make the appropriate adjustments to its price-and-service offerings to be able to hold the profitable traffic. It will take bold management initiative for rail to find a winning strategy. Unless the rail industry is free to explore new initiatives for deregulation, it will probably not succeed. In fact, a winning strategy may well involve a considerable amount of withdrawal from current markets. There is a reluctance on the part of the public at large to let railroads merely go out of business. Therefore, the alternative that looms behind the failure of private enterprise to find a solution to rail's problems is nationalization of the rail system. Where nationalization has been tried in other countries, it has been a dismal failure. Japan, Germany, and Great Britain have all found that

a nationalized rail system requires enormous subsidies just to break even. Trucking deregulation does not improve the prospects for the railroads and, in my opinion, involves some risk if deregulation does go ahead in the trucking area.

One area that will require additional exploration before a possible future can be determined is in the area of intermodal operations (i.e., trailer on flat car, container on flat car, and related services). If these intermodal services are to be viable, they will probably have to exploit both multimodal ownership and operations. Because rail ownership of other modes is currently against the law, deregulation would once again seem to be required before progress can be made.

The impact that the outcome of the deregulatory question holds for the operation of the entire transport system has sweeping implications for the future of the whole U.S. transport system. Will the system have a continued, sickly, and struggling rail sector, no sector at all, a nationalized rail network, a shrunken but profitable private enterprise rail industry, or an aggressive set of multimodal transportation conglomerates? The number of possible alternatives is large, and their outcome is still too uncertain to assign much more than an equal probability to each at this point in time.

Possibilities for New Technology

Among those items that are listed as possible alternative futures for new technology, the most important seems to be the question of the price and availability of fuel. Because petroleum is a nonrenewable resource, it is clear that the world will eventually run out of oil at some point in time. When is the question. If the price in the marketplace were a true reflection of the shortage of petroleum, then as the shortage intensifies, the price would rise and the pace of development to find a substitute would quicken as a consequence. It is my feeling that at some price not too much greater than the one that exists today, a next-best solution will be found. It may be methanol from coal, hydrogen, storage batteries, or any one of a dozen other technologies now being investigated or even something that has not yet been developed.

I could be wrong, however, in which case an eventual solution might be several times more expensive than today's petroleum-based fuels. If so, the new fuel prices would dictate a new equilibrium between transport and the economy. Relevant intermediate solutions will also play a role if they can substantially reduce petroleum use in the transportation sector or in other sectors. For example, a large-scale solar solution to static power generation would release considerably more petroleum-based fuel for transportation. In fact, it would appear that over the long term there is almost complete convertibility from one type of fuel to another at an appropriate cost.

A more current threat, however, is one or more short-term interruptions in the petroluem supply. As we saw during the Arab boycott of 1973-1974, even a short-term break in oil supply can be extremely disruptive to the economy. It appears as though possible interruptions of supply will remain a problem until a more broadly-based source of supply is developed. Already, the potential for avoiding worldwide fuel shutdowns is improved from the situation that existed in 1973 when most of the supply was from the Middle East and Venezuela. Since that time, the North Sea, Alaska's North Slope, and Mexico have all come on line. Nigeria, Indonesia, and Venezuela have all expanded their output, and countless smaller fields are now producing or are under development. At the same time, the United States has increased its dependence on imported oil, including that from the Middle East. In particular, this country appears not to have solved its current shortage of refinery capacity.

Even with a broader base of supply, short-term shortages (especially localized shortages) appear to be a fact of life that must be dealt with from time to time. Unfortunately, by the time our society learns how to cope with these kinds of shortages, we probably will be beyond the current problem. Fuel efficiency, which is terribly important in the face of steadily rising fuel costs, is of almost no use in a short-term shortage. It is important to remember that the key factor in an emergency is to keep the economy working. This means that the shortages, if there are any, should be taken in the private passenger sectors rather than in the freight sector.

Thus, I believe that new fuels, improved combustion processes, and more efficient propulsive devices are the principal products that technology research is likely to be able to provide over the next few years. If we are lucky, technology will produce some widely applicable solutions to the problems we are currently experiencing, perhaps even to the point that the problems go away. More likely, we will muddle through until the rising price of petroleum forces us to use alternative fuels for the entire transport sector.

As to other technological developments that are likely to impact the freight transportation sector, it is difficult to name what they are likely to be at this point in time. This is particularly true of components. An example of this type of possibility is the Roadrailer (the highway trailer with convertible rail wheels that can be moved in short trains by a small locomotive). Although it was tested some years back, the proper environment for its adoption did not exist. At the current time, however, the institutional barriers to its acceptance might possibly be overcome. Containerization in one form or another also appears to be likely. However, the thing that we seem most anxious not to discover is that the most ubiquitous container of this era is the highway trailer. Consolidation of trailers for economical long-distance movement by high-speed unit trains requires considerably more regulatory freedom than currently exists. Hinterlands of sufficient size are difficult to achieve under today's operating certificates.

CONCLUSIONS

In conclusion, then, the alternatives seem fairly clear. For the next 10 or 20 years, the economy will still have very much the same structure that it has today. The trends we see in the current system will probably continue. Per-capita income will continue to rise. Transport output as a percentage of GNP will decline, but overall transport output will have grown from 1.5 to 2.5 times larger than it is at the moment. Likewise, ton kilometers per dollar of output of GNP will probably continue to decline. The principal determinant will be the type of fuel that is being used and the location of its production. Different coal scenarios, for example, could have relatively large impacts on this figure. There will undoubtedly be an enormous growth in foreign trade. The cyclical and sporadic nature of this growth may even condition the U.S. transport system to be more adaptable and flexible under shocks.

The principal determinant of the modal makeup of the U.S. transportation system is the outcome of the current regulatory reform process going on in Washington. The next 10 years will probably see major changes in the regulatory scheme. The outcome will greatly condition the type of transport system that we will even-

tually have. It is difficult to say whether the system will be dramatically different in physical appearances. Chances are it will not. Statistically, however, it is likely to be quite different. It almost certainly will have more truck and less rail, but the essential questions relate to whether the components are healthy, not to their overall magnitude.

The second big unknown is the impact of fuel price and availability. The best of all possible worlds would be a steady rise in the price of petroleum until such time as new technological developments provide us with new energy sources, or new engines, or both. The range of possible outcomes is huge. It could prove to be a very exciting period for technology developers. If fuel prices rise to very high levels, it could even force a generalized reorganization of the economy. This could have major consequences for continued economic growth and would substantially alter the economic patterns of trade and development as well as life-styles. The more probable occurrence, however, is for a series of shorter-term fuel crises. Methods for coping with these without damaging our economy must continue to be sought.

It is clear that the prospects for the future of the U.S. freight transportation system are for substantial and major changes. The future will not be boring and, although it is likely to be difficult, it is not fair to classify it as "bleak" by any means. In fact it might be characterized by Dickens' lines, "It was the best of times, it was the worst of times..."

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Passenger Transportation in the Year 2000

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Prognosticating is always a risky business. The longer the forecast period and the more dynamic the area of interest, the more caution the forecaster must exercise in developing predictions. In the absence of prescience, forecasters generally rely on extrapolation from established trends, and the best results are those that successfully weigh and incorporate the influence of emerging trends on future outcomes.

Thus, a would-be seer of the future of intercity and urban passenger transportation in 1949 would have accentuated the influence of pent-up demand for the better life that had been forestalled by war and depression. In 1959, the forecaster would likely have stressed the expected technological impact on transport from the then nascent space program. On the other hand, a predictor in 1969 would likely have emphasized the increasing importance of environmental constraints and the need for the transport sector to contribute toward achieving general social-welfare goals such as improved employment opportunities for minorities.

At first, one is tempted to note that these projections might have proved wide of the mark. Real economic growth and increased consumption of superior goods certainly characterized the 1950s and 1960s, but growth rates have slowed and, although the demand for travel is still growing, growth has been sporadic. Technology has been far from successful in solving all our transportation problems. Environmental considerations are already being accorded reduced emphasis, and many now feel that reliance on transport solutions to problems, which are only marginally related to transportation, yields only inappropriate transport systems and unresolved social problems. Nonetheless, it is also obvious that these forecasters all correctly identified important influences on the long-run development of passenger transportation that continues to date. Economic growth, though cyclical, has continued strong, and the demand for superior goods such as travel continues to outpace other sectors of the economy. Although technology has not been a panacea, it is clear that the current passenger transport network would be unmanageable, if not impossible, without the breakthroughs of the past 20 years. One need only to travel to those regions where computerized reservation and information systems have yet to be introduced to appreciate the impact of the cybernetic revolution. Finally, although the activism of the 1960s has given way to the lowered expectation of the 1970s, the concerns of that decade introduced a new set of priorities into the transportation planning process, requiring that consideration be paid to the needs of the environment, minorities, the elderly, and others who are economically or physically disadvantaged.

Today, new forces are gathering that will help shape the future transportation environment. Obviously, all of these factors will continue to be important, and the estimates that follow are largely based on projections of economic growth and technological progress within constraints imposed by energy availability, environmental protection, and the sociopolitical system. It must be stressed that the emerging forces will not al-

together supplant, or even necessarily attain parity with, the longer-standing trends, but rather will interact with them to generate a new transport policy synthesis. The latest influences shaping the future of transport environment revolve around a renewed emphasis on economic-efficiency criteria in establishing programs to address transport problems. In part, this has led to a rediscovery of the market as the superior vehicle for ensuring that society's resources are efficiently employed. The recent deregulation of air transportation was an important manifestation of this resurgent interest in economic efficiency, and it is unlikely to be the final, or even the most dramatic, statement of this new direction in transportation policy. In spite of the powerful interests arrayed against it, deregulation of motor carriage will likely occur during the early 1980s. The deregulation movement is, of course, predicated on the proposition that the basically competitive transport sector will better serve society's interests if economic competition is not stifled. The combination of increased traffic, lower fares, and record profits experienced by the domestic airlines provides early documentation for the wisdom of this approach (1).

In addition to reducing government regulation, the renewed reliance on the market will also be reflected in a growing reluctance to continue underwriting transport services that do not produce social benefits sufficient to warrant subsidization. Recent investigations (2) suggest that much of the National Railroad Passenger Corporation's (Amtrak) service falls into this category, and substantial cutbacks in the intercity passenger rail route network have been proposed. Analysis of Amtrak's performance suggests that rail's potential is limited to a handful of densely populated corridors where, because of the external diseconomies resulting from existing air and highway congestion, some Amtrak subsidy might be justified.

The experience gained from the Amtrak experiment should serve to preclude further public forays into quasi-nationalization of intercity passenger transport modes. Therefore, it is unlikely that a national bus passenger route network will be created to challenge Amtrak for an ever-shrinking segment of the intercity passenger travel market.

Obviously, a critical ingredient in the move toward more rational transport policy is congressional willingness to make decisions that, though in the national interest, might be politically unpopular. Well-organized special interests can exploit public misconceptions about relative modal attributes. The case of competitive Amtrak and bus service provides a good example. Buses are more energy efficient, more flexible, more reliable, less costly to operate than trains, and, with minor exceptions, have operated without direct public subsidy. Yet, subsidized Amtrak services have hurt bus operations and, as a result, have lowered the effectiveness of the nation's passenger transport system (3). Many who justify this outcome argue that bus and rail should be complementary modes rather than competitive ones. Both modes compete against the dominant air and automobile modes. They propose that bus and rail be made to interact synergistically through intermodal terminals and cooperative scheduling in order to successfully lure traffic from air and automobile modes. Although this view has political appeal, it is, nonetheless, naive. First, bus and rail both offer a physically similar transport service, and both are roughly at an equivalent disadvantage when compared to the strengths of the dominant modes. Second, there is considerable evidence that travelers prefer to avoid transfers, making bimodal solutions considerably less attractive. Attempts to integrate the services will probably produce little additional patronage. Finally, most strategies calling for joint operations envision a line-haul rail system and feeder bus services. However, it is the line-haul portion of the bus trip that is most profitable. Most bus companies are not interested in becoming marginally profitable rail feeder operations. Thus, although the cooperative approach might be feasible where the modes are both owned and operated by a common authority, this solution is inappropriate as long as bus operations remain in private hands. Clearly the modes offer competing services, and the available evidence suggests that the bus companies have lost considerable ridership and revenues in markets where subsidized rail services are provided.

As economic-efficiency criteria become increasingly important, transport systems will become better tailored to meet the specific needs of the communities served, while contributing to the achievement of national transport goals and objectives in a cost-effective manner. But this will require that choices be made. Some would attempt to redress the problem faced by bus operators from Amtrak competition with compensating bus subsidies. Resource constraints, however, will not allow such magnanimous gestures in the future.

Modal subsidies should be limited to those required to produce a service level sufficient to meet a defined social objective. Bus subsidies required to ensure at least minimal service to rural residents dependent on public transport may be warranted, but compensating for bus losses due to public support of redundant rail operations is another matter entirely.

Many factors will influence the volume and composition of travel demand in the year 2000. Some will be important determinants of individual modal market shares, while other forces will primarily determine the overall level of passenger transport demand. These categories of determinants are not mutually exclusive. The most important variable influencing both the volume and distribution of traffic is the level of national economic activity. High rates of economic growth will allow for increased travel for vacation and personal reasons and, of course, necessitate increased travel for business purposes. Further, the growth in real income has been largely responsible for the patterns of private home ownership and urban decentralization. Continued improvement will foster further suburbanization that will result in increased commutation trip making. In addition to economic growth, the demographic and socioeconomic composition of the population will also affect travel demand and modal preference. Finally, relative modal attributes, traveler requirements, and public transport policy will interact to determine the distribution of the traffic among the alternative modes. Some determinants, such as the total population in the year 2000 or the size of the available labor force, are known with near certainty. Other influences on future travel demand, however, are highly sensitive to forecast assumptions.

There are several recent transportation forecasts available. This paper attempts to combine the results from previous estimates and makes the adjustments necessary to reflect the author's perception of the most likely outcome. One widely employed transport demand forecast presents a range of transportation projections based on low, median, and high economic growth rates (4). Real Gross National Product (GNP) was estimated to increase at a 1.9 percent annual rate under the low-growth scenario, 3.1 percent in the median case, and 3.7 percent in the high-growth case. Another recent effort (5), using the three-scenario approach, estimated real domestic output growth rates of 1.8, 3.5, and 4.5 percent, respectively, to reflect the range of likely out-

comes. Higher rates of growth are expected to produce proportionately greater increases in interurban travel than urban traffic.

There is always the temptation to choose the middle estimate and to classify the high and low projections as extremes. However, there are several reasons for believing that these middle scenarios are too high. First, they fail to take adequate account of the constraints imposed by rising energy costs. Second, the relatively recent importance of environmental and safety restrictions will tend to lower real growth rates, at least through the 1980s. Further, there has been a sharp decline in productivity growth in the United States in recent years, and a reversal in the trend does not appear imminent. Therefore, an average annual growth rate of 2.5 percent over the forecast period was used to derive the projections that appear in Table 1.

The modal demand estimates derive from assumptions concerning the future competitive positions of the passenger transport modes. The rationale for each projection is contained in the individual modal discussions that follow.

INTERCITY BUS

The nation's motor bus industry has entered a critical period. Although ridership had remained constant over the past two decades, the situation recently changed for the worse. Thus, intercity bus operations are now in an era of retrenchment. Physical-output measures demonstrate that there has been little improvement in either capital or labor productivity, and operating costs have risen rapidly, especially during this recent inflationary period. As a result, the operating ratio has deteriorated, rising from 87.6 in 1971 to 95.5 in 1976; the return on equity declined from 16.1 percent to 8.3 percent in the same period. The prognosis for recovery in the absence of substantial changes in the competitive environment is poor.

Yet, the bus mode is not without certain strengths. It is the most ubiquitous of the transport modes, serving more than 15 000 places compared to the 532 served by Amtrak or the 645 receiving air carrier services. Its flexibility allows it to go wherever the highway does and to provide services more nearly door-to-door than those offered by Amtrak or the airlines. Successive studies have established that bus is the most energy efficient of the intercity travel modes (6) and, with the exception of nitrogen-oxide emissions, it is a relatively "clean" mode. Because of its flexibility, bus is often the only public transport capable of meeting the needs of small-town and rural areas in the United States. Because it is highly efficient, it has been able to carry passengers at fares affordable by those who must depend on public transport—young people, the elderly, and the poor. In short, bus transportation has ensured the mobility rights of those without automobiles.

Unfortunately, because it has met the needs of society's disadvantaged to some degree, it has earned an overall public image as the "poor man's mode." Reinforcing this perception is the fact that bus terminals in large cities are often located in a decaying part of the city center and typically lack the amenities available at major airports. As a result, attitudinal surveys of the public's disposition toward the competitive modes consistently reveal that intercity bus is viewed as the least-pleasant way to travel. In fact, this negative reaction so permeates the public's outlook that bus is thought to perform poorly in environmental and safety areas where, in reality, it does at least as well as the preferred modes (7).

Although some bus companies would like to upgrade their urban terminal facilities, inadequate earnings from regularly scheduled services preclude them from doing so. In part, technological constraints have limited the productivity growth necessary for continued financial health. Over the years, the number of seats per bus has grown, but it appears that further increases beyond today's average of 43 seats/vehicle can only come at a very high cost in terms of passenger comfort. In addition, institutional restrictions, such as the 88-km/h (55-mph) speed limit, have also restricted the ability to achieve productivity gains. At the same time, fuel costs and the industry wage bill have risen dramatically, and smaller companies have also been victims of rapidly escalating insurance premiums. Yet, because of subsidized competition from Amtrak, rate regulation by the Interstate Commerce Commission (ICC) and user socioeconomic characteristics, bus firms have not been able to match rising operating expenses through fare increases. If current trends continue, the industry will be operating at less than break-even status by the early 1980s.

Over time, intercity bus operators redirected their efforts away from regularly scheduled passenger operations and toward charter and package express services. In 1939, fares from passengers traveling over regular intercity routes produced 92.1 percent of Class 1's motor bus revenues, but by 1970 this had declined to only 70.8 percent, and by 1976 charter and package express operations accounted for nearly one-third of Class 1 motor bus company revenues (8).

Many fear that the bus industry is facing a situation similar to that faced by the railroads after World War II, and that it will react much as the railroads did by allowing the unprofitable portions of bus operations to decline and contract, while concentrating on expanding the more profitable areas. Clearly, given the relative advantages of intercity bus, such rational, profit-maximizing behavior might run afoul of the national interest.

The industry has recently sought relief from what it feels is excessive ICC regulation. However, although most carriers agree that greater rate flexibility would improve the industry's competitive position, many, including Greyhound, the largest firm in the industry, oppose complete deregulation, if it includes open entry.

The industry supported the recent enactment of federal legislation and the efforts of several state legislatures to assist intercity bus operations. Federal aid was authorized for the first time by the Surface Transportation Assistance Act of 1978. The act allows for terminal development assistance and for service improvements, especially in rural areas. Also, the En-

Table 1. Projections of economic and transportation activity through the year 2000.

Factor	1977	1985	1990	2000
GNP (billions of 1972 $)	1202	1624	1837	2352
Population (millions)	214	230	240	262
Disposable personal income per capita (1972 $)	3988	5013	5434	6374
Passenger kilometers (billions)	4118	5323	5784	7160
Urban local	1296	1776	2032	2528
Rural local	736	928	1024	1216
Intercity	2086	2619	2892	3416
Air	241	400	488	760
Automobile	1797	2168	2238	2565
Bus	40	43	56	78
Rail	8	8	10	13

Note: 1 km = 0.6 mile.

ergy Production and Conservation Tax Incentive Act of 1978 repealed the excise tax on buses and bus parts. It also provided a refundable tax credit based on passenger kilometers.

Several states have enacted programs designed to preserve and promote intercity bus service. The programs vary in size and extent, but Michigan's is the most ambitious. The Michigan assistance program has three main components: (a) operating subsidy for service along specific routes, (b) loan-lease programs to permit the carriers to acquire new rolling stock on favorable terms, and (c) state financing for terminal construction. Like many subsidy plans, the Michigan program was supposed to be temporary. Theoretically, state support would help the industry regain its competitive position and return to profitable operations. However, as is often the case, the hopes for reviving a for-profit industry proved unrealistic. Furthermore, although assistance programs might help forestall the termination of private-sector service provision, they cannot, by themselves, reverse the overall adverse trend. As long as other modes are subsidized and as long as those who use them are not assessed directly for the resources they consume, there will be divergence from the socially optimum outcome, and bus operators will be at a competitive disadvantage. It should be noted that at least one evaluation found that bus is the only mode that is not a net recipient of public funds (9). If traffic is to shift from the more energy-intensive and environmentally debilitating air and automobile modes to intercity bus, then the less-efficient modes must be made less attractive. Mere provision of the bus alternative does not appear to be a sufficient inducement.

If bus subsidies are to be awarded, it would appear that the better course is to grant them to users rather than providers. Provider subsidies, such as those employed in Michigan, are less effective in promoting bus travel. User subsidies not only benefit the bus companies but, in addition, encourage optimal resource allocation (10).

No dramatic technological developments are on the horizon that would significantly alter the character of intercity bus transport. The introduction of turbine-powered vehicles will reduce emissions still further, but such an improvement is not likely to affect the modal split. Changes in state regulations to permit wider buses to use the highways will allow for a more comfortable ride, but again it is doubtful that many will choose the bus, if seating comfort is an important factor in their decision making. Thus, without significant technical innovations and given the expected growth in real income, then privately provided intercity bus operations will slowly, but certainly, disappear unless there are major changes in public transport policy. The current downturn in ridership will begin to accelerate as service quality deteriorates and quantity declines. In some cases, state and regional operating authorities will replace private vendors, but, if past experience is a guide, the services offered will need large subsidies.

There are, however, several reasons for arguing that we have painted too bleak a portrait of the future of private intercity bus service. In fact, there are some factors that suggest the survival of a viable industry even if public policy remains unchanged. Among these, the following are important.

1. The population is aging, and the number of people who will be in the older, public-transport-dependent age cohorts will become increasingly large as we enter the 21st century.
2. Lower rates of real economic growth will decelerate the increase in affluence and, thereby, arrest the long-term decline in bus travel demand.
3. Fuel costs, although still not the dominant influence on traveler choice, will become increasingly important as gasoline prices rise and as U.S. fuel costs approach those that have long prevailed in Europe and Japan.

However, increased reliance on public policies that stress economically efficient approaches to transport problems should produce the most telling impact on the future of intercity bus service. In many markets, Amtrak has harmed bus operations by siphoning off bus passengers. As redundant and overly costly passenger trains are phased out, buses might recapture lost traffic and again operate profitably with, or at least benefit from, user subsidy programs. Deregulation of the motor bus carriage should also help create a viable competitive bus industry that is more responsive to changing market conditions. Rate flexibility and freedom to enter and exit markets, combined with an understanding of the need to tailor service to meet individual market requirements, should produce a profitable industry. One study concluded that small bus firms have operating costs significantly below those of Greyhound and Trailways (11). Under deregulation, small firms could take over the unprofitable rural lines of the major bus companies.

Finally, if policymakers are willing to accept that carrot-and-stick solutions sometimes require use of the stick, then serious efforts might be undertaken to discourage excessive private automobile travel. This, too, will shift more travelers toward intercity bus transport.

Most forecasts project very little, if any, change in passenger kilometers of bus traffic through the year 2000. The bus market share has declined from 2.5 percent in the 1960s to roughly 1.8 percent today, and most estimates envision further erosion. However, as those environmental and energy forces already in motion gain momentum and as overall economic considerations come to the fore, it would appear that intercity bus will not only maintain its relative position by the year 2000 but should have recovered the 2.5 percent share it held in the 1960s. The estimates in Table 1 reflect these assumptions. Further improvements should follow in the early decades of the 21st century.

INTERCITY RAIL PASSENGER SERVICE

In May 1971, in response to the long-term decline in intercity rail passenger services, the U.S. Congress created the National Railroad Passenger Corporation, popularly called Amtrak, and assigned to it the task of resuscitating interurban passenger train travel. Preservation and restoration of intercity rail passenger service were believed by many to be in the national interest because rail is inherently superior to air and highway modes in terms of energy efficiency, environmental protection, and safety. The original Amtrak legislation cited the goals of congestion alleviation and maximization of traveler choice as social objectives of the corporation. Subsequent legislation stressed energy and environmental considerations as justifications for continued public support. Originally, Amtrak was designated as a for-profit corporation, but over time Congress placed increased emphasis on Amtrak's social performance and, in the interest of realism, removed the profitability requirement in 1978.

Congress has repeatedly encouraged Amtrak to expand the route network. Amtrak was required to add international services to Mexico and Canada, add two new experimental routes annually, and enter into agreements

with state agencies to offer services that meet more local needs. Deficits from these state-sponsored services are shared by Amtrak and the states.

However, after a surge in ridership during the energy crisis of 1974, Amtrak patronage has since remained relatively stable, but expenses have increased dramatically and deficits have soared. Annual operating losses are now more than $500 million, and there is little evidence to suggest that they will abate. On a performance basis, Amtrak passengers are more heavily subsidized than users of any other transport mode. All Amtrak patrons could have been given airline tickets at a cost less than the operating deficit.

As already noted, the justification for these large subsidies traces to the belief that rail passenger operations promote the general welfare. The view is widely held that Amtrak either currently contributes or has the potential to contribute to national transportation goals and objectives. However, efforts to uncover a measurable impact on the nation's transport-related problems have not borne fruit. For example, although current Amtrak operations do save fuel by diverting traffic from more energy-intensive modes, the conservation impact is small compared to the rail operating deficit. Buses are more energy efficient than trains, suggesting that Amtrak is not a cost-effective solution to the energy problem. In general, the same observation applies to Amtrak's impact on reducing transportation-induced air pollution. Traffic diversion from more polluting modes does contribute to the general welfare, but the total reduction is small relative to either the Amtrak deficit or the magnitude of the air pollution problem (2). In fact, current Amtrak services produce more of certain emissions, such as oxides of nitrogen, than would have been produced if rail travelers had opted for an alternative mode. To the extent that rail does contribute to either energy conservation or environmental protection, it is Amtrak's short-distance train operations—especially Northeast Corridor services—that generate the savings. This is especially true for Amtrak's congestion-alleviation impacts. These are almost entirely confined to the Northeast Corridor where some airport and highway facilities are already congested and Amtrak offers frequent departures between cities situated along the heavily traveled corridor (2). Further, Amtrak's contribution toward improving the overall quality and quantity of intercity travel must be deemed minimal. It is less often on time than air or bus transport. Deteriorated roadbeds have compromised whatever line-haul speed advantages it might have had over the highway modes and, although riders generally express overall satisfaction with Amtrak operations, several studies by the ICC and the U.S. General Accounting Office have uncovered serious service quality deficiencies (12, 13). Finally, rail is a safe way to travel, but all common carrier modes have posted good safety records, and Amtrak does not appear to be a cost-effective solution to improving travel safety.

Many who endorse continued public support for intercity rail passenger services would readily concede that current Amtrak operations have contributed little to the general welfare, but they would argue that as Amtrak replaces over-aged locomotives and rolling stock, refurbishes and rebuilds terminals, retrains employees and instills in them a more customer service-oriented attitude, upgrades rights-of-way to allow for faster and more reliable service, and completes installation of its computerized reservation and information system, then it will benefit the traveling public in a meaningful way.

Yet, even under highly optimistic assumptions about future ridership and rail service performance, it is impossible to quantify benefits that even remotely approach the capital costs necessary to attract such patronage or the operating deficits associated with providing the upgraded service (2). The difficulty lies not in the concept of intercity rail passenger services but rather in the service mix as offered by Amtrak. Amtrak basically offers three types of services: long-distance, transcontinental trains complete with dining, sleeping, and lounge cars; short-distance corridor services with coach-class service predominantly; and high-speed Metroliner operations in the Northeast Corridor. However, only Metroliner and conventional train operations in the Northeast Corridor and operations in a few other corridor routes produce net social benefits. Amtrak's long-distance trains generate the largest absolute deficits, but many short-haul routes, which Amtrak has been required to add by congressional mandate, have incurred the largest deficits on a per-passenger kilometer basis. Not a single Amtrak route today covers even the out-of-pocket costs of providing the services.

In partial recognition of Amtrak's problem, former U.S. Secretary of Transportation Brock Adams proposed that the route network be pared of many of its most unprofitable lines. The route system would be reduced by 17 600 km (11 000 miles). However, 25 600 route-km (16 000 route miles) will continue to receive regular service, and travelers would still be able to traverse the continent by rail. This proposal was a step in the right direction, but it does not proceed far enough in terms of establishing the economically efficient role of intercity rail passenger service. Passenger train service can only make a meaningful impact on national transportation objectives in densely populated corridors, where it can offer frequent, high-speed, preferably electrified, service between relatively proximate city-pairs. Outside of the Northeast Corridor, the Los Angeles-San Diego corridor and, perhaps, a handful of city-pairs in the Northeast, there are few existing Amtrak routes that can qualify.

A critical factor in restructuring the interurban rail passenger network to create a more viable and socially useful operation is gaining acquiescence from those members of Congress whose districts stand to lose train service. Even those members who are usually conservative on fiscal matters often balk when it comes to abandoning trains that serve their states in spite of very low ridership and large losses. Rail passenger service lobbyists are particularly well organized and very vocal in their opposition to system reductions. Unfortunately, their patronage is not enough to justify continuing most Amtrak operations. Nostalgia, coupled with misinformation as to comparative modal performances, can be a potent force in preserving an inefficient system.

If, as we have indicated, economic-efficiency considerations become an increasingly important factor in transport policy formation, then Amtrak will be reconfigured so that it serves a real national need. Concentrating on markets where the volume of travel is sufficient to take advantage of rail's capacity advantages, Amtrak could offer frequent, high-speed, electrified operations that would help conserve energy, reduce transport-induced emissions, and relieve congestion at major airports and on urban highways. Notwithstanding this potential for social impacts, subsidies should be limited to those necessary to produce identifiable social benefits.

Therefore, rail ridership should remain constant during the transition era as redundant routes are eliminated and Amtrak concentrates on those markets where demand potential is significant. However, after 1985, when upgraded Northeast Corridor service will be in full operation, total system ridership should begin to increase. Between 1990 and 2000, development of other

corridors, where population and potential benefits warrant, should produce additional ridership growth as indicated in Table 1.

Because there will no longer be a national interconnected rail passenger network but instead regional or intrastate rail services, Amtrak—a national organization—will likely be replaced by operating authorities within state departments of transportation. Federal involvement will likely be limited to grant-in-aid programs administered under a separate division of the new Surface Transportation Administration.

State and local agencies may be better able to coordinate rail service offerings with the legitimate needs of the traveling public. Concentrating on relatively short-distance travel markets, the operating authorities could expand the rail system potential by improving the accessibility of line-haul rail through minibus collection and distribution systems.

AIR PASSENGER TRANSPORT

Recent deregulation of the nation's air carriers has made the task of predicting future aviation activity levels particularly difficult. Reduced fares and increased intramodal competition have greatly complicated the forecasting equation.

On the one hand, the long-term evidence shows a strong positive relation between air travel demand and the level of national economic activity. Periodic technical breakthroughs, such as the introduction of jets, have also increased air travel demand. Assuming the lower rate of economic growth employed in this forecast and accepting that there are no significant innovations on the horizon to rival the introduction of jets or jumbo aircraft, it follows that air travel should grow at greatly reduced rates. Most forecasts that assume low economic growth rates project a sharp reduction in the growth of air travel. However, previous estimates have assumed continued economic regulation by the Civil Aeronautics Board (CAB). Clearly, this presumption severely affects the accuracy of the earlier projections.

Two major repercussions are expected from economic deregulation of the airlines. First, air carriers will enter some routes and exit others in response to perceived changes in market conditions. Markets that gain service will obviously benefit from increased competition, but those cities losing certificated carrier services might also benefit as third-level operators replace the trunk and regional airlines. Commuter carriers often operate with equipment better suited to the needs of smaller markets. Thus, they can not only provide more frequent and better-timed departures, they can do it without subsidy (14). The trunks and regional carriers cannot economically provide a comparable service quality. The other major impact is, of course, on the fare level and structure. It has long been argued by economists that the CAB's prohibition against price competition merely channeled the naturally competitive instincts of the airlines into uneconomic methods of rivalry (15). Nonprice competition took many forms, including (a) operating more frequencies than warranted by market demand in order to gain market identification, (b) introducing new equipment long before older aircraft had completed their useful lives, and (c) providing on-board amenities far in excess of what the public would have been willing to pay for, if given the choice. The result was higher costs and fares, as well as lower load factors and output levels, than would have occurred in the absence of CAB regulation.

Service-competitive practices led the carriers to demand technically superior equipment from the manufacturers. Economic considerations were secondary. But during 1966-1975, air travel demand grew more slowly, and many airlines found themselves saddled with substantial excess capacity. Meanwhile, capital, labor, and fuel costs rose considerably and profits declined. Although the industry earned $367 million in 1966 with a sales margin of 7.4 percent, the next 10 years saw profits plummet to an annual average of $160 million, and the margin declined to 1.5 percent. In 1975, the airline industry lost over $100 million. Low rates of return rendered the industry unattractive to potential investors. Capital acquisition, in the absence of adequate internal cash generation or investor interest, proved to be quite costly. Many carriers have relied heavily on aircraft leasing, but even this option has narrowed as airlines approach the limits on equipment leasing set forth in loan agreements with secured creditors (16).

It should be noted that not all carriers have fared poorly in a regulated setting. Some operators, like Delta, had thrived under CAB auspices. Neither had all carriers overinvested in new aircraft. Several airlines successfully coordinated aircraft investment decisions with earning potential (16) and, as a result, maintained reasonable debt-equity ratios. Some carriers have always been better managed than others, and it is very likely that differences in carrier performance will be even more pronounced in the deregulated environment. The weaker carriers will be forced to contract their route systems in order to become profitable, while healthier airlines are likely to expand. On balance, the evidence strongly suggests that the deregulated industry should prosper. Although ridership growth will be less than that envisioned under the most optimistic scenarios, it will be greater than it would have been had CAB regulation continued.

The airlines have now elevated economic efficiency to primary importance as an element in the investment decision process. Aviation users have demonstrated that low fares are more important to them than technological virtuosity, and the airlines have indicated that, for the foreseeable future, they will demand maximum economic performance as opposed to maximum operating performance from new aircraft. The manufacturers have responded to this change in emphasis. The latest models tend to concentrate on more economical operation, improved energy efficiency, and reduced noise levels. New short-takeoff-and-landing aircraft, especially designed for feeder markets, displays much-improved operating economies over earlier models. It now appears that the next generation of aircraft will be more efficient versions of existing models as opposed to the more dramatic changes of the past. Such important innovations as double-decking jumbo jets will permit greatly increased capacity, but, in the main, such improvements will generally involve evolutionary rather than revolutionary technological changes.

Although deregulation is expected to act as a stimulus offsetting the negative effects of lower rates of economic growth, no similar counterbalance exists for general aviation. However, the Federal Aviation Administration (FAA) has estimated that, even under a slow economic growth scenario (3.1 percent annually), hours flown by general aviation aircraft will increase nearly 50 percent to 57.4 million by 1989 (17). Another projection forecasts a slow-growth increase of nearly 300 percent through the year 2000. There are several reasons why these projections are probably too high. First, the energy problem has grown more severe in recent months, suggesting that future fuel prices will be much above those used in these analyses. Second, the lower real economic growth rates employed in the two general aviation estimates cited here are both greater than the 2.5 percent rate that appears more reasonable. Third, gen-

eral aviation historically has not been charged an amount consistent with the burden it places on airport and airway facilities (18). As full-cost recovery charges are imposed, there will be a slowing in demand. Perhaps the most important influence on the future growth of general aviation activity will come from the move to introduce economic-efficiency criteria in allocating scarce airport space.

The recent surge in air travel demand has exacerbated preexisting terminal airside and landside capacity problems, especially at the largest hub airports. Nonetheless, most capacity problems remain confined to the diurnal and seasonal peak-traffic periods. As an airport becomes increasingly congested, the operating authority must decide whether to add runways or make other capital improvements to expand available capacity. As the competition for available landing slots intensifies, the value of added capacity will increase. However, current airport-pricing techniques do not provide airport planners with useful information on which to base investment decisions, nor do they promote efficient resource allocation. Over time, a somewhat perverse pricing mechanism has developed that fails to optimally perform either the revenue-generation or resource-allocation functions of price.

Major airports derive the greatest share of their revenues from concession rentals rather than landing fees. The concessionaires, in return for the grant of an exclusive franchise to operate at the airport, are required to share their monopoly profits with the airport franchiser. This transfer of the producer's surplus from the concessionaires to the airport merely represents an income transfer and, as such, does not necessarily produce any diminution of the general welfare. What is done with these quasi-rents is another matter. Airports often use concession rental income to hold down the charges to the air carriers and general aviation users of the airport (19). Landing fee charges are typically based on size and weight of aircraft. This presupposes that the primary resource consumed in supplying the service is the runway pavement, or, more precisely, the cost of providing runways to handle aircraft of a certain size. However, although such long-run considerations are important and if the pricing system is to generate information to guide investment decisions, then the prices must also play an allocative role. The resource that must be allocated in the case of airports is the available number of landing slots, and this is time dependent rather than a function of aircraft weight. Weight-based landing fees promote inefficient use of the airport facility by allowing too many flights at peak periods and fail to assign available slots to those users who value them most. As a result, there are more general aviation aircraft in the peak-period queue than optimal because they are charged the lowest landing fee—when they are charged at all. Further, general aviation aircraft impose much higher congestion costs on air carriers than vice versa. Not only are there more passengers on the airline's craft, but also, whenever there are smaller planes in the queue, greater spacing is required to minimize the danger from the wake vortex. However, because air carriers spend a longer time on the runway and apron areas and because of their greater passenger loads, it is not true that there is a one-to-one trade-off in terms of costs and pressures on the airport facilities and on terminal subsystems as general aviation planes are replaced by those of the airlines.

Peak-load pricing, based on marginal congestion costs, is one solution to the resource allocation problem. A recent FAA study showed that the current inadequate pricing system has led to serious overinvestment in airport facilities and significant subsidization of general aviation traffic. The model developed by the FAA indicated that the average general aviation passenger had to value his or her time at $225/h in order to justify being in the queue during peak-travel periods (20). Similar results have been uncovered by others who have investigated the problem (21).

Airports will be able to expand capacity somewhat through introducing the Upgraded Third Generation Air Traffic Control System, but they will face increased pressure to allocate more efficiently ever-scarcer runway space among competing users. Physical expansion of existing facilities and construction of all-new airports are becoming increasingly more expensive options. Opposition from people who live near airports and environmentalists can long delay airport expansion and development projects. The solution will be to get better use from existing facilities through spreading the peak and through diverting general aviation traffic to less crowded (relief) airports.

Some analysts have objected to these solutions because they fear that certain classes of travelers will be squeezed out of hub airports or allowed to arrive only at unfavorable times. Much general aviation traffic at large airports is commuter or connecting commercial traffic. Thus, the short-distance traveler, or one who is connecting with a peak-period flight, might be forced out of the market. Services to small communities might be severely curtailed by the imposition of rational airport-pricing schemes. Conceivably, individual travelers from small communities might place higher value on a peak-hour arrival or departure than individuals from more populous places, but, because they are less numerous, they are unable to bid enough to secure preferred landing slots. Regardless, such reductions in demand might be required. If the benefits from expanding the airport are not large enough to justify the cost, those travelers from smaller communities may find it necessary to take an alternative mode or forego the trip. But, with only minor exceptions, there are no reasons why those who reside in small communities should be subsidized through underpriced airport-landing slots. There are no a priori reasons to place a special burden on urbanites, long-distance travelers, or the public at large to subsidize short-haul travelers or those flying to or from small communities.

The result of peak-load pricing or general aviation diversion strategies will be to make general aviation less attractive. This should retard its growth so that, by the year 2000, hours flown should be approximately 80 million, or roughly twice today's level.

AUTOMOBILES

The automobile will continue to dominate both intercity and urban travel, but, as its comparative advantage erodes in the face of rising gasoline prices and growing concern with its environmental impact, its market share will decline, albeit only slightly.

The trend, mandated by legislation, is toward more fuel-efficient and less-environmentally harmful vehicles. The fuel economy standard for 1985 is about 11 km/L (27.5 miles/gal), and we can safely conclude that the automobile fleet will average at least this standard by the turn of the century. Emission standards for the transport-induced pollutants (hydrocarbons, nitrogen oxides, and carbon monoxide) have also been established, and new automobiles will produce far less pollution per vehicle kilometer of travel than older models. Technological developments in automobile propulsion systems could produce significant changes in motor vehicle fuel use by the year 2000. Gas turbine and Stirling engines can use any fluid fuel that will burn when mixed with air.

Electric-powered and hybrid vehicles are even more flexible with regard to energy sources. The Stirling, gas turbine, electric, and hybrid engines are all cleaner burning than gasoline or diesel engines. The diesel engine, long regarded as a viable solution to the fuel economy problem, produces unacceptably high levels of particulate matter, which may be carcinogenic, and sulphuric emissions. Technical barriers to the introduction of the other engine types must still be overcome before they can be mass produced, but regardless of which engine is eventually adopted, future vehicles will be less energy intensive than today's models. Thus, improved operating efficiency will partially offset the expected increase in fuel prices. If fuel prices increase fourfold and vehicle efficiency doubles, then, even if real income grows by only 2.5 percent [annually], the real operating cost faced by the motorist in the year 2000 will be only 20 percent above current levels. This increase is far too small to induce a major shift in modal [use].

As long as energy to power passenger cars continues to be available, the automobile will be the preferred mode for virtually all local trips and most intercity trips of less than 1600 km (1000 miles). No other mode can match the flexibility, convenience, and privacy of automobile travel. Although special-interest groups may have promoted private automobile travel to the detriment of alternative modes, the automobile has achieved its dominant position because of its superior attributes.

Generally, we assume that the collective welfare derives from the sum of individual well-being. However, whenever externalities are present, allowing individuals to maximize their separate welfares might not optimize the general welfare. It is often alleged that private automobile travel should be restricted because drivers do not pay for all the resources they consume in making their trips. User charges cover only part of the cost of providing the street and highway network. The costs associated with damage to the environment are not borne by those responsible. In addition, the costs of traffic congestion in terms of the delay imposed on other users of the road are not covered by the peak-period traveler. Finally, there are intertemporal costs arising out of our current consumption of finite fossil fuel stocks. Future generations might suffer because we have undervalued these petroleum resources. Therefore, it is clear that we are either consuming too much for the price we pay, or we are not paying enough for the amount we consume. Either consumption should be drastically reduced or higher charges levied. Most estimates assume that we will eschew the former course. The question, of course, is how far we wish to pursue the latter.

For the most part, the key determinants of the volume of highway traffic are the broad socioeconomic and demographic variables rather than vehicle ownership and operating costs. In spite of some recent attempts at urban-center revitalization, it is unlikely that the long-standing preference for home ownership and suburban living will be reversed. Thus, given our projection of population and income and assuming continued urban decentralization, there is a strong basis for forecasting the continued growth of automobile travel. Only an adverse event, such as a permanent oil embargo, would cause an actual reduction in automobile travel. Selective reductions in heavily congested areas through mandatory carpooling or restrictions on downtown parking are possible, of course; but such attempts at altering public behavior in the absence of a national crisis are not apt to be politically feasible.

Nevertheless, there are serious problems associated with continued highway travel growth. Increased fuel economy will reduce the flow of funds from gasoline taxes to state and federal highway authorities. Although significant expansion of the highway network appears unlikely, there is some fear that user fee revenues will prove insufficient to preserve the current highway network. One recent study (5) projected approximately $900 billion (in 1975 dollars) in highway capital needs through the year 2000 to maintain existing levels of service. However, the study indicated that revenues from highway receipts would be far less. Today, approximately two-thirds of all monies spent on highways comes from user charges. An additional 25 percent comes from other taxes and fees (general and property taxes), and the remaining 8 percent is borrowed. Over the forecast period, total revenue available for highways is estimated at $753 billion. Projected user fee receipts are $484 billion but not all of these are available for highway construction. Although federal funds are largely tied to capital expenditures, state revenues are also allocated to maintenance and operations. The report estimated that the states will spend $349 billion on maintenance and operations and an additional $40 billion in interest payments on highway bonds through the year 2000. The remaining $364 billion is far below the amounts necessary to preserve the integrity of the highway system. Further, if highway expenditures were limited to the projected user impost revenues, there would be virtually no money available for highway capital in the late 1990s—not even for routine resurfacing (5).

If there is to be continued automobile travel on the nation's urban and intercity highways, funds must be found to meet capital requirements. Yet, in an era of rising gasoline prices, public authorities are loathe to raise fuel prices still further. Public authorities will have to rely more on appropriations from the general fund and borrowing to meet capital needs. However, the states can also tap another source of revenues that might help them to close the gap, while simultaneously contributing to environmental protection, energy conservation, and efficient resource allocation. These multiple goals could be addressed through greater use of tolls, especially charges that vary with the diurnal volume-capacity ratio. Arguments against toll charges have often focused on the difficulty and inconvenience associated with collection. However, modern vehicle-monitoring techniques can overcome this objection. Further, varying charges by time of day can help spread the peak and obviate the need for at least some urban highway construction.

Increased reliance on economic-efficiency criteria should allow for continued use of the automobile as the primary means of transport for people. The automobile market share of intercity travel will be somewhat less than today's due largely to the even more rapid expansion of air travel.

The automobile will continue to be the most important form of travel in the year 2000 simply because the advantages it has over the alternative modes are highly prized by trip makers. Mere provision of alternative transport, no matter how attractive (within reason), will fail to induce people to abandon their automobiles. Free public transit would hardly affect, and certainly not eliminate, the morning and evening traffic jams in most major cities, nor would free intercity bus service diminish the stream of automobiles entering the national parks each summer. If transport planners want to reduce the amount of automobile travel, then they must consciously implement programs designed to make driving less attractive, severely restrict fuel availability, or ban the automobile outright. The driving public will not make the sacrifice voluntarily.

LOCAL PUBLIC TRANSIT

Local public transit includes commuter railroads, rail rapid transit, transit bus, taxicabs, and streetcars. It includes local nonautomobile travel in both urban and rural places.

Both urban and rural public transport share a recent history of decline in the quantity of services available. Rural places relied heavily on the local operations of intercity buses, but, as the Interstate highway system was completed, bus operators found it more difficult to leave the line-haul facility to serve small communities.

Urban transit systems shrank for many reasons. Rising incomes allowed people to acquire automobiles and decrease their reliance on mass transit. Rising incomes in conjunction with subsidized mortgages and preferred tax treatment of home ownership stimulated private home ownership. As a result, urban populations decentralized, making it difficult for fixed-route or fixed-guideway systems to continue to meet traveler needs. Urban sprawl has even made it harder for buses to operate efficiently. Today, a bus must travel 25 percent further to gain an additional rider than it did in 1960. Furthermore, as decentralization continues, average journeys are becoming longer. More recently, retailing and industry have joined the exodus to the suburbs. Trips are no longer so highly concentrated along arterials leading to the city center. The mononuclear city has given way to one with multiple areal centers.

Between 1945 and 1975, annual transit ridership declined from 30 to 9.6 billion passenger-km (19 to 6 billion passenger miles), in spite of a 50 percent increase in the urban population. Fare increases more than offset the decline in use so that transit revenues rose 57 percent over the same period. However, operating costs more than tripled, and services that could be operated profitably in the 1940s generated large losses by the 1960s.

By 1976, 91 percent of transit service was provided by the public sector. Efforts to hold down fare increases have substantially reduced the contribution of farebox receipts to system costs. During 1967-1976, fares—as a percentage of costs—declined from 96 percent to 54 percent. The failure to raise fares to match cost increases is due to the desire to serve the needs of those who must rely on transit and, except for a few major cities with highly developed networks, most transit systems are patronized almost entirely by captive users (5).

Recently, steps have been taken to revitalize public transportation in both rural and urban areas. It is still too early to gauge the ultimate impact of these attempts, but up to now these programs have succeeded only in arresting, rather than reversing, the long-term contraction in transit ridership. Nonetheless, there are several discernible trends that indicate that transit should at least preserve its market share through the year 2000 in spite of continued suburbanization and increased affluence. First, reduced family size and rising housing prices may decelerate the tendency toward urban sprawl Low-density detached housing patterns may begin to give way to higher-density, condominium-style home ownership. Further, the infusion of federal funds to aid and promote mass transit is a relatively recent phenomenon. Finally, new technologies, such as automated guideway systems and people movers, offer the promise of eventually making an important contribution to solving many urban transport mobility problems.

The resurgent interest in mass transit is nowhere more evident than in the recent introduction of new rail systems in San Francisco and Washington, D.C. Similar, although smaller, systems are being planned for several other medium-sized cities. Unfortunately, the evidence from the San Francisco experience is not favorable for further development of rail rapid transit. That system appears to be proving what many who oppose such capital-intensive approaches have long argued—that is, rail rapid transit is an appropriate solution only in areas where there are very high corridor volumes (such as in New York City) or where the basic infrastructure is already in place (22). New systems are likely to incur huge operating deficits for the amount of service provided. Further, at least part of new rail-system ridership will come from buses and part will be induced, thereby compromising the system's intended congestion-alleviation benefits.

Changing patterns of trip making require more flexible solutions. Trips between low-density suburban areas cannot be satisfactorily served by fixed-guideway or fixed-route systems. New systems must be more demand responsive and must be capable of increased flexibility to meet changing traffic flows.

Although many forecasts project that rapid rail systems will increase their share of total transit ridership, this result would run counter to our assumption that solutions will become more economically efficient. The negative experience with the San Francisco Bay Area Rapid Transit system should cause cities contemplating a similar system to rethink their transport needs. On the other hand, greater reliance on jitney-type services, especially in rural and small communities, should afford more economical service than full-sized buses. In urban areas, bus transit can be made more competitive through operational strategies that promote bus use, such as reserving exclusive bus lanes during peak travel hours.

Urban public transport should be market oriented and cost-effective. This opts for flexible demand-responsive systems rather than more technically exotic modes. Finally, the transit system should not be operated as a mechanism to redistribute income. The fares charged should reflect the cost of service provision, less any identifiable external benefits from fares below full cost. The needs of the poor can be better met through adequate welfare payments or by issuance of transit stamps, rather than by subsidizing the entire transit system.

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Future of Statewide Transportation Planning: What Can the Professionals Deliver?

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The fact that the committee planning this conference expressed concern with the role of the professional in statewide transportation planning and programming is indicative of a significant problem. As transportation professionals we have an image of what "transportation planning" should be about. This image is one acquired through the evolution of statewide transportation planning from its roots in urban transportation planning over the last 20 years.

In today's world, issues at the statewide level in transportation are increasingly complex and are presenting unique problems and challenges to the profession. Confronted with these issues, our old model of how statewide transportation planning should be done is brought seriously into question. Indeed, many of us are asking, What should our role be today and what can we as professionals deliver at the statewide level?

Although the challenge facing the profession and this conference is substantial, we believe that the roles and potential for transportation professionals in dealing with state-level issues and problems are more exciting today than ever before. These roles call for strengths and skills that are more diverse, more difficult, more challenging, and, ultimately, substantially more rewarding than those we have played in the past.

This paper, first, describes the nature of statewide transportation planning as we see it today and the challenge posed for planning professionals. Second, the paper examines the nature of possible professional roles in this activity and, finally, looks at the challenge we face as individuals and organizations in looking to the future.

STATE-LEVEL TRANSPORTATION PLANNING TODAY

As numerous recent studies have documented (1), there are many issues facing state transportation decision makers and agencies. Some of these issues are briefly described here:

1. Implications and changes in rail systems and service, including not only the historical evolution of rail passenger service abandonment, but also changes in branch-line and main-line freight service;
2. Potential implications of deregulation for both rail and trucking;
3. Increasing difficulty of financing adequate highway maintenance and surface and structural renewal, while also providing for some modest expansion of highway systems (similarly, bridge replacement and Interstate rehabilitation needs may curtail any substantial improvements on the rest of the system);
4. Implications of the changing nature of air transportation for state service to major and minor activity centers;
5. Implications of the continuing energy crisis for short-range contingency planning and for long-range strategic planning, including the implications of fuel efficiency standards or long-term motor vehicle tax revenues;
6. Changing nature of the U.S. economy and of society's concerns for the environment and for development as these impact on the magnitude, nature, and location of economic growth and development; and
7. Continually evolving nature of institutional and organizational relations at the state and substate levels, including the role of the state in financing and promoting urban area transit options, transportation system management options, and intercity transit.

To address these issues and make difficult policy choices, decision makers require a range of information and analysis which is organized in a manner that highlights the implications of different policy directions. These information requirements (2) generally include the need for the following processes.

1. A wide range of options, including not only traditional investment in infrastructure (highways, transit facilities, airports, and so forth) and maintenance, but also a wide variety of service strategies (routes and schedules for rail and air service, whether service is offered at all by some modes and particular markets) and pricing decisions, as well as organizational, institutional, and regulatory options should be available. In addition, transportation and nontransportation measures designed to minimize or avoid adverse social, economic, or environmental effects must be given due consideration.
2. Impacts on a wide range of interests must be evaluated. These include the direct costs and revenues incurred by both passenger and freight users and by operators, including private companies and public entities; concerns for mobility for a wide variety of potential user groups such as the elderly, the handicapped, the low-income, the non-car-owner, and other groups; and implications for urban and rural development, employment, preservation of open space and recreational areas, and such environmental effects as air quality, water quality, noise, disruption of neighborhoods, and energy consumption.
3. A commitment to an open planning process at each level of government in which multiple-interest groups, both public and private, and multiple agencies provide input throughout the decision-making process concerning transportation actions. These actions may be major infrastructure changes, short-range policy-oriented actions, energy contingency plans, branch-line abandonments, or pricing policies.
4. Explicit recognition of the uncertainties that are inevitable in state-level transportation decisions. Realistic acceptance of uncertainty implies that any major decisions will need to be implemented in stages. The only firm decision is one from which implementation can begin immediately; everything else is always tentative and may be revised substantially as the issues change in future years.

In thinking about the requirements of state-level transportation decision making today, we can compare them to an image of transportation planning that has its roots in urban area transportation planning.

In the classical period of urban transportation planning, generally throughout the decade of the 1960s, the dominant image was characterized by the terms "coordinated" and "comprehensive" (3, 4). In this era, the primary transportation planning activity revolved around the development and the analysis of alternative comprehensive schemes for land use and transportation for a time horizon of 20-30 years in the future. In this environment, although analysts did spend some time developing alternatives and predicting their effects, the vast majority of planning activities was dominated by the management of large-scale data-collection efforts and the development of large-scale and complicated models to be used for predicting the effects of various strategies.

This period was one in which there was a highly technocratic overtone to the nature of transportation planning activity. That is, planners were almost wholly oriented toward the abstract intellectual activity of developing and using large-scale models and related technical apparatus (for example, cost-benefit analysis). The predominant style of analysis carried with it an image of attempting to do a relatively objective and value-neutral assessment of the likely effects of alternative courses of action by using sophisticated technical methods. The implication was that transportation planning should be somewhat aloof from the political process, should be removed from the value issues of conflicting goals and objectives, and should stand apart from the emotionally expressed needs and desires of various interest groups.

Thus, transportation planners attempted to operate as objective professionals, that is, proceeding deliberately and supposedly unemotionally and objectively through the steps of a highly refined technical process that was widely accepted (at least among professionals). In this activity, the systems and models represented high standards of technical excellence, and the role of judgment—especially value judgment—in planning was minimized, at least in the rhetoric of planning. In short, the planner strove to be viewed as a technical expert. His or her major political role was to appear at meetings or public hearings as an expert who could talk in a neutral way about the likely effects of alternatives, and the reasons why a particular plan, evaluated in a value-neutral manner, appeared to be best for society as a whole.

Well, we all know what happened to this image in urban transportation planning. The freeway revolt of the 1960s, the environmental movement, fiscal restraints, all of the ramifications of recent federal and state legislation and policy changes, and changes in the nature of issues considered important by elected officials and the public have all significantly changed the nature of urban transportation planning. The same changes can be observed at the statewide level.

In the early periods of statewide planning, most professional activity revolved around trying to mimic the urban transportation process. Most planners involved with statewide transportation issues were primarily concerned with establishing formal procedures for predicting the effects of transportation plans and for programming investments in transportation systems. Substantial efforts have been devoted to trying to identify data-collection needs and to collect data in order to develop statewide systems of transportation planning models for use in predicting future demands for travel at the state level as well as related economic and other effects.

Furthermore, some substantial effort has been devoted to developing formal decision procedures for deciding on the desirable mix of capital projects from a statewide programming perspective. Similar to the situation at the urban transportation planning level, this technology transfer of the planning "image" has been seriously called into question in recent years.

The challenge is reflected in the changing context of state-level transportation described earlier. Today, long-range comprehensive planning at the state and urban levels is an image that is central to the redefinition of the planner's role; the real issue is not attempting to be comprehensive and to settle for all time a long-range plan for the region as a whole, but to respond to a variety of issues facing state transportation decision makers by providing professional insights into both the long-term and the short-term consequences of decisions. In short, there are multiple issues, oriented around different bundles of options, impacts, and interest groups, which must be addressed at the state level. There is a need for a variety of analysis styles, ranging from quick-response policy analysis within a few days or a few weeks, to midterm technical studies of three or six person-month efforts, to multiple-person-year in-depth planning and analysis activity.

Correspondingly, there is a need for a variety of analysis capabilities, including not only the traditional long-range comprehensive models, but also simplified procedures that can focus on specific near-term policy questions, including not only simplified computer models, but pocket calculator, manual worksheet, and judgmental methodologies as well. There must be a recognition that there will always be a wide variety of types of data relevant to a decision. Data will be located in various public agencies and private firms, and assembling these data will always be a major task. However, it should not dominate the analysis required.

Finally, there is a need for a variety of products from the planning process that reflect the variation in issues, analysis styles, and analysis methods. Although there will continue to be a role for detailed and comprehensive technical documentation, results of the planning process will have to be communicated by brief issue-and-decision memoranda and the budget and program implications of planning analysis will have to be explicitly explored.

To be effective in today's environment, statewide transportation planning must reflect the facts that (a) comprehensiveness is infeasible, (b) long-range planning often is unrealistic, (c) large data-collection activities and model development efforts will be relevant only to a small portion of the issues, and (d) the professional style of the past—analysis oriented, aloof from the complexity of the organization and political environment, technically objective and value neutral—will not be an effective role. Rather, today's environment calls for a new kind of professional role. Instead of seeing ourselves as statewide transportation planners who are aloof and concerned only with treating long-range issues comprehensively, we should look to becoming problem solvers and issues analysts. This may appear to be merely a semantic change, but the point is that we must challenge traditional planning roles and methods to continue to be effective at the state level.

IS THERE A PROFESSIONAL ROLE IN ALL OF THIS?

A New Role

In our view, there is a rich and exciting challenge in what transportation professionals can do in the changing environment at the state level. In fact, many are already creating and accepting new roles. The key issue is, Are the challenges, responsibilities, and opportunities of the new roles recognized as being legitimate? For example, are we comfortable with these activities? Are we trying to get other members of our organization to accept and to excel in them? Are we training our junior colleagues who are entering our organizations or attending professional schools in these activities?

The role we are suggesting for state-level transportation planning in today's environment is to provide timely information for the decision-making process. Although decisions in some cases will be made about comprehensive strategies and long-range policy directions, more often decisions will focus on one or more well-defined issues. In some instances, one to two years may be available for response, but more often one to two weeks or months will be available for analysis. However, regardless of the scope and time frame of decisions, the basic format of the information required by decision makers is based on

1. The major alternatives open to them,
2. The major advantages and disadvantages of each alternative—with particular attention to the incidences of gains and losses, and
3. The viewpoints of all who are significantly interested in or affected by the decision.

This format applies whether we are talking about a statewide airport plan, decisions on state financial components of a rail system plan, or operating strategies for rural public transit for the next year. Only if these conditions are met can decision makers act with reasonable confidence that their decisions can be implemented. Furthermore, while we want to provide a basis of technical analysis that is useful to decision makers, they will make decisions whether or not the analysis results have been produced in a timely and relevant fashion. In other words, the environment of state-level transportation today requires that planners and analysts must operate as staff to decision makers and provide both formal and informal information to support decisions.

Various terms have been used to describe the kinds of activities in which various technical staff must participate—catalyst, coordinator, entrepreneur, for example. These terms all suggest styles of work that involve substantial interaction with individuals and interest groups, along with traditional technical analysis. Thus, in state-level transportation, planners and analysts need not only to operate from bases of technical information and to perform analyses of alternatives and their consequences that are useful to decision makers and the public, but also to interact with a wide variety of public and private individuals and organizations.

To see the implications of this situation for state-level transportation professionals, some specific topics (e.g., analysis methods, planning products, and participation) are examined here.

Analysis Methods

Does the image of planning we are posing mean that data collection, model development, and the use of models to analyze the consequences of alternatives should be abandoned? Our answer to this, of course, is no. Instead, there are a number of analysis methods that are potentially useful in different situations. Historically, lip service has been given to this premise through the notion of sketch-planning methods. However, little real effort has been devoted to seriously developing a variety of simplified, relevant, yet valid, analysis methods for use in a variety of different situations at the statewide level.

What is needed are analysis techniques with different data and time requirements for application and with different degrees of comprehensiveness in the scale of analysis, from a focus on a specific issue or strategy to a focus on more comprehensive regional or statewide issues.

For travel demand, for example, a variety of potential approaches have already been developed, largely at the urban level, but some at the statewide level as well. Recent innovations have assisted in stimulating the development of a variety of styles in which such methods are used for forecasting. Such styles can include the use of simple elasticities and nomographs, the transfer of policy results from other areas, quick manual calculations with structured worksheets, pocket-calculator-assisted methods, and special-purpose models in standard computer environments, as well as large-scale major model systems (5-13).

The implication is that, as a practical priority, there needs to be ongoing development of planning and analysis methods in each state organization and on a national level to produce a variety of analysis techniques and to continually update and revise those techniques as new transportation issues and problem situations arise. Professional staff in state and other agencies should be comfortable with a wide variety of analysis styles and should be comfortable with reasoning through what is the appropriate technique for a particular policy or planning issue and a particular set of time and resource constraints.

In other words, we should all be comfortable with the idea that state-level transportation analysis does not require a comprehensive statewide multimodal model. Rather, it is an appropriate professional activity with which to make a quick assessment of policy consequences by using judgments about elasticities. This approach is just as legitimate as the use of computer models or pocket calculators. In addition, although we have used the travel demand area to illustrate the need for, and increasing availability of, a range of analysis styles and methods, the same message is appropriate for all areas in which technical analysis and judgments are required. A recent report of the National Cooperative Highway Research Program surveyed statewide analysis techniques available in these areas (1): environmental, social, economic, travel, development, legal, administrative, institutional, financial, and plan and program evaluation. In each case, a variety of analysis approaches are available and others are under development.

Products of Planning

Another way of understanding the new style of professional work required is to examine the notion of what the products of planning should be. Historically, from the heritage of comprehensive urban planning, the key product of statewide planning was visualized as a comprehensive statewide long-range plan, predominantly for the construction of fixed facilities such as highways or airports. The target date was 25-30 years in the future. An alternative image is indicated in the concept of a multiyear program plan. As illustrated in Figure 1, a multiyear plan contains actions staged over several periods into the future, beginning with near-term immediately implementable actions in the first year or period of the plan, additional actions tentatively planned for implementation in the short-range period (years 2-5), the midrange (years 5-15), and the long range (beyond year 15). The plan also contains actions consisting of studies, such as planning, design, data-collection or research activities, and changes in infrastructure through construction of new facilities or improvements of existing facilities, and a wide range of operating, policy, and pricing alternative actions.

Such a multiyear program plan would be updated annually or biennially, and the periodic updating process would move some projects scheduled for future years into the current year's implementable program. (Those familiar with current U.S. Department of Transportation urban transportation planning regulations will recognize that the transportation improvement program corresponds to that portion of the multiyear program plan dealing with years 1-5 and containing primarily the capital projects. The annual element of the transportation improvement plan is the first year of the multiyear program plan.)

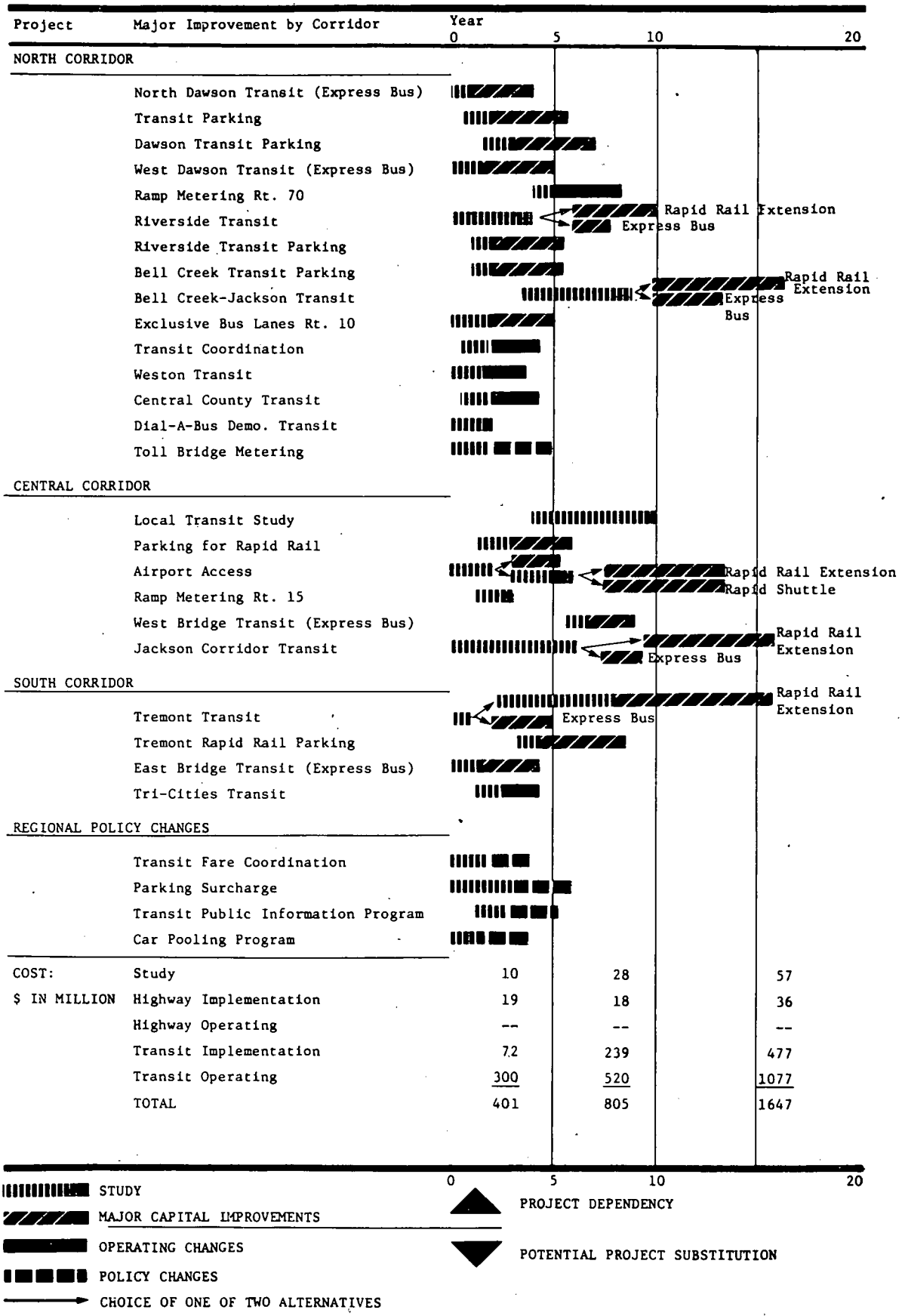
Thus, according to this concept, the primary product of the planning activity is reflected in the decisions that culminate in an annual cycle of updating and advancing the multiyear program plan. A wide variety of planning and analysis activities are required to accomplish this. In addition to such traditional planning activities as analyses of alternative long-range future systems, other planning studies can look at interim or short-range changes to existing systems. Other analyses can look at the potential implications of changes in pricing policies, regulation, or institutional arrangements. Still other planning activities can involve the design and implementation of data-collection activities. Alternatively, the planning activity could have as its focus the obtaining of an agreement among several private shippers or carriers to produce certain data in future years on a coordinated basis.

Thus, the multiyear program plan provides a concept for structuring a process of planning at the state level that involves a variety of professional activities. Many of these activities can take place primarily in state-level transportation organizations. Others can be cooperative activities involving state, metropolitan, rural regional agencies, and private carriers or shippers. Each activity can be organized and structured to produce appropriate outputs at some point in time for input to the decision process of updating and adopting an annual multiyear program plan.

The concept of a plan program document as a key product is not to suggest that we do away with long-range systems planning. Rather, we simply want to suggest that often the important information we as planners can bring to the decision-making process is the long-range implications of near-term budget and program decisions. By tying longer-range plans to near-term proposals via a program plan format, (a) long-range analyses can be more influential and (b) the need to focus analyses on a variety of issues will be more apparent.

We also do not mean to suggest that all planning activities and resources should be oriented toward the production of one product, whether long-range master plan or multiyear program plan. Many decisions will not wait for a regularly scheduled annual or periodic plan update cycle to be completed. In short, various forms of decision memoranda, issue papers, and so

Figure 1. Program plan concept.



forth, will have to become routine products of the planning process for our analyses to really be useful on an ongoing basis. Again, the message is that we must be flexible and respond to the information needs of decision makers at different levels in an organization. While we cannot simply become fire fighters for top management, neither can we afford to see well-intentioned and, by and large, high-quality, comprehensive studies and plans relegated to library shelves.

Participation

Another important area is that of participation. The image of participation from the early days of highway and urban transportation planning is that public involvement is a response to citizen opposition, and participation activities are primarily targeted toward neighborhoods within communities that are most likely to be affected. Environmentalists and other nonestablishment groups are also affected. Implicit in this orientation was the idea that we were trying primarily to respond to concerns raised by potentially opposing groups. Today, of course, in both statewide and metropolitan planning, the appropriate image of participation should be a much more balanced one.

At the statewide level, participants in the planning process include a wide variety of interests with various concerns, including industry, shippers, carriers, labor, environmentalists, growth as well as no-growth advocates, and so forth. There needs to be a carefully designed variety of participatory mechanisms to involve the appropriate affected interest groups constructively in each of the issues that concern them. This requires that participation of interest groups be viewed in a positive catalytic role as an asset and as support to various kinds of planning activities, rather than simply as a potential opponent. Of course, each type of planning activity, described earlier in this paper, will have a correspondingly appropriate constituency and mechansims for involvement of affected interests. Involvement of affected interests should be seen as assisting problem solving. For example, in adjusting to rail abandonments and trying to find reasonably equitable strategies to replace the discontinued rail service, or to provide substitute jobs or industrial locations for those who are affected, various task forces could be created to provide a positive alternative rather than simply opposing any route rationalization. Although we can anticipate that there will still be confrontations from time to time, we should look for more opportunities to develop constructive partnerships with the various groups and interests involved in state-level transportation issues.

CONFERENCE CHALLENGE

A number of fruitful issues have already been articulated by the planners of this conference in designing the two sets of workshops and the specific transportation and implementation issues to be addressed by these workshops. Basically, our discussion boils down to a simple line of reasoning. In the past, we had a relatively simple image of state transportation planning. Our agencies, usually highway agencies, had essentially a single product—the design, construction, and maintenance of highways. To implement this product, they evolved over many years a well-defined and well-organized production process, in which there was a sequential flow from adoption of a statewide freeway or expressway system plan to corridor and route planning, facility design, production of plans, specifications and estimates, right-of-way acquisition, and construction. In this process, there were well-defined professional roles and required skills, largely of a quantitative engineering nature together with closely related technical skills. Furthermore, the organizational structure of most state highway and transportation agencies was designed to implement this sequential production process in a very efficient way.

What we need to have today is a broad view of the nature of state-level transportation planning. A wide variety of potential roles and functions to be accomplished exists. We should ask ourselves (a) What are some of the specific functions and activities to be accomplished? (b) What organizational restructurings within an agency might be desirable for the organization to function more effectively in this new more varied environment? and (c) What do we need to do to enable our transportation personnel in a statewide organization to be more comfortable with and more equipped for roles in this new agency environment.

We still have largely the same personnel base and the same organizational structures that we inherited from our earlier and simpler period. Our personnel are good; they are highly qualified, but they do vary in their capabilities to adapt to new roles and new challenges. We need to think very carefully about what staff development is necessary or desirable to help our personnel equip themselves to perform a wider and richer variety of professional tasks than those they were originally trained or asked to perform.

Therefore, the real challenge at this conference is to ask (a) what kinds of planning activities should be undertaken across the broad spectrum outlined here, (b) what kinds of alternative organizational structures might be appropriate, and, most important, (c) how can we help the personnel we now have in our agencies to move into more satisfying roles, acquire new skills, enhance old skills, and develop a new entrepreneurial-coordinator-catalyst-communicator style of transportation planning at the state level? Our profession has evolved dramatically over 20 years and will evolve even more dramatically over the next 20. We look forward to your response to our ideas.

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Part Four

Workshop Reports

Series 1 Workshops: Influences on a State Transportation System

The eight Series 1 workshops dealt with issues and products related to comprehensive and effective statewide transportation planning and programming. The workshops examined a variety of external factors influencing state transportation systems.

Each workshop considered topics such as the adequacy of current planning techniques, significant issues to be faced now and in the future by transportation planners, problems associated with the implementation of transportation planning and programming, research and data needs, and the relation between plans for individual modes and those for multimodal systems. The summaries and comments that follow reflect not only the wide-ranging views of participants in the discussions, but also the collective experience of state departments of transportation in a given topic area.

State Highway Planning

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SUMMARY

Several facts permeated the discussions of the state highway planning workshop: (a) the maturity of most state highway systems, (b) the maturity of highway planning practice, (c) the significant declines in 1974 real-dollar financial sources, and (d) ongoing disinvestments of existing highway plants exemplified by deteriorating physical highway conditions. These facts emphasized the need for highway and transportation departments to regard themselves more and more as managers and operators of a highway system rather than primarily as builders of a highway system.

Participants identified the following issues as the most important for consideration today and over the next decade:

1. Awareness of financial constraints, planning, and programming;
2. Need for a broader approach to highway planning that incorporates the ability to deal with external issues such as regulation, deregulation, energy, and financial constraints;
3. Credibility of the highway planning program with the administration, with the legislature, and with the general public (projects must provide demonstrable benefits);
4. Better procedures for measuring and determining pavement life, bridge life, and the impacts of heavier truck movements on highway pavement;
5. Long lead times required to implement programs during which changes in community values and conditions may stop projects that, with shorter lead times, could have been implemented; and
6. Need for a better understanding of how individuals make modal choices and, further, how modal trade-offs are made in freight movement.

COMMENT

Highway Planning Issues

Highway planners are becoming increasingly aware of the need to take a broad approach to highway planning. This approach should deal with external issues related to the highway system such as regulation or deregulation of trucking and railroad freight movements. In the past, most highway planning activities dealt with a narrow range of issue-oriented problems such as the investment needs required to keep a highway system operating efficiently. Planners, now, should be asked also to provide answers to a broad range of policy questions: How does the energy shortage impact on highway demand and what are the trade-offs among air quality, energy use, and land use?

The highway planning process is not new. The current practice is well developed and encompasses such activities as the following:

1. Evaluation of highway system performance from the user, community, state, and national perspectives;
2. Identification of options for efficient system operation and investment strategies for capital and operating programs;
3. Measurement of investment impacts against public-interest objectives and performance standards; and
4. Development of investment and policy programs that consider operational efficiency and effectiveness but minimize societal and user costs.

The focus for the future transportation planning effort

is twofold. First, the credibility of the planning products must be assured; and, second, the response to investment issues must be improved.

Mechanisms for improving the credibility of planning products are based on the following:

1. The system planning process must consider the current financial constraints that are prevalent throughout the country and must avoid developing plans and programs that ignore fiscal reality;
2. The spectrum of interested parties must be tapped and coordinated to ensure improved communications and understanding of the contents and constraints of plans and programs; and
3. Legislators and policy decision makers must be provided timely, accurate, and concise information concerning highway plans and programs.

The planning response to several key investment issues must also be improved. These include (a) developing methods to identify investment trade-offs between capital improvements and system operation improvements, (b) identifying projects that would have the most effective safety benefits, and (c) improving the procedures to measure the impacts of heavier truck movement on highway structures and pavements.

Highway Planning Techniques

Like the highway planning process, the methodology and techniques associated with the process are well developed. However, many of the processes are time consuming and complex and do not lend themselves to a quick response to many of the highway policy issues that emerge on a day-to-day basis. Efforts to find and improve quick-response planning techniques should be undertaken.

In order to be responsive to the broad nature of current planning questions, there is a great need for information exchange among highway planners and programmers. It is particularly important to exchange information on methodology and planning techniques.

The workshop participants identified a need for improved planning techniques in the following areas:

1. Procedures to determine highway pavement life and highway structure life (these measurement procedures also imply the necessity to develop better estimates of truck traffic volumes as well as truck weight);
2. Procedures to estimate commodity flow, as well as to improve commodity-flow data-collection methods; and
3. Procedures for planners to better understand how individuals decide which mode to use in their daily trip-making activities (the same is true for freight movement analysis).

Additional Data and Information Requirements

Because the highway planning process is a well-developed one, the workshop participants believe that the data-collection procedures for many of the ongoing planning activities are adequate. Unfortunately, some of the procedures result in a large use of manpower and, therefore, are very costly. Thus, it is important to make better use of existing data sources and to develop short-cut methodologies.

The scope of future data-collection activities will change because of the nature of responses to policy issues. In the future there will probably be fewer and less comprehensive data-collection efforts and more small-scale ad hoc efforts. Therefore, the ad hoc efforts will make greater use of the existing data sources as well as require more narrowly focused collection efforts.

There is also a need to consolidate and to coordinate the data requests from various governmental levels. In particular, the federal-level request for data collection is ongoing and considerable. Greater emphasis should be given to advance the coordination of data-collection requests, to avoid duplication of requests, and to consolidate data types. For example, different agencies should use the same definition of urbanized area.

These areas require additional data and information.

1. Even though Project 8-17 of the National Cooperative Highway Research Program describes freight data needs and availability, more information is needed on commodity flow. This is necessary in order for state and local governments to analyze the trade-offs among freight modes.
2. The impact of the energy crisis and a changing life-style will require more information on individual travel behavior. Unfortunately, the traditional origin-and-destination surveys are time consuming and costly. It is hoped that more efficient techniques can be developed to adequately predict travel behavior.
3. Personnel responsible for statewide system planning are usually unfamiliar with the scope of private-sector transport operations. There is a real need for additional information on the operational characteristics of private carriers. Those characteristics should include cost of operation, sensitivity to time, packaging, and truck weight characteristics.

Because each facet of the planning and programming process has its own unique need for data and information, the members of this workshop recognized that the identification of the limited numbers and types of additional data needed probably do not reflect many other specialty data needs.

Planning Research Needs

Workshop participants reviewed the important issues that would be facing the highway planners over the next 10 years. Based on that review, several research needs were identified.

1. Improved methods must be developed to predict the structural performance of pavements and bridges. Current methods evaluate the existing condition of pavements and structural members. However, there is very little research into predictive measurements of future structure performance for both pavements and bridges. For longer-range highway planning investments in particular, planners and programmers would like to know when actual replacement would be necessary. Can the improvement be postponed, for example, one, three, or five years?
2. Highway improvements are being made not only to improve current performance of the system but also to induce increased economic activity in the area. Methods are needed for predicting the economic impacts of various types and levels of investments.
3. At a time when there is increased emphasis on energy conservation and transportation safety, relations of those items to current design practice should be quantified, especially in light of new trends in vehicle design. What is the relation between fuel efficiency and highway geometric design?

It is important in the highway planning and programming process to establish the need for improvement and

priorities for those improvements. Because the current methods of establishing and measuring highway system performance require extensive data-collection activities, more data-efficient procedures are necessary.

In addition to investment-related research needs, certain management functions can be improved through research investigation. For example, the identification of an appropriate level of effort for various statewide planning activities is necessary. Also, effective institutional and organizational relations should be identified between various levels of governmental and private agencies.

Interrelations of the Highway Mode with Other Modes

The process of making intermodal investment trade-offs is difficult at best. However there are several obvious interrelations among the modes. In particular, improved planning for intermodal transfers at terminal facilities is necessary. The coordinated planning of transportation centers to include rail passenger, intercity bus, and urban transportation has become increasingly important. Similar planning for commodity interchange is also important.

In most high-density intercity corridors several passenger modes provide service. There are important interrelations among the modes in those corridors, and highway planners must understand the trade-offs among modes in order to coordinate highway investments with aviation, intercity bus, and National Railroad Passenger Corporation (Amtrak) investments.

Highway planning and other forms of modal planning can be improved by a higher degree of coordination among the modes at the various governmental levels. Many agencies tend to work in a vacuum and do not discuss plans with other modal agencies or with private providers of transportation. For example, the emerging issue of rail branchline abandonment is not a single-mode issue. The impact of a branchline abandonment on highways must be studied carefully in order to determine the most cost-effective approach to the issue.

Implementation Problems

The implementation of plans and programs for all modes is difficult. The time involved in the planning and programming phases is getting longer and longer. Also, the necessity for a broader look into the socioeconomic and environmental impacts of transportation investment requires a much more thorough study process to implement any project.

The workshop participants identified a series of problems associated with the implementation process. Most apply to nonhighway transportation investments as well as highway investments.

1. Because of the long lead time necessary to implement any project, the affected community may experience a change in its values, which in turn changes the scope of the project.
2. Because of the long lead time, the political structure in affected communities may change. It may be necessary to have the political structure reaffirm or alter past plans and programs.
3. Plans and programs must be fiscally realistic in order for those plans and programs to reach the implementation stage. Without the inclusion of fiscal reality in plans and programs, a pie-in-the-sky attitude will prevail. This will also impact the credibility of the process.
4. Because of long lead times required for project implementation, there are continuous changes in land use within a given area or corridor. Those changes may well dictate that the project scope and direction be changed, which further lengthens an implementation process.
5. There is a problem associated with many of the categorical and special programs that come from the U.S. Congress and from state legislatures. Such short-term special programs disrupt the normal planning and programming process and tend to delay previously established schedules.

Rail Freight Planning

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SUMMARY

The primary planning concern of a state—the first issue addressed by workshop participants—should center on problem solving, special issues, and such subjects as light-density lines. The state should not assume the responsibility for planning the entire system. However, the state must understand the economic impacts of changes in the rail industry structure and regulation, especially because of its concern with maintaining a healthy and competitive economic environment.

A second major issue was regulation and deregulation, which will have major effects on how states handle freight planning and related policies. Because states have been modally oriented, they do not have clear understandings of the implications of regulation and deregulation; therefore, they do not know how to deal with the shifts from one freight mode to another that are caused by regulatory changes. The workshop concluded that

1. Freight shippers and receivers, railroads, and state government representatives should participate in the rail planning process;
2. Data needs must be defined very precisely, their costs estimated, and confidentiality of data assured before data are collected or obtained from private sources; and
3. Institutional constraints to implementation are real and include legal and constitutional prohibitions—for example, limitations of staff resources and expertise, labor practices, and difficulty in obtaining consensus among different groups.

Research needs were identified as those that relate primarily to the diversion of traffic from rail to truck and the impact of regulatory and other policy changes on modal splits.

COMMENT

The participants in the rail freight planning workshop

identified a number of problems and issues. First, in considering the appropriate and legitimate role of the state, if any, in rail freight planning, several factors must be considered. States must consider the financial impacts of changes in rail industry structure, whether instigated by the carrier (e.g., abandonment and merger) or by public policy (e.g., federal or state legislation, Interstate Commerce Commission procedures, and governmental policy). The primary planning concern of the states should focus on problem solving and special issues. States should not assume planning responsibilities on a systemwide basis or for corporate strategic planning. States should assume responsibility for subsidy operations, abandonments, and alternatives to subsidized operations (e.g., intermodal facilities and consolidated terminals). Further, states should be concerned with broad economic impacts and opportunities associated with changes in rail structure, regulation, and deregulation.

Second, regulation and deregulation will have major effects on how states handle freight planning and related policies. States do not have a clear understanding of these implications, nor do they have technical capabilities to define the issues or analyze and prepare contingency plans. States need input to deregulation policies and legislation from the outset. Because states are modally oriented, their ability to deal with the multimodal environment of deregulation is inhibited.

Third, will states be involved in rail freight planning in the long term? At the moment, the rail industry prefers minimal or single-issue state activity. The states favor permanent organization and capability.

Fourth, the rail industry's primary planning concern is financial profitability. The lack of earnings, capital shortfall, and investment result in no innovation, deteriorating service, and shipper dissatisfaction. States must recognize industry objectives and problems in the state planning process.

Finally, regulation is the primary problem affecting the rail industry.

Planning Techniques

Freight planning data needs must be defined clearly. Planners should avoid trying to assemble too much data, should consider the availability and cost of retrieval, and should have the methodology and means to use necessary data.

Freight planning methodology should incorporate opportunities for participation by shippers. They are the primary constituency group affected by rail freight planning and subsequent actions.

Impact analysis techniques (cost-benefit ratios, input-output studies, and demand models, for example) must consider planning goals and purposes. Cost-benefit analysis should not be the sole evaluation criterion used for rail project feasibility or for efficiency of operations. There has been too much abuse and misuse of single-criterion methods. Qualitative, social, and other nonquantitative factors need to be considered. However, a correct, consistent, and reproducible measure should be employed to determine who gains and who loses.

Comprehensive planning frameworks are necessary for proper and accurate single-mode planning. Impacts and trade-offs can only be assessed in the larger context of statewide transportation planning, economic, land use, and environmental relations.

Implementation Problems

In dealing with implementation problems, the workshop participants suggested some areas that merit increased attention.

1. Specific projects must be identified for inclusion in an annual budget or program.
2. Funding sources must be adequate and assured.
3. Institutional constraints are often impediments to implementation of plans, programs, and projects—for example, legal and constitutional prohibitions, staff limitations, jurisdictional authorities, labor practices and protective requirements, and difficulty in getting consensus on objectives.
4. Flagouts by rail carriers must be fully assessed by state rail planners for possible changes in routings.

Information, Data, and Research Needs

Planners at all levels require certain amounts and types of information. This workshop section identified a variety of information, data, and research needs to assist in effective planning and programming. They include the following:

1. Data needs should be defined precisely. Planners should use existing sources and should develop mechanisms to share data among users. Although a census of county business was identified as a readily available source for freight planning purposes, U.S. census data were deemed worthless for freight planning on a statewide level.
2. Shipper sources of data should be used more extensively. Again, such data must be defined precisely and new collection efforts should be avoided unless absolutely necessary.
3. Confidentiality of data must be protected and ensured. Carriers would rather have a defined and consistent data package to provide states. Special requests are often difficult to handle.
4. The impact on highway systems of rail diversion to truck should be studied.
5. The impact on highway networks of modal shifts due to policy changes is an area to be researched. Policy changes may affect truck size and weight and noise guidelines, for example.
6. Techniques for evaluation and development suitable for rail project analysis are necessary. Currently, states are concerned that the cost-benefit analysis will be the only tool used in decision making.

Interface with Other Modes

Because rail freight planning is a relatively new state-level activity, planners can and should draw on techniques developed and tested for other modes. State transportation planners are in good (best) position to use this prior experience. Rail grade-crossing and line relocation are good examples of project-level planning interface opportunities.

Staff involved in state rail planning and implementation should be particularly alert to developing integrated operations among modes as alternatives or adjuncts to rail freight systems—for example, planning an operation of feeder highway routes to a rail head as an alternative to continued light-density line operation. An intermodal terminal can be developed to optimize state transport investment, maximize efficiency, and minimize any adverse effects of abandonment.

Waterway Transportation and Ports

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SUMMARY

Given the embryonic nature of port and waterway planning at the state level, the first issue to be addressed is the nature of the state's role in this area. Such a role is expected to vary significantly from state to state because of differing needs and resources. The state role may focus on the following:

1. Decisions as to the proper functions of various state ports and waterways after an inventory of facilities, analysis of traffic flows, estimates of future volume, and specialization potentials of different ports and waterways;
2. Coordination with the state economic development or industrial development agency;
3. Advocacy role regarding waterway and port improvements;
4. Provision of a forum to discuss issues related to ports and waterways planning;
5. Provision of funding;
6. Port master planning, including interfaces with other modes; and
7. Acquisition of data and estimates of freight movements appropriate for both domestic and foreign water transport.

The workshop recommended three high-priority research projects: (a) development of a manual for port and waterway system planning and for port master planning; (b) development of methods to analyze the capacity of locks, terminals, and waterway systems; and (c) compilation of better facility-service inventory information and development of a system to maintain it.

COMMENT

There are several historical analogies with other statewide transportation planning components that set the tone for identifying issues in waterway transportation and port planning.

1. The nature and extent of possible ports and waterways planning activities may bear a similarity to aviation system plans and airport master plans initiated by the Airport and Airways Development Act of 1970. In other words, it would appear that there are both system plan and master plan elements to a comprehensive port and waterway planning activity.
2. The development of ports and waterways planning activities in state departments of transportation today is at about the same level of emphasis as railroad planning activities were before the passage of regulatory and reform legislation a few years ago.
3. As in some other modes, there is little for a state department of transportation to accomplish unilaterally in the ports and waterways area. State agencies would do well to recognize the primary role of the private sector in ports and waterways activities as well as the active role of other state agencies dealing with industrial development and commerce.

Issues

The first and central issue of this workshop focused on a discussion of the potential role for state departments of transportation in ports and waterways planning. Obviously, participation in such planning is expected to vary substantially from state to state. This situation is likely to continue as long as no federal program exists to disseminate guidelines on planning and funding of ports and waterways activities. Even if such a federal role emerges in the next few years, the geographical and economical differences among states will continue to dictate the role that states play in port and waterway planning. The rationale on which the state department of transportation may base its anticipated role in this area depends greatly on its legal capability, interest, and perceived need for planning such activities. There are numerous potential roles that may be considered. Some are described here.

1. Port system planning, involving feasibility studies of the potential role of the port facilities in a state, would include an inventory of facilities and forecasts of commodity flows. Special attention would be given to adequately incorporating the economic aspects of the regions that comprise the hinterlands of the ports of origin and destination. Modal shares would be an issue, particularly in the waterways area, where competition with railroads and trucking is intense for certain commodities. Attention would be given to port shares, for example, the distribution of imports and exports among nearby ports in the same state, as well as to port specialization. The extrapolation of physical needs and the plan for capital and operating budgets would also receive attention. In general, emphasis in port system planning would be on developing a realistic hierarchy of port systems throughout the state, minimizing duplication of service, and fitting scarce resources and sites to likely traffic flows.

It should be recognized that an inland or coastal port is often a major "development anchor" in the region, bringing together income-producing land development, public and private investments, and all modes of transportation. Yet, despite this obvious significance, no state or regional planning guidelines exist for planning mechanics, funding and implementing port-oriented intermodal facilities, either at the A-95 or statewide transportation agency level.

2. Coordination should occur with state economic development or industrial development agencies—particularly in the area of access to ports and waterways facilities. By its nature, the port is a transportation node. Therefore, it has significant intermodal relations with railroad, truck, and pipeline systems.
3. Advocacy activities can influence needed ports and waterways system improvements. The initiation of U.S. Army Corps of Engineers studies, for example, is at the local level and could be expedited with state assistance.
4. States may provide a forum for rationalizing ports and waterways issues. The use of the water and its banks, coordination of multimodal rates, and determination of spoil areas for dredging are some of these issues.
5. Providing stable funding sources for numerous port and waterway development activities, such as land acquisition, access, acquisition of spoil-disposal areas, and development of facilities, is important. Port master planning, especially consideration of interface with other

modes and other access issues, should serve as the format for establishing a funding program. Such a role would undoubtedly follow local initiative. This activity may assist in obtaining the necessary state and local assurances for spoil areas—a long-standing problem.

6. States may obtain and maintain data and information on freight movements appropriate for water transportation, both domestic and foreign. This process could involve the development of mechanisms for securing export-import data from the U.S. Customs Service and domestic data from the Corps of Engineers. Standards would also have to be developed by which the proprietary nature of much of these data could be protected.
7. States may establish a participatory ports and waterways planning process that involves shippers and carriers and that may ultimately enhance incentives for private investment.
8. States may also monitor and assess national and local ports and waterways issues. Such activity is comparable to an early warning function.

The rationale for the active involvement of a state department of transportation in ports and waterways planning is not unlike that found in other modes. Basically, it would provide sound information on which to make investment decisions and would provide a forum for public and private interests to communicate.

A second issue associated with ports and waterways planning involves the federal role in waterway transportation and port activities. No single agency at the federal level has the primary authority for waterway and port transportation planning. The most likely agencies for coordination in this area include the Office of Maritime Affairs, the U.S. Coast Guard, the Maritime Administration, the Economic Development Administration, and the Corps of Engineers. These agencies could do much to synthesize a high-level interagency coordination of navigation, construction and systems maintenance, port planning, and research in water transportation. There are also continuing and sometimes conflicting federal initiatives in coastal zone management (save wetlands), National Maritime Fisheries (save food supply), flood control, urban development, Environmental Protection Agency (save water and air quality), Economic Development Administration, and dredging activities. Also, substantive issues, such as inland-waterway user charges, and the attendant modal issues must be addressed at the national level but with an extreme sensitivity to the potential impact on states.

A third issue centers on a lack of understanding by the public and by decision makers of ports and waterways operations and benefits. It is recognized that port service is hard to measure because there are many indirect benefits to the localities, states, and nation.

As states take a greater interest in the activities of coastal and inland ports, particular attention will have to be given to the balance between public involvement and the need for private autonomy. Port autonomy carried to an extreme is detrimental to developing an effective, integrated multimodal transportation system, and it may in fact be detrimental to shippers. However, a substantial degree of port autonomy in certain areas is desirable. Port administrators should have the flexibility to quickly implement business decisions in order to attract and retain commerce.

Finally, the need for planning guidelines for waterway and port planning is also at issue. In certain areas, the growth of this transportation sector is substantial and involves extensive impacts on the land side. Information needs are also great; they include inventories of facilities and vessels, existing and future flows, and port funding and operations. Technical planning guidelines that cover procedures for capacity analysis, demand forecasting, and improved traffic management are not fully developed. Inadequacies exist in the forecasting area where proved techniques used in other modes have not yet been applied. For example, the problem of vessel scheduling (especially on the Great Lakes) has not been adequately addressed, although it is almost certain to involve a reapplication of existing technology. There also is a need to improve capacity-analysis techniques for ports, terminals, and locks, as well as systemwide analysis. Facility inventory information and a system for keeping such information current do not exist in many areas, although the Maritime Administration has a good start on a nationwide basis.

Research and Information Needs

Due to the infancy of statewide transportation planning for ports and waterways, little information was developed in this workshop on the currency of planning and programming techniques, the integration of modal plans, and the identification of problems associated with the implementation of plans and programs. However, the participants were able to highlight several research and information needs.

High priority was given to (a) developing a handbook or manual on port system and master planning guidelines; (b) inventorying facilities and services—probably more acute in the inland waterways area; and (c) expanding capability and standardizing approaches to capacity analysis for locks and terminals (transfer and storage) as well as to systemwide capability. Medium priority was assigned to (a) developing the capability to optimize the provision of landside feeder systems, (b) scheduling systems for vessels to optimize productivity of water and shoreside facilities, and (c) developing more extensive and more disaggregate data for planning purposes.

Intercity Bus and Rail Passenger Planning

R. A. Keith, chairman

D. R. Bentz
R. A. Gorman
P. Hazen
B. J. Riggs
J. C. Sherwood
W. G. Stage
P. R. Stopher

SUMMARY

State government interest in intercity bus and rail passenger service is increasing due to federal proposals and actions concerning these two modes. A large cutback in Amtrak route kilometers has been proposed by the U.S. Department of Transportation (DOT). Some relief from taxation has been granted intercity bus companies, but appropriations have not been provided to support recent congressional subsidies to intercity bus carriers.

Profits of intercity bus carriers are declining, and this makes these companies less able than before to provide traditional cross subsidies. Deregulation may accentuate this problem, and the result may be that many small communities are left without service on short notice. State governments should develop contingency plans regarding what action they will take if such events occur.

Conflicting federal policies are evident. Estimates

have been made that Amtrak diverts 30 percent of bus passengers in the Northeast Corridor and 9 percent elsewhere in the country. Historically, rail fares have been higher than bus fares. With current subsidies, however, a rough parity exists between the two. For the federal government to have to support both systems is incongruous.

Also, numerous federal rural and special transit programs exist that are funded by many agencies. Most are uncoordinated. Rural public transit funds are inadequate to finance both local and intercity transit. The American Bus Association surveyed the urban initiatives program, for example, and found that no transit-terminal projects are being contemplated. There was some concern that current rural transit funds are being channeled to local governments, thus making it difficult to undertake multicounty or multistate intercity bus or transit programs.

The direction of future rail service depends largely on congressional decisions related to Amtrak. States must learn how to react to federal programs and policies; they should anticipate their impacts to the extent possible. Rail- and bus-change problems may involve multistate regional solutions.

COMMENT

Participants in this workshop discussed several aspects of intercity bus and rail passenger planning—techniques, issues, implementation, information and research needs, and interrelations among modes. They noted the following:

1. Some sophisticated techniques related to demand forecasting exist for high-density corridors, but their use is not generally transferable.
2. In most cases, making future projections of total intercity demand and suballocating among modes are not recommended procedures.
3. Techniques being examined in Wisconsin and at DOT's Transportation Systems Center show promise (e.g., projecting subsets of total population and then analyzing their propensity to use transit, studying light-density areas, and providing annual financial analysis for bus operations).
4. Industry profits are on the decline. This situation makes it more difficult for industry to accept traditional cross-subsidy practices.
5. DOT has taken no positive action to fund Sections 21 and 22 of the Surface Transportation Act of 1978.
6. Potential public aid for bus operations may require extensive paperwork and red tape. In addition, the bus industry, though wary of public involvement, sees no other course of action at this time.
7. Should deregulation occur, the state's position remains uncertain, and many small communities may be left without transit service on short notice.

The participants examined some of the problems related to implementing plans. They singled out the difficulty in compelling a private carrier to fulfill plans unless financial aid is used as leverage. In some cases, a purchase-of-service agreement is recommended for aid purposes.

Information and research needs are greatest in the areas of analysis of passenger data from private carriers, cost and revenue figures, origin-destination figures, and acceptable accounting methodologies and cost models for determining individual route subsidies. Fare experimentation for short-distance travel, a bus-passenger signaling system for lightly used pickup points, and planning data and operational concepts suitable for newly authorized Urban Mass Transportation Administration funding for intercity bus terminals were also recommended as areas for study.

The need for multistate coordination and the effect of deregulation on the least profitable routes were also mentioned as study projects.

It was suggested that future terminals can be located in the suburbs and be used in conjunction with urban fringe-area parking lots, that multimodal terminals shared with urban transit and private carriers may be joined to urban initiatives activities, and that Section 22 funds can provide the necessary leverage to overcome institutional resistance. Cities, such as Buffalo, Harrisburg, and Washington, D.C., were cited as examples of places where planning for multimodal terminals has been successful.

Urban, Small-City, and Rural Transit Planning

G. T. Lathrop, chairman

S. Austin
W. T. Gruen
V. K. Gunby
R. C. Lockwood
D. J. McKelvey
W. D. Merrell
H. Mields

SUMMARY

Why should the state be involved in transit planning—an area usually characterized by direct federal aid to local authorities? State government, according to workshop participants, has a responsibility to provide equality of mobility to all citizens. Further, the state is concerned with environmental quality, energy conservation, relief of congestion, and economic and physical development—all of which may be supported to a greater or lesser extent by increased use of transit.

State governments can play many roles related to urban, small-city, and rural transit planning. Some suggested by participants include planning, programming, coordinating between and within agencies as well as across programs, funding, stimulating or initiating service rather than just being responsive to local government requests, and providing technical and managerial assistance. A number of examples were cited:

1. A coordinating role between and among agencies, especially with regard to overlap between social-service transportation delivery systems and their involvement with rural or small-city transit authorities;
2. The provision of technical and managerial assistance, including exchanges between technical, managerial, and policy-level personnel;
3. An advisory and assistance function regarding employee and labor relations; and
4. Service as a representative of a state's transit systems to DOT, Congress, and regulatory agencies.

In general, participants agreed that planning techniques were adequate. However, there was considerable concern about methodology and information for evaluating the adequacy, equity, effectiveness, and efficiency of transit service and for supporting allocation of funds at local, state, and federal levels.

COMMENT

In discussing the need for and the role of states in tran-

sit planning, participants maintained that the state has a responsibility (a) to provide transit services and access to those services, (b) to respond to a variety of values and objectives on which transit may have an impact (environmental quality, energy conservation, economic and physical development, and traffic congestion), and (c) to respond to federal statutory and regulatory requirements affecting state transportation systems. The state role, which ranges far beyond just a planning function, will vary according to the characteristics (governmental, geographical, demographical, and climatological) and needs of each state. Primary functions would include, however, planning, programming, coordinating, funding, encouraging and stimulating transit services, and providing technical and managerial assistance.

State departments of transportation can perform activities such as the following:

1. Establish and operate transit systems, particularly through coordinated plans and technical operating assistance;
2. Develop and maintain regional and statewide transit information services through a network of information centers and an advertising program (as part of a multimodal information and referral service);
3. Maintain close ties with operators in the industry and be sensitive to their needs;
4. Develop and operate paratransit systems, especially systems that provide special services for elderly and handicapped persons;
5. Assist authorities (e.g., utilities, transportation commissions, insurance commissions, cities, counties, and licensing departments) in revising regulations affecting paratransit operators to improve overall service;
6. Provide assistance in marketing, advertising, and paratransit information and referral services (as part of a multimodal information and referral service);
7. Supervise or conduct special programs;
8. Conduct training programs;
9. Provide technical, managerial, and policy staff exchanges among operators and managers, elected and appointed officials, and other employees; and
10. Provide assistance and advice related to employee and labor relations.

Although the group generally agreed that planning techniques were adequate, considerable concern was expressed about techniques and information for evaluating the adequacy, equity, effectiveness, and efficiency of transit service and for supporting fund allocation at the local, state, and federal levels. These inadequacies were thought clearly to identify information and research needs.

Some opposition was voiced concerning institutional or functional merger (such as the proposed Surface Transportation Administration) because of possible submersion in highway and other programs. However, a need exists for integration at (or near) the local level—something that might be accomplished by giving the local planning officer or primary local government branch a strong planning and programming role.

An examination of current and future issues confronting state planners focused on

1. The need for a clear definition of the scope and nature of the state role in transportation planning;
2. A planning framework that considers such factors as research assistance, inventory, technical aid, alternatives analysis between competing modes, multimodal or intermodal planning, funding sources, and procedures designed especially to meet the needs of small cities and rural areas;
3. An administrative-management framework for small cities and rural areas that pays attention to grant application, setting up management procedures especially for rural areas, purchasing programs, insurance, and labor negotiations;
4. Coordination of planning, programming, information, and technical services;
5. An appropriate accounting methodology to oversee revenue and expenditures; and
6. The understanding of organizational, legislative, and regulatory impacts on statewide transportation planning.

Participants agreed further that a transit vehicle for small-city and rural operations is needed now. This need is not satisfied by vehicles currently available due to maintenance and performance problems.

The next decade is likely to see an increase in the level of transit subsidies (above the inflation rate), demographic shifts, shifts in energy costs affecting transit demand, and final passage of a federal energy policy.

Aviation Planning

H. M. Goodwyn, chairman

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R. E. David
W. R. Delis
T. P. Messier
R. E. Royer
K. R. Sattler
T. J. Thompson

SUMMARY

The 1980s will strongly challenge the states to make contributions to air transportation system development. Deregulation is expected to prompt demands to sustain existing or to support new air service to small communities. Substantial air travel growth rates will require new approaches to air traffic management at all levels. Environmental considerations will continue to be important.

Because a state's technical capacity to deal with these problems varies, a major challenge will be the collective educating and upgrading of a state's aviation community to deal effectively with aviation system development in a time of diminishing resources.

A critical problem is the integration of concerns about airspace and air safety into the airport system planning and development process. Priority programming of airport capital improvement projects, including airport operation and maintenance costs, is also necessary.

Three high-priority research needs are (a) analysis of air service demands in low-density markets, determination of essential needs, subsidy requirements, and how to attract carriers into this market; (b) development of aircraft suitable to low-density market service; and (c) identification of the state of the art regarding the airspace planning process.

COMMENT

The 1980s will provide increasing opportunities for significant state contributions to air transportation system development. Existing technical capabilities to deal with issues, however, vary dramatically among states. A major challenge in the 1980s, then, will be the collective educating and upgrading of a state's aviation community to deal effectively with these issues in a time of dimin-

ishing resources. The three most important areas requiring new or higher levels of state technical expertise are described below:

1. Provide more effective airport system planning and development. Basic to this issue is the need for more clearly articulated system development policies. Once priorities are established at the national, state, and local levels, a meaningful priority-programming process can be developed. New programs, such as maintenance management and transportation system management (TSM) adaptations to airports, need to be investigated and instituted where shown to be effective.
2. Provide support for existing or replacement air service to small communities and in low-density markets. Small communities rarely have the expertise needed to deal with the carriers or the Civil Aeronautics Board (CAB) in air service matters. CAB will be spread too thin to provide needed advice to the hundreds of communities affected. By developing sufficient technical expertise, states can advise communities, represent their interests at administrative hearings, and coordinate new service opportunities with regional and commuter carriers.
3. Integrate airspace and air safety concerns into the airport system planning process. Although airspace problems usually develop around a single large-carrier airport, resolution of the problems will involve a number of airports sponsored by both public and private entities. The planning and designing of terminal airspace have traditionally been federal prerogatives. System access and local interests are often overlooked in that process. State and regional system planning can seek ways to maintain essential air safety, while still meeting local and system needs.

New or improved planning and analysis techniques needed include (a) priority programming of airport capital improvement projects, (b) inclusion of airport operation and maintenance costs into the airport system planning process (TSM adaptations), (c) integration of airspace planning into the airport system planning process, (d) evaluation of service potential in low-density markets, and (e) consideration of ground access to small-carrier and low-activity general aviation airports.

Information and data needs center on the retention of annual data on passenger origins and destinations (now collected by CAB) and the expansion of that data base to include third-level and intrastate carriers. Also important is the continued development of methods for measuring and evaluating activity at airports without control towers.

The workshop identified a variety of research program areas. These include

1. Analysis of air service in low-density markets to support essential air service determination, subsidy requirements, and stimulation of new carriers (high priority);
2. Development of new aircraft suitable to air service in low-density markets (high priority);
3. Identification of the state of the art related to the airspace planning process (high priority);
4. Identification of options for preserving private airports that provide needed urban system capacity (medium priority); and
5. Identification of links between state and community economic development and air transportation services (low priority).

The participants also made note of institutional obstacles to plan implementation. These may include

1. Inability to accurately project federal, state, and local funding sources available for system development;
2. Inadequate marketing of state plans and policies;
3. Initiative for individual airport development and maintenance, which is often dependent on a sponsor (usually a unit of local government) who is not necessarily concerned with system requirements;
4. Provision of a significant portion of urban general aviation system capacity by privately owned airports that are not eligible for state or federal grants;
5. Lack of state-level enabling legislation for implementation of noise abatement plans and control of tall structures; and
6. Lack of clearly articulated federal policies for development of the national airport system.

Environment, Population, and Economics

H. A. Reed, chairman

S. J. Bellomo
R. C. Blensly
M. Brenan
C. E. Canane
E. H. Collagan
C. T. Faircloth
I. Hand
H. C. Hanna
T. Hoffman
G. Jones
M. Poole

SUMMARY

Five issues relating to the natural environment—one of several external influences on transportation—were identified.

1. Requirements to protect the environment are for the most part here to stay and will likely grow in number and complexity, depending on various national, state, and/or local priorities.
2. The ability of states to satisfy these requirements may suffer in a time of diminishing financial resources. To prevent this, state departments of transportation could more fully integrate environmental considerations in the project development process.
3. To increase the credibility of environmental planning, the time to accomplish environmental studies, in particular the review time, must be reduced substantially.
4. Mitigation measures recommended in the environmental impact statement (EIS) should be incorporated in the project's bidding, inspecting, and monitoring processes.
5. Environmental regulations should be reevaluated to provide a better balance between environmental and economic considerations, with special consideration as to how both will be weighted and compared during project analysis.

The workshop participants concluded that states should be concerned about the long-range impacts on transportation systems of the probable economic futures of a state and its internal regions. Study of alternative economic futures and the monitoring and surveillance of statewide economic development are needed as guides to statewide transportation investment policy. In this regard, Connecticut's development plan was cited as an example.

The need for a comprehensive statewide planning capacity at the state level was stressed. Because transportation departments are concerned with the short- and long-range impacts of their transportation activities,

they should encourage development of adequate state-level planning capacity.

COMMENT

Participants identified several issues, problems, and suggestions related to the external (environmental) influences on transportation systems and evaluations.

1. Environmental requirements are here to stay and will in fact grow in number and complexity.
2. Although requirements to preserve the environment will remain, concern was voiced that the human and financial capacities necessary to carry out these requirements may suffer in this time of declining project implementation resources. To keep this from happening, it was recommended that the environmental process should be given stature in the transportation agencies by top management, including the establishment of the process as an integral part of project development and equal to other project considerations.
3. To increase EIS credibility, the time to accomplish the studies must be reduced substantially. Five ways were suggested: review sessions, scoping activities, reassessment of rules and regulations, delegation to states of federal EIS responsibility, and program reviews.
4. It is essential that the mitigation measures recommended in the EIS process be made an integral part of the project bidding, inspecting, and monitoring processes.
5. This conference should encourage the regulatory agencies to reevaluate the rules and regulations that have evolved over the last decade with an eye toward balancing environmental and economic considerations.

There is a need to be concerned about the long-range transportation impacts for probable economic futures on a state or substate level in order to formulate a statewide transportation investment policy. Likewise, there is a need for a statewide planning capacity in state government. Because departments of transportation are concerned with the short- and long-range impacts of their transportation activities, they should encourage the development of such a capacity in their states. Further, a monitoring and surveillance process to oversee statewide development and transportation service conflicts and opportunities was recommended. The suggestion was also made that TRB could play a leading role in conjunction with the U.S. Environmental Protection Agency and transportation agencies to develop more acceptable ways to analyze, measure, and monitor environmental impacts and findings.

Although not necessarily a statewide system consideration, it was felt that, in this time of revenue shortfall, the states with the aid of transportation agencies should look for opportunities to combine economic growth and needed transportation improvements. A state should serve as the catalyst to combine economic development with needed transportation improvements in order for the private sector to share more extensively in capital improvements.

Energy and the Economy

M. S. Bronzini, chairman

H. Caldwell
J. Gable
D. Goettee
F. Gottemoeller
I. Hoch
T. F. Humphrey
G. Johnson
J. Kinstlinger
W. Lazarek
M. Lehr
E. Margolin
G. McCormick
F. Mulvey
P. Pickens
J. L. Reith
L. Sams
R. K. Taube
R. Threlkeld
M. Watnee

SUMMARY

Of six issues identified by the workshop, three were particularly important.

1. Energy conservation as a national policy will require alteration of traditional revenue sources such as the imposing of ad valorem rather than per-liter fuel taxes and the development of additional major funding sources.
2. Inflation in transportation construction costs exceeds the inflation rate of the consumer price index, and this increases the disparity between transportation revenues and transportation needs.
3. Increased export and import activity will change the demand for transportation services.

Two high-priority research projects were recommended. First, timely and accurate information on fuel consumption in each state must be collected and used as a basis for evaluation of conservation program effectiveness. Second, further research is needed on energy-price elasticity and on income elasticities related to the demand for transportation.

COMMENT

This workshop considered the problem of how a state department of transportation can deal effectively with the twin externalities of energy and a state's economic development when preparing a statewide transportation plan. Three conference resource persons quite independently chose to address this topic from the perspective of the state's need for basic planning information.

David Goettee identified the economic and population structures of the states as the fundamental generators of transportation demand. He maintained that there is a need for improved integration of the multiregional structural economic forecasts generated for national program evaluation into state planning. This information could be provided to the states as a technical aid, if desired, through existing institutional structures.

Georgia Johnson outlined some of the near-term and long-term petroleum supply expectations of the U.S. Department of Energy (DOE) and the anticipated impacts of future changes in automotive energy efficiency. She cautioned the states against using unadjusted EPA fuel-efficiency measurements and future standards to estimate fuel use because EPA substantially overstates the realistically achievable kilometers per liter of current-technology motor vehicles. Current estimates made with DOE's light-duty vehicle fuel-consumption model indicate that vehicle kilometers traveled will increase by nearly one-third by 1990, while the quantity of fuel used for this travel will actually decline slightly.

Richard K. Taube emphasized the importance of federal economic policy and of other federal actions in determining a state's future population and economic activity. Many nontransportation decisions—for example, housing policy and programs—can drastically affect transportation demand and system performance.

Somewhat surprisingly, and in contrast to the re-

source presentations, workshop participants did not view information on externalities as a high-priority need, but they were more concerned with the energy and economic issues that must be recognized in statewide transportation planning. The following were singled out as especially important for consideration in the coming decade.

1. Extraction and transportation of energy resources can produce severe impacts on communities and transportation infrastructure. Amelioration of these impacts may require realignment of state transportation program priorities.
2. Energy availability and price influence the mobility of people and goods. These factors will ultimately influence technology options—for example, conversion from petroleum-based fuels to alternative propulsion systems. Over a much longer horizon, availability and price may even influence future spatial patterns.
3. Energy conservation as a national policy will require alteration of traditional revenue sources—for example, imposing of value taxes rather than per-liter taxes, and development of additional major funding sources. The content of transportation plans and programs must also change to emphasize energy efficiency.
4. Energy conservation efforts adopted by the states may have impacts on transportation safety. For example, reduced fuel tax revenues have already caused deferred maintenance and repairs, which have resulted in serious hazards.
5. Inflation in transportation construction costs exceeds the rate of growth of the consumer price index. This, combined with the shortfall in gasoline tax revenues from conservation, will increase the disparity between revenues and needs, however defined.
6. Increased export and import activity will change the demand for transportation services. This may require alterations in transportation investment programs.

There was little evidence of dissatisfaction with existing planning techniques. Given a hypothesized energy and economic scenario, techniques exist for incorporating the scenario's assumptions into the planning process. The difficult part of the statewide planning process is generating the appropriate scenario. With this as a background, participants in this workshop recommended that states should be developing contingency plans to deal with severe energy shortages. With effective contingency planning, the question is open as to whether ongoing planning, programming, and investment decisions should be keyed to anticipated energy availability shortfalls.

In view of the undecided distribution of energy shortage considerations between contingency planning and mainstream planning and programming, three statements of information and research needs were developed.

1. There is a need for timely and accurate information on fuel consumption, by state, to evaluate conservation program effectiveness.
2. Further research is needed on the energy price elasticity and the income elasticities of the demand for transportation.
3. The energy and economic future is so uncertain as to preclude a definitive statement of the related information needs for statewide planning and programming. Adoption of a widely accepted national energy policy could greatly reduce this area of uncertainty. In the meantime, research is needed on development and application of techniques for planning in the face of uncertainty.

Although the participants accepted as legitimate the need to emphasize programming, they also recognized a need to be alert to the impacts of alternative futures. And, while eschewing the traditional models of statewide system planning, policy planning, and so on, the participants evidenced considerable reliance on traditional activities, such as economic forecasting and statewide demand modeling—albeit within a more evolutionary context. This evolutionary, less product-oriented, and shorter-focused approach, of course, maintains the flexibility needed to deal with rapidly changing energy and economic conditions.

In summary, current concerns for the impacts of energy and economic externalities on statewide planning are not very different from the usual concerns and problems of transportation planners. The emphasis and pervasiveness of these impacts may be different, but their basic nature is still very traditional.

Series 2 Workshops: Elements of a Statewide Transportation Plan

The Series 2 workshops highlighted the implementation tools necessary to effect a statewide transportation plan. Seven workshops dealt with topics that included meeting management needs, intermodal planning and programming, resource allocation, regulation and deregulation as implementation tools, and the roles of public and private organizations in comprehensive transportation planning. Work done during the conference's general sessions and in the Series 1 workshops formed the primary input for the Series 2 workshop discussions that are summarized below.

Meeting Management Needs and Plan Content

S. J. Bellomo, chairman

H. R. Atchison
H. M. Bennett
D. R. Bentz
R. E. Bowling
H. Caldwell
C. E. Canane
E. H. Collagan
W. R. Crockett
R. E. David
W. R. Delis
J. Gable
G. Gunderson
W. T. Gruen
J. L. Housworth
R. C. Lockwood
P. Pickens
M. C. Reinhardt
R. E. Royer
L. Sams
I. Shafran
J. C. Sherwood
R. E. Spicher
M. Watnee

SUMMARY

The products of statewide transportation planning and programming should include the following:

1. Policy statements that define what the state department of transportation intends to do in the field of transportation;
2. A management-organization plan that defines the role of the state department of transportation and, by inference, the roles of other transportation agencies;
3. A statement on financial resources and problems;
4. A documentation in the state's action plan of the process by which plans and programs are developed, including participation of other public and private agencies;
5. A short-range plan and program, including a multiyear program of projects; and
6. A long-term plan that is flexible, provides general direction for the short-term element, and is based on an examination of alternatives.

Procedures for developing a statewide transportation plan have, in many respects, followed those used in urban and regional transportation studies to date. However, such procedures suffer from a combination of high cost, low reliability, and an inability to respond quickly and directly to policy issues. Thus, better performance-evaluation and sketch-planning techniques are needed. Sketch planning helps to develop an overall planning methodology that will be policy-sensitive and will allow the testing and evaluation of alternatives in order to produce comparable, rapid, and reasonable cost results.

COMMENT

This management-oriented workshop had two purposes: first, to recommend how state planning staffs should respond to the needs of management, and, second, to specify what the content of a statewide transportation plan should be. Prior to developing workshop findings, resource persons made presentations of plans, documents, and processes used in Maryland, North Carolina, Connecticut, and Wisconsin. The common threads and differences in the content of these presentations and the procedures used in other states then were discussed.

From these discussions, a variety of ideas and conclusions emerged. For example, the process and products of various states were workable given their respective institutional framework. The contents of statewide transportation plans and programs were varied in terms of scope, long- versus short-term emphasis, and modal emphasis (variations related to the unique institutional requirements of each state). The process varied in terms of public involvement and technical procedures. An issue-analysis approach was used in preparing most of the plans and programs discussed, and a range of alternatives was usually examined in establishing priorities. Most states gave some priority ranking to the issues.

In addition, a need for input from policymakers and those responsible for program development was cited. Plans and programs should be tied to budgets, and specific budgets by mode should be established. Multimodal analysis techniques should be used for analysis wherever possible.

Participants generally agreed that the basic outline of a statewide transportation plan and program product should include some basic elements—policy statements, management functions, multimodal plans and programs, and a discussion of financial resources and problems. The process for planning should also allow for surveillance, monitoring, early warning indicators, and new legislation.

Some aspects of short- and long-range plans and programs were outlined. A short-range process should focus on a multiyear program of projects; should be reviewed annually or biennially, depending on the state's budget cycle; should contain the first-year element and be reviewed annually; should relate the program's length (in years) to the budget; and should include contingency funds to deal with inevitable uncertainties, such as fuel limitations and price increases. A long-term plan should be flexible and suitable for alternative policy and program analysis, should provide general direction for the short-range element, and should assist in identifying emerging issues, potential implications, and options for addressing those issues. Furthermore, the long-term plan and program should be expected to set short-range program and project priorities based on existing policies; to provide a framework for extrapolating impacts of current policies and programs and identifying future problems, to be reflective of statewide transportation needs, and to identify and analyze future options. Policy statements identifying a preferred long-range alternative selected by decision makers may also be part of the process. This alternative may be termed a no-committment option. Planning should be based on an open, participatory process; the techniques and the level of public involvement should be at the state's discretion.

Statewide Planning Process

The planning process may take many forms. The process, however, is likely to be based on adopted plans and policies and management direction. Opportunities should be provided for incorporating needs that have been identified by other interests, including field offices, local governments, and individuals, and for information feedback to participants and decision makers. Such feedback may result in changes in standards, legislative recommendations, or other elements in the statewide planning process. The process should start with the state legislature, and every effort should be made to involve legislators as early as possible. The process ought to be documented in the state's action plan.

The workshop participants then reviewed the evaluation process developed in Figure 1. This process, they agreed, represented the kind that should be used in identifying and evaluating state-level plans and programs.

Sketch-planning techniques are needed to resolve the problems noted in Figure 1. These techniques should be quick to use and simple to apply. The techniques should provide broad support to decision makers and cover a wide range of impact areas, such as priority programming and economic, financial, mobility, environmental, and social considerations. Travel demand techniques ought to be flexible enough to deal with such a broad-based evaluation.

Information Needs and Research

A clearinghouse to gather and disseminate information on techniques and processes used by the states was a prime research recommendation. The clearinghouse could focus on techniques and approaches for the analysis of statewide planning and programming options. There should be broad involvement from the governmental and private sectors.

Additional training of decision makers and policy analysts was also suggested. Through this training, decision makers would be better able to provide direction to state transportation department staffs.

Participants agreed that the need existed for better performance evaluation tools that indicate how well transportation actions and activities are meeting specific statewide objectives. Research on the cost-effectiveness of citizen-public involvement techniques was also urged.

Intermodal Planning and Programming

T. F. Humphrey, chairman

S. Austin
R. C. Blensly
C. Fleet
C. W. Friesen
V. K. Gunby
M. L. Halladay
G. T. Lathrop
D. E. Matzzie
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W. D. Merrell
J. D. O'Doherty
T. Stockwell
P. R. Stopher
T. J. Thompson
R. Threlkeld

SUMMARY

Making decisions on the allocation of funds between modes and on the coordination of two or more modes was the primary interest of this workshop. This session resulted from combining two others that had been originally scheduled to deal with (a) intermodal planning and (b) techniques for multimodal programming.

Intermodal planning and programming are impeded by a variety of factors, including (a) the constraints of federal mode-categorical planning funds, (b) similar state and legislative interests in single-mode categorical budgeting, and (c) the different time horizons of the several modes and their different constitutencies.

There appear to be no comprehensive multimodal planning techniques available that can provide all the answers needed to evaluate trade-off decisions as between all the modes. Only in specific corridors and at specific modal interface points—in other words, on a case-by-case basis—can such trade-offs be developed.

In programming, most decisions on allocating funds among modes are made by the U.S. Congress and the state legislatures. Ideally, legislative policymakers will use technical analyses prepared by professional staffs when they make these important programming decisions. However, the degree to which the legislature accepts technical analysis depends on the consistent credibility of the planning process to produce realistic information in a timely fashion.

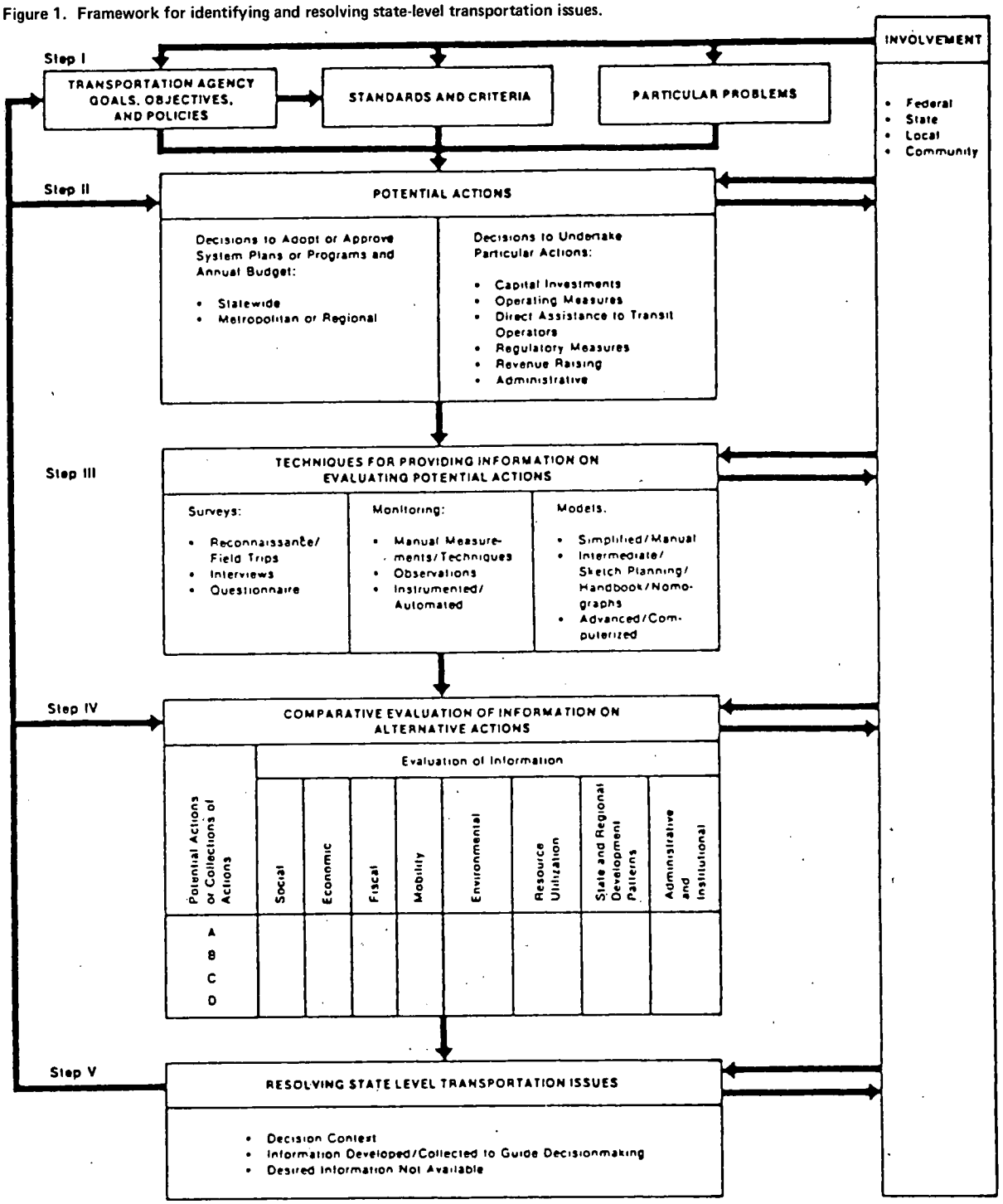
To improve state capabilities to deal with intermodal problems, workshop participants noted that

1. Crisis planning should be avoided,
2. Regular communication should occur between all participants of all modes,
3. Transportation planning is usually done for each mode and deals with individual mode problems, except in specific instances and at modal interface points. Consideration must be given to intermodal problems as individual problems may dictate.
4. Although significant progress has been made in focusing on intermodal problems during the past five years, there is a need to improve both the analysis techniques and the institutional framework for dealing with intermodal problems.
5. Ability to respond quickly to problems should increase, and
6. A unified planning fund would assist in the evolution toward multimodal planning.

COMMENT

There are numerous factors that influence and constrain

Figure 1. Framework for identifying and resolving state-level transportation issues.



actions and decisions made as part of the statewide planning and programming process. Some of the major issues of concern are summarized here.

Issues and Constraints

Federal Funding Process

Federal funds are appropriated and targeted for specific modes of transportation and for programs within each mode. The availability and, in many cases, the unavailability of federal funds for both planning and programming functions are major influences on all programs at the state level. The decisions on funding for a particular mode at the national level are influenced by many factors that include

1. National policies, such as federal subsidies for urban mass transportation, intercity passenger service improvements, regulation and deregulation issues, and the objective of completing the Interstate highway program within a specific time period;
2. Special interests that make an effort to influence the major funding decisions made by Congress, including various national associations of consumers and providers of transportation services and facilities, as well as var-

ious government and quasi-government organizations;

3. Regional concerns that reflect the different problems and constraints that exist in various sections of the country—an issue that many times will focus on the allocation formulas used by Congress in apportioning available federal aid to individual states; and

4. National and regional concerns that include factors such as inflation, unemployment, international balance of payments, energy, air quality, and elderly and handicapped considerations.

Regulatory Action at National Level

Many transportation decisions are significantly influenced by regulations that are established at the national level to achieve various national objectives. For example, environmental regulations have significantly altered the transportation decision-making process. The deregulation of air carriers and the possible deregulation of the trucking industry could have a significant impact on the intercity movement of people and goods. Federal and state agencies are also playing a more significant role in decisions related to railroad programs because of the decline in the economic viability of the nation's rail systems. Future regulatory actions may further influence the degree of involvement by public agencies.

Public-Sector Decisions and Private-Sector Actions

Historically, land development decisions made by the private sector have had a major influence on many transportation decisions, especially in urbanized areas. The availability of good transportation services has also influenced the location decisions made by business and industry. Public investments in certain modes have also had an influence on the competitive status of various individual modes. For example, the construction of the Interstate highway system has generated increased automobile highway travel at the expense of public transportation, most notably by bus and rail. The railroad industry has argued that its ability to haul commodities at competitive prices has been diminished by the availability of Interstate highways for trucks.

Demands of State Executives

The governor of a state and the state secretary or commissioner of transportation have certain short-term needs and expectations, and the professionals responsible for planning and programming actions must respond to those needs. At times, it may be difficult to fully consider the long-term impacts of short-term decisions, but recognition must be given to the importance of that relation.

State Budgetary Process

In the same way that federal decisions on funding affect state programs, the state budgetary process also determines the nature and magnitude of state programs. Planning and programming decisions must account for the manner in which state funds are authorized for transportation programs. For example, at one end of the spectrum, a state may simply appropriate only enough funds to match federal funds for all modes on an individual modal basis. This approach removes much of the discretion that might otherwise be available in making modal trade-offs at the state level. Additional constraints are imposed when state legislatures require line-item approvals on a project-by-project basis.

At the other end of the spectrum, a state may have a single transportation fund and a wide range of options for determining how to use those funds. In this case, programming decisions would not necessarily be based on the availability or the unavailability of federal funds. Thus, more funds than are needed to simply match federal funds would potentially be available and would allow for intermodal trade-offs to be made.

Range of Parameters

Each mode of transportation is influenced by a different set of factors that influence how decisions are made, both at the planning and at the programming stages. For example, decisions to implement major new highway and fixed-rail projects are usually long-range decisions because an extensive amount of time is needed to proceed through the planning, environmental, and design stages before construction can begin. Some decisions on railroad programs may have to be made quickly in order to respond to immediate issues or to take advantage of funding that may be available for a minimum amount of time. The funding of expanded bus services can be accomplished quickly to respond to changes in demand or program funding. These examples indicate that each mode must be analyzed by using a time frame that is somewhat unique to that mode, thereby making it difficult to coordinate many planning and programming decisions.

The political funding and public-sector support for each mode is usually represented by different interests within a community or state, as well as in the nation. Sometimes that support is complementary, but at times it is also competitive. Those differences must be recognized and fully considered in all planning and programming decisions. In fact, coalitions of various interest groups (including citizen groups and political interests) frequently must be sought to achieve overall program objectives.

Federal funds for planning and for program implementation are administered by different agencies, and different congressional committees are responsible for appropriating those federal funds. Consequently, different rules, regulations, and guidelines must be dealt with at the state and local levels. Although DOT has made significant progress in recent years to reduce such administrative burdens and coordinate requirements among the modal administrations, there are still many difficult problems that must be dealt with.

The democratic process requires that all political interests in both the legislative and executive branches of government be incorporated in the planning and programming process. Thus, enough flexibility in those processes must be maintained to be certain that those interests are served in a positive way.

External Influences

Numerous external influences, that is, those factors over which state government has little or no control, are constantly at work and require attention on a continuing basis. Often, such influences cannot be anticipated; thus, the planning and programming process may have to be changed quickly to respond to them. Obvious examples of such influences include energy shortages, environmental issues, national and international economic influences, and changing fiscal constraints at the national and state levels.

Techniques

The techniques for planning and programming purposes at the state level currently in use are diverse, and they vary in degree of intensity and sophistication from state to state and between modes. Regardless of the degree of formal approach, the actions of each state can be classified into four broad categories or levels of planning and programming—policy planning, planning for each mode, intermodal coordination, and programming of projects, which can be further categorized into establishing priorities and allocating funds.

Planning and programming actions usually do not fall into neat categories and frequently do not occur in a sequential manner. There is a continuing need for feedback between all actions, and necessary adjustments must be made to consider all the factors summarized earlier in this report.

Following is a summary of the techniques currently being used in carrying out the four sets of actions summarized above, as viewed by the participants in this workshop. It is important to recognize that the procedures used may not always be quantitative in nature, but many times rely on qualitative judgments and the experience of those in responsible positions to deal with complex transportation problems within the context of the issues and constraints summarized earlier.

Policy Planning

At the policy-planning level, major program directions are established for each mode and on an intermodal basis. Some research has been done to evaluate quantitative analytical procedures for policy planning. Some states have attempted to use such techniques. However, in most instances, policy-level decisions are made on the basis of qualitative judgments. Those judgments are influenced by many of the factors summarized earlier.

It is at this stage that long-range objectives can and should be established. However, the definition of long range varies in accordance with the nature of the problems to be resolved. For example, highway design standards can be established for a 20-year time frame, but bus improvements will be more short term in nature because of their shorter life span.

Frequently, short-range objectives may have to take precedence over long-term goals. That is because there are immediate needs that require immediate attention, as well as a requirement to use available funds as efficiently as possible. However, it is important that every effort be made to ensure that short-range objectives be compatible with long-range goals.

Funding levels for each mode and certain modal tradeoffs are also made at this stage. Thus, a decision may be made to use more than the minimum amount of funds necessary to match federal funds for a particular mode. Such a decision would determine the nature and extent of the effort necessary at subsequent levels of planning and programming.

Planning for Each Mode

There is general agreement that it is virtually impossible to do multimodal systems planning as part of a single planning effort. Each mode has its own set of problems, constraints, and opportunities. Thus, planning is usually done for each mode and deals with individual modal problems, except in specific corridors and at modal interface points. Obviously, consideration must be given to intermodal problems as individual problems may dictate.

Each state has developed its own procedures and techniques for doing modal planning, and those techniques vary from state to state. However, there is a general pattern of analytical approach that is followed.

Urban highway and transit planning techniques have become relatively sophisticated during the past 10 years. Substantial funding is available for such planning, and considerable experience has developed in most states. However, state planning organizations have only begun recently to undertake comprehensive statewide planning efforts for intercity rail and bus travel and for airport planning. Some states are also actively involved with water transportation as a major mode of transporting people and goods. In these cases, there are less sophisticated techniques available and a smaller data base to work with. However, many states are engaged in considerable qualitative analysis.

The major point in this case is that each state has developed planning tools and techniques with which planning officials feel comfortable. The credibility of the process is dependent on the reasonableness of the results and not on the degree of sophistication used to achieve those results.

Intermodal Planning Techniques

Although there are no comprehensive multimodal planning techniques available that can provide all the insight and data needed to assess various intermodal trade-offs, certain actions can be and in many states are taken with regard to intermodal considerations. For example, those opportunities exist (a) in specific corridors, where, for example, trade-offs might be made between highway or rail and between water or surface modes; (b) at specific modal interface points—for example, at points where commodities are transferred from one mode to another; and (c) in other instances where opportunities might present themselves to better coordinate two or more modes.

There are generally no specific quantitative analysis techniques used to carry out intermodal planning for the examples described here. Again, each state has selected its own techniques for dealing with intermodal planning problems. Some have gathered considerable data to assist in their analysis, others rely more on experience and judgment.

Intermodal Programming Techniques

Generally, there are relatively few trade-offs that can be made between modes when decisions must be made on allocating funds. This is because funding levels are usually set by individual mode, both at the national and, in most cases, at the state level. Thus, the only programming discretion that occurs is within specific modal categories. Highway funds represent a major portion of total transportation funds available. However, because of the numerous highway funding categories established by Congress, there are often relatively few choices that can be made even for highway programs.

In some states, intermodal transportation funds have been established by state governments to provide for intermodal programming flexibility. However, even in those states, the rigidity of federal funding categories and the long-term commitments to various state projects severely restrict interfund flexibility.

In spite of rigid funding constraints, some states do allocate more funds than are necessary to simply match federal funds. For example, some states have made substantial commitments to intercity rail improvements by using state funds on a 100 percent basis. However, such actions require close cooperation between the executive and legislative branches of state government

Theoretically (and ideally) policymakers will use in-

formation and analyses generated during the planning stage to make programming decisions. The degree, however, to which this action is taken depends on the ability of the planning process to produce realistic information in a timely fashion.

Recommendations

The 1974 Williamsburg Conference on Statewide Transportation Planning provided an opportunity for identifying the emphasis that planning officials must provide to make statewide planning and programming relevant to transportation decision making. During the past five years, states have made substantial progress in improving analysis techniques and in providing the analytical support necessary to assist in rational decision making. The nature of those procedures varies from state to state in terms of complexity and sophistication. Although the general feeling of the workshop participants was that each state, in its own way, is actively involved in rationalizing transportation planning and programming actions, the following recommendations were made for further consideration.

1. The problems associated with each transportation mode are so complex that they must usually be evaluated on a single-mode basis. However, as such analyses are undertaken, they should focus on factors that will influence funding decisions, legislation at both the state and federal levels, and program policy decisions. The use of timely and relevant planning techniques can provide the information needed by policymakers so that the best use will be made of available funds.
2. By definition, planning programs should seek to anticipate crises that may occur. Obviously, this is not always possible. For example, no one could have predicted an oil embargo in 1973 and 1974. However, by undertaking a realistic analysis of modal problems and by assessing the practical issues related to intermodal coordination, a good planning program should be able to anticipate many crises and provide the needed recommendations for action.
3. There are numerous participants in the transportation planning, programming, and decision-making process. A concerted effort must be made by all participants to communicate on a continuing basis.
4. The traditional deficiency in the transportation planning process in most states has been its lack of credibility, resulting from its inability to respond to problems in a timely and relevant manner. While great progress has been made since 1974 in overcoming this problem, those responsible for the transportation planning process in each state must continue to focus on the necessity to provide input to short-term decision making quickly and effectively.
5. Considerable debate has occurred in recent years about the desirability of single-mode funds for planning and programming or the establishment of an intermodal transportation fund at the federal and state levels to provide maximum flexibility for planning and programming purposes.

There appears to be a growing consensus that a unified planning fund has many advantages and should be pursued. The Standing Committee on Planning of the American Association of State Highway and Transportation Officials made a formal recommendation in this regard in 1978. The progress in developing unified transportation planning guidelines by the Urban Mass Transportation Administration and the Federal Highway Administration was also a significant step in this direction. The potential establishment of a Surface Transportation Administration would further strengthen this concept.

6. Although significant progress has been made in focusing on intermodal problems during the past five years, there is an obvious need to improve both the analysis techniques and the institutional framework for dealing with intermodal problems. The best way to achieve that objective is to work diligently in each state to identify opportunities for better coordination. A nationwide effort is not suggested at this time because an adequate data base and adequate experience among the states do not exist.

Uncertainties of Future and External Influences

There are numerous external influences that have a major impact on the planning and programming of transportation improvements in every state. They have been discussed earlier in this report. In addition, there are numerous surprises or uncertainties that can destroy the best-made plans. The challenge exists to determine how such external influences and uncertainties can be accommodated in the planning and programming process. The following suggestions were made.

1. Establish boundaries of impacts. In evaluating particular issues, an effort should be made to analyze the best and the worst conditions that might occur. Then, a sensitivity analysis should be made to assist in estimating the most reasonable set of stable conditions that can be assumed to make probable forecasts for decision-making purposes.
2. Maintain the flexibility necessary to accommodate the unexpected. Analyses and conclusions should not be so rigid that they cannot be altered, perhaps even drastically, to account for unexpected factors. The ability to be flexible will be a major factor in the perception by policymakers of the relevance of the process to the real world.
3. Develop contingency plans. Transportation contingency plans should be prepared and kept current to serve as a solution to emergencies that might develop. The current and most relevant kind of contingency plan is concerned with a potential petroleum shortage. However, preparations should also be made for other potential problems, including railroad abandonments, transit strikes, and disasters caused by hazardous materials.

Information and Research Needs

There are extensive quantities of data, information, research, and reports available on most of the subjects covered in this workshop. However, it is always difficult to obtain the right information at the right time. Consequently, the following recommendations were made.

1. The federal government should place additional emphasis in the exchange of information and in the dissemination of reports on technological developments and intermodal planning and programming issues.
2. State government should increase its efforts to exchange information and experiences to avoid having to repeat similar mistakes and to provide opportunities for taking advantage of other's successes.
3. A major information deficiency involves data from private carriers. More assistance is needed from the carriers on current activities and planned activities. However, this must be accomplished in a manner that will respect the desire of the carriers to maintain con-

fidentiality of critical information that could influence their competitive positions.

It was the consensus of the workshop participants that more must be learned about the practical day-to-day problems summarized in this report before specific recommendations can be made for further research in this area. However, it would be desirable to develop performance-monitoring factors that would assist in the evaluation of how intermodal actions taken in the past have affected overall statewide transportation programs. Another kind of research might evaluate the losses that would have occurred because intermodal factors were not considered adequately in particular instances.

Resource Allocation

J. A. Bivens, chairman

C. L. Amos
R. L. Buchwalter
T. Deen
H. M. Goodwyn
R. A. Gorman
H. C. Hanna
T. P. Messier
F. Mulvey
M. Poole
H. A. Reed
I. Shafran
R. K. Taube

SUMMARY

Little or no flexibility was deemed possible at the state level for allocating resources between the modes. Barriers to flexibility include (a) the desire by state legislatures to establish funding policies related to single modes and (b) opposition from special-interest groups.

Most panel members were reluctant to recommend the creation of a uniform transportation fund, but they believed that there is a place for categorical funding. However, participants concluded that some increased discretion was desirable and could be achieved if (a) an open programming process is developed; (b) the legislature is involved in the process on a continuing basis; (c) legislated minimum expenditures in each category are established, with state transportation departments free to reallocate funds over the minimum; and (d) multiyear budgeting is enacted to permit states to carry over funds from one year to the next, thus preserving legislative intent.

The means for evaluating existing programs and their results (in terms of accomplishing state transportation goals) are needed. If available, such tools would provide a better basis for recommending different levels of categorical funding to the legislature.

COMMENT

There are various reasons why states have little or no flexibility with which to allocate resources between modes. Among the existing barriers to multimodal allocation of resources are the following:

1. Legislators feel that the only way in which the expenditure of funds in the proper places can be ensured is by strictly categorizing programs. This provides the legislature with some control over the programming process.
2. Special-interest groups do not want flexible programs. They fear that fewer dollars will be spent on their particular programs if the transportation agency has greater authority to allocate funds.
3. Some state transportation agencies have used categorical programs as a crutch. Such programs relieve them of the difficult decisions that must be made in establishing priorities. Furthermore, they can resist special-interest groups by citing their limited discretion over funding.
4. Some transportation agencies have not used the limited flexibility that they already have. For example, although federal-aid primary funds were available for bridge replacement, many states failed to use them for that purpose, thereby necessitating a special bridge replacement program.
5. Almost all federal funds are restricted to specific programs. After the states provide their matching requirements, there is little money left for use at the state's discretion.
6. Many states have constitutional provisions that restrict the use of highway funds for highway purposes. Also, some states prohibit aid to private carriers, such as railroads and bus operators.
7. Administrative regulations attached to particular programs compound legislative or constitutional restrictions.

Very little, it seems, can be done about this problem, especially in the short run. Therefore, the recommendations made were general in nature and aimed at affecting long-range policy. Among these were the following:

1. Develop an open programming process and one that involves the legislature.
2. Communicate with the legislature and their appropriate subcommittees on a continual basis.
3. Develop means for evaluating existing programs and widely report their results.
4. Do not develop multimodal programming techniques as long as funding continues on a modal and categorical basis.
5. Consider categorical programs. They ensure that at least a certain level of funds will be used for a particular purpose. However, setting minimum fund levels and allowing the states discretion over the residue may be the preferred approach.
6. Make use of multiyear budgeting that would allow the agencies to carry over funds from one fiscal year to the next. Thus they would be relieved of the burden of expending all their existing funds or losing them.

In summary, the states have little or no discretion in allocating funds across categories and across modes. However, not everyone in the workshop felt that this is a desirable goal. As long as federal programs are unimodal, the states will continue to have limited flexibility. Nonetheless, better communication, an open programming process, and evaluation of existing programs may have a long-term influence on future program flexibility.

Regulation and Deregulation

E. Margolin, chairman

W. B. Allen
J. Derwin
D. Dornan
W. T. Druhan
D. Goettee
T. N. Harvey
H. A. Reed
J. L. Reith
B. J. Riggs
C. H. Smith
W. G. Stage

SUMMARY

A basic fact on which this workshop predicated its discussion was that regulation is an unknown territory for practically all professionals working in state transportation departments. Yet, economic regulation is the set of rules by which the private enterprise transportation game is played. Changes in regulation will have a real impact on a number of important areas, including mode choice and the location of economic activity.

The recommendations of the workshop, therefore, were intended to influence state departments of transportation to play a greater role in this area.

1. State transportation planners must develop a working knowledge of regulation and its effects on a state.
2. Transportation department professionals should develop regular communication and interaction with the staffs of regulatory agencies.
3. The ability to estimate the impact of proposed federal (and state) changes in regulation must be developed.
4. The effects of regulatory changes on economic activity, population, and commodity flow need greater clarification through impact analysis and study.

COMMENT

The transportation planner's role and function vary from state to state. Within the various departments of transportation (not found in all states), there is a wide difference in authority, structure, and level of responsibility. There is also a wide variation in the relation that the state transportation departments have with other state agencies, such as those dealing with economic development and energy. These variations require that state transportation planners be flexible and responsive to the different needs and opportunities available. Planners must be able to understand the different ways in which regulation and deregulation impact that state's transportation systems.

Although the transportation planner in a state organization other than a department of transportation may have a different focus or mission, that focus should include consideration of regulatory issues. Furthermore, the relation of the transportation department to the public service commission often dictates whether regulatory issues are considered by transportation planners at the state level.

The uncertainties of regulation and deregulation also require that decision makers be given some insight into the possible impacts of regulatory changes before they are implemented or approved. The transportation planner should be knowledgeable about contemplated regulatory changes and be able to provide the decision maker with reasonable information and policy advice as to the the potential significance and impact of regulatory changes on the state's transportation goals, plans, and programs.

The workshop also identified several information and research needs applicable to the role a planner may have in assisting decision makers. For example, it was noted that (a) commodity-and person-flow information should be developed, (b) a mechanism to get information that would otherwise be lost if deregulation occurs should be studied, (c) the effects of regulatory changes on modal flows and economic activity change ought to be investigated, and (d) an inventory of existing services and facilities for goods and people movement could be organized.

Implementing Transportation Plans

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B. Bruzas
C. T. Faircloth
P. J. Metz
T. H. Myers
M. S. Reid

SUMMARY

The workshop identified constraints that impede the implementation of state transportation plans. Several examples of these constraints are long lead times; lack of funds; differing objectives of federal, state, and local governments and of shippers and carriers; labor relations; and unexpected events.

Awareness of these constraints should enable state departments of transportation to take suitable countermeasures as they prepare for implementation. Among these countermeasures the most important is the quality of the plan. A good, goal-oriented, financially feasible, and flexible plan developed through consultation with the private sector as well as with public and local government officials faces fewer obstacles to implementation.

New skills are needed by state department of transportation professionals. Among these are an operating knowledge of the private transportation industry and financial analysis ability. Labor relations, contract negotiation, and public and media presentation skills are also important.

COMMENT

Plan implementation is greatly dependent on the planning process. An open process that involves different levels of government, private industry, and citizens from its inception is likely to result in successful implementation. Furthermore, planning that recognizes various obstacles to implementation and allows for flexibility and deviation is expected to produce satisfactory implementation. Implementation is defined as the process of getting facilities built and services operating as called for in a transportation plan in conformance with state transportation goals.

Plan implementation, it was suggested by one speaker, is contingent on data, knowledge of industry, financial and investment analysis skills, ability to plan and implement in the face of uncertainty, contract negotiation skills, ability to form and use advisory panels, and skills in working constructively with private-sector carriers. A second speaker noted other features concerning plan implementation. The plan covers private modes, as well as publicly owned modes, that operate on their own rights-of-way and are not completely under the state's influence. All parties should be consulted for plan inputs. The ultimate goal is to produce the most cost-effective transportation for both shipper and taxpayer, and the concerns of special interests and politics should be dealt with during planning, not implementation. Further, one mode should not receive direct or indirect subsidy at the expense of other modes.

Participants identified implementation issues or con-

straints that included long lead times, availability of funds, differing objectives, labor relations, effectiveness measures, monitoring techniques, institutional constraints, unexpected change, uncertainty, and categorical funding. Two new implementation techniques were cited—incentive-penalty provisions and planner-implementer teams. Only two new professional skills that are not widely found at state transportation agencies were identified—knowledge of transportation industry operations and of financial analysis.

The effect of alternate futures on implementation was also discussed. The significance of future events and conditions could more appropriately be dealt with in terms of plan contents and contingencies. However, two areas of impact on implementation are delays induced by declining real incomes and needed flexibility to cope with heightened uncertainty stemming from deregulation. The group concluded that new information needs are more relevant to planning than implementation.

Roles of Governments and Private Companies in Planning

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B. E. Cannon
D. Dees
A. Della-Valle
M. R. Lehr
P. Cordelle-Reeh
T. Watson

SUMMARY

This workshop was charged with addressing the question, "How can plural governments and private companies contribute to the preparation of a statewide transportation plan?" In responding, the participants offered the following recommendations:

1. All states should consider revamping their existing citizen-participation process to the extent necessary to allow participation of different groups in an open planning process.
2. All states should involve all necessary groups and individuals in the early development stages of state transportation plans or shorter-term plans and programs of projects.
3. All states should investigate and implement the use of multimedia presentations and techniques as part of their approach to information dissemination and response to the public.
4. A synthesis ought to be completed of existing and available techniques to obtain input data from transportation providers and users in the private and public sectors.
5. An inventory should be compiled of existing methods and techniques that states use to involve different sectors in developmental, advisory, and review roles. It should include an analysis of how each was successfully implemented.
6. Training of transportation personnel should be provided to enhance their interpersonal skills, group dynamic techniques, and knowledge of political structure in different functional roles or meeting situations.

COMMENT

In order to deal with the question of what contributions governments and private companies can make to transportation planning, the workshop participants first developed two basic definitions to help focus their discussions. First, "plural governments" refers to the array of state agencies, boards, or commissions. Second, "private companies" connotes all private, nonprofit, or profit-making entities. Based on these definitions, it was seen that the contribution to the preparation of a statewide transportation plan by any of these groups implies a shift or change from the traditional citizen-participation process—the first of this workshop's conclusions.

Citizen Participation

The citizen-participation process was developed in the 1960s and early 1970s in partial response to the need for public input to decision making for public works. This was particularly true as the first modal or statewide transportation plans were being developed.

Public response to this input process was predictable. Many individuals expressed concern over proposed projects or elements of a plan that directly affected or negatively impacted their neighbors, businesses, or other resources. Opposition was recorded at public hearings to planning efforts thought to have been developed in a vacuum. Others expressed confusion in attempting to read and interpret the entire scope of the plan. Modal or statewide transportation plans covered very broad goals and objectives and, at the same time, attempted to be program and project specific. The massive size and number of complex issues and interrelations dealt with in these plans overwhelmed much of the public; ultimately, the plans were perceived as unorganized and incomprehensible. The sophisticated analytical techniques and methodologies available at the time added to the confusion.

These problems in early citizen participation were augmented by similar concerns from transportation consumers and providers, both public and private. These groups felt left out of the planning process or maintained that data and information they had provided had not been fully used in the decision-making process.

States also encountered problems with the citizen-participation process. The major problem was a lack of experienced staff to conduct formal public hearings. Another was the selection of an adequate process or procedure that would accommodate the variety of substate jurisdictions, that is, local, county, regional, or special districts, and the private sector. The use of hearing results in plan revisions and adjustments represented another obstacle.

The problems experienced in the implementation of citizen-participation requirements, mandated in recent legislation, provided the impetus for some states to reexamine their use of the process—specifically, who the participants were, when they were to be involved, and how they were to be involved. This reexamination was completed during a period when the emphasis and structure of statewide transportation planning process were also changing.

Involvement and Changing Roles

From early experience with the citizen-participation process, it became apparent that the involvement process was a multifaceted phenomenon. The process prompted response to plans developed by public-sector representatives from other public-sector entities (federal, state, and local officials), private-sector enterprises and institutions, and the general public. The type of information and comments presented at public

hearings on statewide transportation plans exposed a variety of capabilities and talents that had yet to be explored. For instance, a cross section of hearing participants could be convened to assist in the development of future statewide transportation plan updates or modal plans. Specific segments of the private and public transportation providers could be used as information and data resources. Similar to the developmental role, a role for advisory participants was possible also.

Participation: New Approaches

In looking more closely at various state approaches taken to deal with citizen participation in transportation planning, the group discussed a paper written by Neil H. Wilson and Bruce E. Cannon of the Federal Highway Administration (see TRB, Transportation Research Record 710, 1979, pp. 7-14). It took note of new approaches to citizen participation in four states—Arizona, Iowa, Louisiana, and Minnesota.

Arizona

As part of the early development of Arizona's statewide transportation plan, the Arizona Department of Transportation (ADOT) organized and scheduled 19 workshops in 18 cities. The plan, entitled Arizona Transportation Directions, provided background information about the transportation systems in the state and gave some indication of growth in demand for transportation.

After completion of the plan, a multimedia campaign was launched that included more than 2000 letters of invitation, 1000 phone calls, 1500 posters or flyers, 50 press releases, and numerous spots on 25 radio stations. The multimedia approach produced approximately 800 participants at the workshops from all walks of life.

The structure of the workshops varied significantly from the usual public-hearing process. ADOT personnel began each workshop with an overview of operating procedures for the session and the planning document. This was followed by a slide presentation of the plan and the variety of alternatives it offered. The participants were divided into informal discussion groups. The discussions of each group were summarized before the entire workshop, and the taped sessions were reviewed and used as input to delineate the issues and directions of future transport systems in Arizona.

Iowa

A significantly different approach to participation in the statewide transportation planning process is a continuous front-end and open citizen-participation process implemented in Iowa. This process resulted from a recommendation made in Iowa's 1976 Statewide Transportation Plan. During the development of that plan, three statewide advisory councils were created to advise and recommend direction, structure, and implementation of transportation programs.

Iowa has 10 regional citizen advisory councils throughout the state. Some 950 participants from numerous career fields meet bimonthly in these groups. They provide input on all aspects useful for transportation decision making, including a review process for the five-year transportation improvements program.

Louisiana

Another procedure for citizen involvement, which addresses a totally different aspect of the multidimensionality of transportation decision making, has been instituted in Louisiana. Although this process is limited at this time to highway planning and programming, it provides a creative technique to educate, communicate, coordinate, and establish priorities among jurisdictions, citizens, legislators, and highway transportation specialists.

The structure of this citizen-involvement process hinges on legislation that defines roles for the Louisiana Department of Transportation and Development (LDOTD) and the state legislature's Joint Committee on Transportation, Highways, and Public Works. LDOTD prepares the usual highway needs evaluation, project priorities, and preliminary construction program. The joint committee examines the LDOTD information and plan, conducts public hearings, receives review and comment, recommends changes, prepares necessary legislation in accordance with comments, plan review, and availability of funds.

During this process, LDOTD staff answer technical inquiries from both participants and legislators. This process allows any individual to comment, advise, and assess highway projects in the area where construction is slated. It also permits different dimensions of public- and private-sector decision makers and those positively or negatively impacted by a project to achieve consensus.

Minnesota

A multiphased approach to public involvement has been taken by the Minnesota Department of Transportation in the development of its statewide transportation plan. The state's approach contains aspects of approaches taken in Arizona and Iowa.

The first phase of the state's effort concentrated on the development and identification of transportation problems and issues as perceived by the public. The retrieval of this information, which represented the basis and starting point of the plan, was accomplished by mailing 2500 letters to all sectors of society, through statewide public hearings, and through requests for information from the general public. From these responses, some 400 issues were identified, and 12 major policy areas of concern were consolidated and published.

Phase 2 required development of background data, analysis, issue papers, and policy alternatives. These analyses and policy alternatives were fed back to the regional advisory task forces for review, project identification, and ranking of project selection criteria.

Phase 3 focused on the drafting of the statewide transportation plan, public review, regional task force response, and public meetings.

Expanded Participation: Panacea or Bust

Early use of citizen participation through public hearings, mandated by law after plan completion, had some serious flaws. However, the process continues in most states as well as substate jurisdictions. In this era of serious public questioning of government, its size, obscurity, and inaccessibility, it is anticipated that citizen participation will become a question of increased importance. One significant determining factor affecting the future of citizen involvement is that transportation environment is changing so rapidly. As a result, 20-year statewide transportation plans may be obsolete; they may have to be supplanted by shorter-term program plans of 5-10 years. In turn, these plans may include project programs of 1-5 years.

Regardless of whether a statewide transportation plan or a series of shorter-term plans and project programs is attempted by a state, an expanded citizen-participation or involvement process can and should produce a higher-

quality, more acceptable, and more credible product. Achieving these attributes requires an open planning process that begins with citizen involvement. It also requires the development of transportation alternatives and options that allow for trade-offs. Open planning, citizen involvement, and alternatives analysis should result in better information for all decision makers as well as fewer plan revisions and better staff allocation.

Although, at the same time, public credibility, accessibility, acceptance, and product quality may attain new levels, the open planning process and front-end citizen involvement impose substantial risks and costs. First, organizational and short-run costs for personnel, travel, and plan development time will exceed those for the traditional public-hearing process that occurs after plan completion. Second, given the significant variations in state modal responsibility, geographical location, and organizational structure of substate jurisdictional authority, open planning and front-end citizen involvement may present numerous political and interactive hurdles.

Finally, the methodologies and techniques of interactive group dynamics remain an emerging art. This represents a substantial risk or potential for failure of any citizen-involvement effort. It will require training of existing staff or hiring new staff with the necessary skills to effectively implement involvement of the advisory, developmental, evaluative, or informational roles of all potential participants. Beyond the selection of any or all roles in the process, state personnel must be able to shift from multimedia presentations to opinion polls to provision of hot-line response networks in order to achieve an acceptable, credible, and implementable plan.

Institutional Obstacles to Implementation

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SUMMARY

The need for a federal and state transportation policy framework for decision making to overcome the lack of a mechanism or mechanisms for resolving policy conflicts among various federal agencies, goals, and directives represented one of the three major recommendations of this workshop. The second revolved around the need for short-range comprehensive programs (SRCPs) to include capital and noncapital programs, as well as economic policy and performance objectives to (a) lay out programs for all modes, (b) simplify procedures and reduce document submittals by states to the federal government, and (c) address the problem of resolving conflicts created by new policies in relation to already established ones. The third recommendation stressed that legislative participation and leadership are essential to the planning program and to the success of implementation.

COMMENT

Initially, members of this workshop on institutional obstacles to implementation agreed that the 1974 Williamsburg Conference report on the role of the planner and the process of policy planning is still applicable and then began a current analysis of the issue.

The federal government in all its complexity is a microorganism of interests in the rest of the country. For example, in transportation, the Federal Highway Administration represents those groups interested in highway improvements, and the Urban Mass Transportation Administration represents the groups interested in transit improvements. Often there is a conflict between the goals of these two groups. In another example, Congress sets safety principles in legislation; ideally, these principles are not in conflict. However, agency regulations and administrative procedures may cause conflicts. Although the principles of providing increased mobility and reducing air pollution may be viewed as not in conflict, administrative actions to control air pollution may have as a conflicting goal the stopping of new highway construction. Participants in this workshop found that generally a mechanism is lacking for resolving such policy conflicts among the various federal agencies.

The federal government does many things well (e.g., collect taxes, raise issues, and distribute funds to needed programs). But it has difficulty in resolving at times conflicting goals inherent in specific projects. Therefore, participants urged that conflicting goals and interests related to transportation projects should be resolved at the lowest level of government where such projects can be implemented.

Both short- and long-term improvements could be made in the process. In the short term, as a technique for implementation, legislative participation and leadership must be obtained, and appropriate ways must be developed to involve the legislature so that it may contribute constructively to planning and implementation. Also, throughout the process there should be participation from all groups, organizations, and individuals who would be in any way involved or affected by the program. Efforts should be expanded to ensure such participation.

A term other than "statewide transportation planning" ought to be used, and "state transportation: issues and actions" or "state transportation: issue analysis and problem solving" were suggested. The purpose of the name change would be to avoid the use of the term "planning"—a term viewed negatively by some individuals and groups. Furthermore, the "product" is not a plan in the true sense of the word.

A statement on where both state agencies and the U.S. Department of Transportation are going and on what each agency needs is highly desirable. Therefore, an annual SRCP at both state and federal levels was recommended. The SRCP would include capital and noncapital programs, as well as economic policy and performance objectives. The relation between state SRCPs and federal SRCPs will have to be worked out. It is important to note that the SRCP would lay out all programs for all the modes—highway, rail, water, transit, and air—and should be used as an opportunity to simplify procedures and reduce document submittals by the states to the federal government. The SRCP would directly address the problem of resolving the conflicts of new policies in relation to established "process" policies at the federal level. This would provide the tie between stated presidential policies, such as on urban policy and ongoing federal programs. Such an approach would also help to resolve policy conflicts among the various federal agencies.

Research needs related to both short-range and long-range planning were identified:

1. Assess the range of transportation issues,
2. Determine the most appropriate level where gov-

ernment decisions need to be made, and
3. Determine if changes are necessary in the locus of decision making—for example, decision authority.

Participants stressed the need for a federal and state transportation policy framework for decision making. Policy planning and analysis should be responsibilities of the executive branch at the federal and state levels in order to avoid conflicting agency goals and directives such as those on and related to energy policy, air pollution, and mobility. To achieve this, the group recommended the following:

1. An appropriate summary of this conference should be transmitted to the appropriate congressional committees;
2. The steering committee for this conference should develop an appropriate mechanism for exchanging views with congressional staff;
3. A summary of this conference should be transmitted to various associations to carry out an independent follow-up of the conference's recommendations; and
4. In organizing future workshops with policy implications, specific steps should be taken to involve congressional members and their staff.

Two issues with implications for the future were identified. First, the U.S. Department of Energy's actions and energy concerns were not viewed as causing fundamental changes in the short run, but there is some uncertainty on the extent of their longer-term impacts. Second, deregulation's impact is viewed with some doubts by the states. They see that the impact will depend on the course of deregulation and speed at which it comes about. In connection with deregulation, the states were advised to try to understand the railroad industry's corporate plans and to be prepared to assume new responsibilities in their statewide transportation planning process. For example, depending on the service provided by the railroads, or that is not provided in the event of railroad abandonments, varying highway improvements would be needed to interface with a new restructured rail system.

Part Five

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