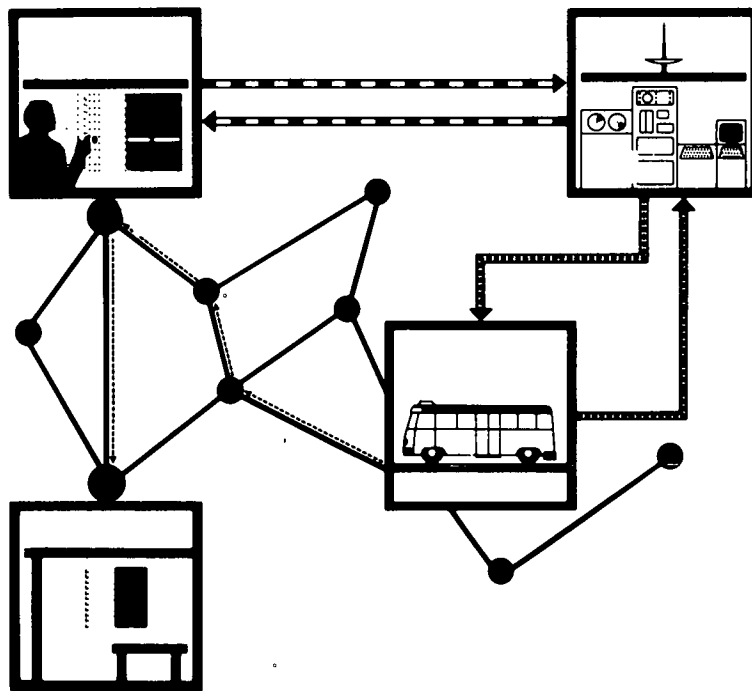


Special Report 196

Urban Transportation Planning in the 1980s



Transportation Research Board
National Research Council

Urban Mass Transportation Administration
Federal Highway Administration
U.S. Department of Transportation

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1982

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Special Report 196

Urban Transportation Planning in the 1980s

Proceedings of a Conference on Urban Transportation
Planning in the 1980s, November 9-12, 1981, Warrenton, Virginia

conducted by the Transportation Research Board
and
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The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competence and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

The views expressed in this report are those of the authors and do not necessarily reflect the view of the committee, the Transportation Research Board, the National Academy of Sciences, or the sponsors of the project.

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Foreword

The nature of urban transportation planning has changed more during the last 5 years than in the preceding 25. Only a start has been made, however, on the development and dissemination of planning techniques and methods that reflect these changes. As the social and economic settings for urban transportation evolve, so do the statutory and regulatory requirements that dictate the daily activities of planners and the technical methods by which transportation analysis is conducted. Emerging requirements for transportation planning are complex. They reflect changing federal budget priorities; shifting roles for state and local governments; changing social and demographic patterns in American society; and emerging new insights about energy and the environment, transportation technology, and transportation research.

Discussions are needed among government officials, transportation planners, consultants, and academic experts who have considered emerging problems and have recommended both technical and institutional responses to them. To provide a forum for such discussions, the Transportation Research Board (TRB) was invited by the Urban Mass Transportation Administration (UMTA) and the Federal Highway Administration (FHWA) to convene a conference on urban transportation planning in the 1980s.

Such a conference attracted more than 120 experts on transportation planning who met at Airlie House in Warrenton, Virginia, November 9-12, 1981, to discuss possible improvements in urban transportation planning procedures, methods, and policy. The emerging role of the private sector—as a financier or supplier of transportation services—in the transportation planning process, while noted in several presentations, was not an issue explored at the conference. The conference proved especially timely because it took place while UMTA and FHWA were conducting a comprehensive review of urban transportation planning policy and regulations. The participants were charged with the responsibility of identifying and discussing

1. New requirements for urban transportation planning in light of shifting federal, state, and local needs and responsibilities;
2. Technical procedures and methods that have proven appropriate in meeting emerging requirements; and
3. Research needs in light of the new requirements for transportation planning.

The conference began with a wide-ranging panel discussion on evolving relationships among federal, state, and local governments and their implications for the future of urban

transportation planning. Senior federal, state, and local officials participated, as did experienced consultants in the field of urban transportation planning and management. The presentations by the panelists (see Part 2 of this report) challenged the participants (a) to consider the appropriate roles of federal, state, and local organizations in an era of fiscal austerity and (b) to question the appropriateness of existing regulations and organizational structures for transportation planning.

Three resource papers (see Part 3) by technical experts offered observations on the methods of transportation planning as they have evolved over the past 30 years. One stressed the basic strengths and continued relevance of existing urban transportation models, another posed a new paradigm for planning based on a critical analysis of past experience, and a third focused on ways to make transportation planning techniques more responsive to recent social, economic, and demographic trends. These papers, presented prior to the start of the workshop discussions, served as background material and enhanced the conference's central themes.

The central themes of the conference were addressed in five workshops. These workshops considered

1. Long-range regional transportation planning;
2. Project planning—evaluation of alternatives and impacts;
3. Planning for transportation management and operations;
4. Planning for financing, implementation, and evaluation; and
5. The future of the urban transportation planning process.

Each workshop assessed the efficacy of methods and practices, now widely employed, and discussed policy innovations and immediate methodological changes that might improve urban transportation planning. In addition, each group considered research needed to produce planning techniques and practices suited to the problems of the 1980s. The participants formulated recommendations (see Part 1) regarding potential improvements in transportation regulations and practice, as well as methodological requirements for transportation planning. These recommendations are made with the approval of the Steering Committee to Develop the Conference on Urban Transportation Planning Methods.

Despite the diversity of backgrounds of the participants and the varied workshop topics, the workshop reports (see Part 2) made at the closing plenary session of the conference indicated that there was general agreement on appropriate future directions for urban transportation planning.

**Part 1:
Summary of
Findings and
Recommendations**

Conference Findings and Recommendations

Many issues of general concern on which there was substantial consensus among the conference participants are reflected in the findings and recommendations summarized below. These issues are elaborated on in the reports of the workshop that appear in Part 2.

ALTHOUGH THERE IS A CONTINUING NEED FOR URBAN TRANSPORTATION PLANNING, SYSTEMATIC PLANNING SHOULD NOT REQUIRE THAT THE SAME METHODS AND PROCEDURES APPLY AT ALL LEVELS OF GOVERNMENT, AT ALL TIMES, AND IN ALL PLACES.

The need for systematic urban transportation planning remains as great as it has ever been—especially in order to maximize the effectiveness of limited public funds. This is true at the regional level and is emerging as an even stronger need at subarea and corridor levels. The fact that the nature, scope, and administration of the planning process can vary according to the characteristics and needs of the community must be recognized.

Planning in areas of growth does not need to resemble that taking place in areas of stability or decline. At the same time, similar technical or methodological approaches might be appropriate in several cases, but administrative arrangements could differ. Planning for projects that span many units of government may employ approaches that differ from projects entirely within one jurisdiction. For example, the planning of physical facilities may be central in some urban areas, but issues including financial management, maintenance, and operations planning may be more critical in others.

FEDERAL TRANSPORTATION PLANNING REQUIREMENTS SHOULD BE STREAMLINED AND, WHERE POSSIBLE, THE FEDERAL ROLE SHOULD BE TO PROVIDE FLEXIBLE GUIDELINES RATHER THAN STRINGENT REQUIREMENTS.

The federal government has been the leader in fostering sound urban transportation planning. However, transportation planning regulations have proliferated over the years to the point where they have become expensive and time-consuming to implement, restrictive, and at times difficult for state and local governments to administer. The federal government should continue to have a central role in urban transportation planning in order to assure that decisionmakers at all levels have the necessary information to make transportation investment choices. Nevertheless, that role should be tailored to the diverse planning needs of the 1980s.

To accomplish this task, federal policies should state national goals and require transportation planning. The regulations, however, should be streamlined and flexible enough to permit a variety of planning styles, emphases, and levels of

detail. To help achieve local control over planning, many of the current federal planning regulations should become advisory guidelines rather than remain as formal regulations. Although concerns for efficiency, environmental protection, and equity should be explicit in national policies for transportation planning, states and regions should be equal partners with the federal government in designing the specific requirements that must be met to ensure the attainment of these goals.

THE THRESHOLD POPULATION SHOULD BE RAISED FOR URBANIZED AREAS FOR WHICH COMPREHENSIVE TRANSPORTATION PLANNING SHOULD BE MANDATED.

An urban transportation planning process should be mandated, as it is today, in urban areas that exceed a stated threshold population. The minimum population of an urbanized area in which comprehensive, coordinated, and continuing transportation planning is required should be increased from the current level of 50,000 to a larger population—perhaps at least two to four times the current minimum level. Such an increase would recognize the differences in the planning process required for a small-sized versus large-sized area.

A REGIONAL FORUM SHOULD BE REQUIRED FOR TRANSPORTATION PLANNING AND PROGRAMMING, BUT PRESENT REQUIREMENTS REGARDING THE ROLE OF THE METROPOLITAN PLANNING ORGANIZATION ARE UNDULY RESTRICTIVE.

A regional forum should be required to oversee and participate in urban transportation planning in every urbanized area that exceeds the threshold population to ensure that regional investment decisions are coordinated and supportive of common goals and objectives. Current specifications for the role of metropolitan planning organizations (MPO) should, however, be made more flexible. In some cases, cities, counties, states, and other bodies of government should take the lead role in defining metropolitan transportation planning needs. In general, the organization with the lead responsibility for implementation should also take the lead in organizing the transportation work program.

CERTIFICATION OF THE URBAN TRANSPORTATION PLANNING PROCESS SHOULD BE RECONSIDERED.

Federal certification of local transportation planning organizations should be subject to periodic review on a less frequent

basis than is currently the case. Certification should be for a longer period of time or perhaps should continue until a specific decertification action is taken.

LONG-RANGE PLANNING SHOULD BE STRATEGIC AND NOT ORIENTED SOLELY TO SPECIFIC FACILITIES.

Long-range planning of transportation systems, as it is still practiced, largely reflects the focus on completing regional networks that was critically important during the decades following WWII. The need still exists for longer-term planning for a time horizon of more than 10 or, perhaps, 20 years. But, to a greater extent than in the past, long-range transportation planning will be "strategic" rather than facilities-oriented.

Strategic planning involves anticipation of major shifts in demographic, social, and economic conditions, and the development of appropriate strategies for addressing changes in transportation that would follow from alternative futures. The requirements for strategic planning should be determined locally as to the level of emphasis and should not be federally mandated.

FACILITIES PLANNING SHOULD BE CONDUCTED OVER A SHORTER TIME HORIZON THAN IN THE PAST AND SHOULD PLACE GREATER EMPHASIS ON THE MAINTENANCE AND RECONDITIONING OF EXISTING FACILITIES.

Systemwide transportation facilities planning should be permitted to take on a diversity of styles in different jurisdictions to account for the differences in problems and conditions. It should be federally mandated to serve at least as a process for systematically testing the appropriateness of major components of the Transportation Improvement Program (TIP). The time frame for which facilities plans are drawn should be flexible, but in general it will be based on a planning horizon of between 5 and 15 years as contrasted to the current long-range focus in excess of 20 years. In rapidly growing communities, facilities planning may appropriately emphasize expansions of capacity and service to developing communities. In stable or declining communities, however, facilities planning might appropriately emphasize reconstruction, rehabilitation, and maintenance of the aging transportation infrastructure.

LONG-RANGE PLANNING SHOULD INCORPORATE GREATER ATTENTION TO COSTS AND FISCAL MANAGEMENT.

Long-range transportation plans should be more responsive to local political concerns and should include increased attention to long-range financial feasibility and life-cycle program costs, including the cost of maintenance and operations. To a greater extent than ever before, long-range planning for maintenance, operations, and finance should be of central concern to transportation planners.

PROJECT PLANNING SHOULD BE CONDUCTED BY THOSE WHO HAVE THE RESPONSIBILITY FOR IMPLEMENTATION, AND THE SCALE OF PROJECT PLANNING SHOULD VARY WITH THE COMPLEXITY OF THE PROJECT.

Project-level planning includes the development of sufficient information about the feasibility, costs, benefits, and environmental effects of alternative transportation improvements. Effective project planning leads to informed decisions about whether and how to proceed with implementation. For this reason, the project planning process should be guided by those who have the decisionmaking responsibility for implementation, along with all parties who are likely to be significantly affected by any of the probable outcomes. Furthermore, the level of effort devoted to project planning should be governed by the complexity and scale of the project rather than by a set of uniform requirements.

CERTIFICATION ACCEPTANCE PROCEDURES SHOULD BE APPLIED TO PROJECT PLANNING TO SIMPLIFY THE FEDERAL REVIEW OF TRANSPORTATION PROJECTS.

Although technical methods currently in use for project planning are generally adequate, serious problems exist with administrative procedures and regulatory requirements that result in a much too cumbersome and time-consuming process. One of the principal problems involves overly detailed and restrictive federal requirements and very long review processes. Federal regulations that govern project planning should be streamlined and made more flexible. Certification acceptance procedures should be applied to project planning. Authority should be delegated to those agencies that can demonstrate the ability and the willingness to conduct the project planning process in a manner fully consistent with the National Environmental Policy Act and applicable regulations.

ECONOMIC, FISCAL, AND PRICING ISSUES SHOULD BECOME MORE CENTRAL IN URBAN TRANSPORTATION PLANNING.

Greater sophistication is needed in methods for forecasting tax revenues and their relationships to general economic conditions and fuel prices. Similarly, the analysis of transportation prices should take into account many more factors than the simple elasticity relationships used in the past. The economics of labor contracts, the cost of money, variations in consumer price indexes, and changing construction costs are among the important subjects that should be addressed by transportation planners in analyses of pricing and taxation policies. New approaches to the funding of capital and operating costs are also required, including private-sector involvement.

DURING THE 1980s, TRANSPORTATION PLANNING SHOULD GIVE INCREASED ATTENTION TO SYSTEM MANAGEMENT.

New roles are emerging for the transportation planner in the management and operation of transportation systems. During

the 1980s, transportation planners should play a larger and larger role in operations planning, marketing, financial management, safety management, human resources planning, performance monitoring, management accounting, ridesharing, goods movement, and other newer concerns of mobility and the existing transportation system.

GOOD MANAGEMENT AND FISCAL RESPONSIBILITY REQUIRE THAT GREATER ATTENTION SHOULD BE PAID TO THE REVIEW AND EVALUATION OF COMPLETED AND ONGOING PROJECTS.

Greater public cost consciousness requires continuing reassessment of completed projects and ongoing services. Evalu-

ation methods are needed that are likewise ongoing, pragmatic, and understandable and that provide a feedback loop in the programming cycle.

TO MEET CHANGING NEEDS, THE FEDERAL GOVERNMENT AND TRB SHOULD PLAY CENTRAL ROLES IN EDUCATIONAL PROGRAMS AND INFORMATION DISSEMINATION.

To be responsive to the emerging diversity of transportation, federal transportation authorities and TRB should play more direct roles in the continuing education of transportation planners. New methods should be disseminated rapidly, and practitioners should be continually engaged in educational and training activities.

**Part 2:
Panel and
Workshop Sessions**

Evolving Federal, State, and Local Relationships: The Future of Urban Transportation Planning

Several perspectives on the future of urban transportation planning were presented at the opening session of the Airlie House conference. These were to serve as a backdrop for the detailed discussions to follow in the five workshops and are summarized below.

Thomas B. Deen, TRB Executive Director, noted in his opening remarks that "this meeting has a kind of combined focus—policy on the one hand and technology and methodology on the other. The conference's purpose is threefold: to identify new requirements for planning, given the shifting roles of the various levels of government; to identify those processes, procedures, and methodologies that work, so that we can share them; and, finally, to identify gaps in any of these areas."

Deen observed that "the changes in the planning process that we see going on today really are commonplace to all of the professions in many ways. The current transition will set the future pattern of this process for future decades. . . . The current trend of less federal involvement in the planning process should be viewed as a positive step in the evolution of transportation planning."

Deen pointed out the trends occurring to compel change—

tight budgets, less demand for new construction in some areas of the country, and more emphasis on keeping the existing system in operation. He said, "We are going to have less systems planning than we have had in the past, certainly less than we had in the 1960s and 1970s. We may have the use of computers more than we have seen in the past, although I do not think they will be aimed at long-range projects as has been the case so far. There will be a much greater focus on management planning and the delivery of improvements to existing facilities and services as opposed to planning new ones. There will be a more outward focus to planning, with less attention being paid to esoteric models, and greater attention being paid to communications of plans and programs to the administrative and legislative arms of the government and to the public."

Deen continued, "A greater emphasis will be placed on the role of the private sector and working with state and local government planning agencies to develop cooperative programs. This latter aspect still has to be tested and tried throughout the country, but there are some indications that this involvement is beginning to occur."

Panel Presentations

Francis B. Francois, Executive Director of the American Association of State Highway and Transportation Officials, served as the moderator of the panel discussion on the roles of the various levels of governmental involvement in the transportation planning process. In his opening remarks, Francois stressed the point that "if there is one characteristic of this nation, it is change."

"Transportation changes also. As we see changes between regions of this nation and as we see change within regions, transportation is a key element to what occurs. We see changes in transportation every day. For example, the railroad system of this country, once the basic transportation network, is now a shadow of its former self. Readjustments are being made in the Northeast to the problems of Conrail. Further abandonments are occurring, which means additional highway traffic, which then means movement, in some instances, of businesses and workplaces from one area of the country to another."

The status of the nation's public transportation, Francois noted, has changed "from a thriving private industry to a

government industry. It has changed in the nature of its vehicles, in what it does, in where it runs, and in the amount of money that it costs to operate. Our highway system has changed dramatically over the years, and we have built in the last 20 years one of the most awesome highway networks anywhere."

The question before planners and others now is, Francois observed, "How do we utilize it in the future, what do we do with it, and how does it accommodate these other changes we have been talking about?" Francois pointed to the kind of growth being experienced in this country and resulting changes in its location, the mix of households, jobs, and other factors. He also emphasized that there must be an accommodation to change.

Francois observed, "We have changed because of energy problems, we have changed because of the resultant mixes in our automobile fleet due to that energy problem. We have changed in how the responsibility of the private sector toward transportation is viewed, that is, more and more involvement of the private employer in public transportation, which means new things in transportation and new problems for all of us."

A basic question for this panel and this conference to consider is, Francois stated, "Do we still need transportation planning? We must somehow relate all of these changes to each other, interrelate the things that are happening, and, in the process, devise an effective transportation network. At the same time, we must also ask if all the regulations that we have built up around transportation planning are necessary."

In concluding Francois said that "the transportation issues before us are not too dissimilar from the old classic phrase of what it takes to be a good newspaper reporter, the 5 W's—Who, What, Where, When, and Why." Francois then charged the five-member panel to consider some of these factors from the perspectives of their activity and experience in urban transportation planning. Their comments are summarized below.

Ray A. Barnhart
Federal Highway Administration

This country voted in 1980 for a change in the way the government has conducted its business.

I believe that we in Washington are responding by significantly redefining federal responsibilities and carefully examining federal relationships with state and local governments. I have said it before all over the country, and I say it again now because I believe in it and I believe it must be one of our guiding statements, that control over local issues belongs at the local level and not in Washington, D.C.

So, we at FHWA are attempting, to the extent permitted by the Congress, to return authority and responsibility to state and local governments in those highway matters that are predominantly of local interest. Federal involvement will be curtailed or eliminated in areas in which the benefits of federal activity do not justify the intrusion of federal requirements or where the federal interest is questionable. In short, national significance and Congressional direction will be the criteria used to determine the extent of FHWA involvement.

In addition, beyond defining what is the federal responsibility, we will do everything possible to reduce the red-tape burden that you have had to cope with and minimize the delay that state and local agencies have experienced in trying to get transportation improvements implemented.

Beyond that, FHWA believes that the Interstate highway system must be completed and that we must rehabilitate those older sections now in a serious state of deterioration. Therefore, we will expand the 3-R program to include a fourth R—reconstruction.

Our continued involvement in the primary system and the bridge programs is also high priority. I also see the continuation of FHWA involvement in planning assistance to state and local agencies in carrying out their responsibilities.

We have produced legislation that would provide for some \$46 billion over the next 5 years to the Federal Highway Aid Program. Both Houses of Congress have introduced their own legislation. The House of Representatives has already passed a 1-year bill that essentially re-authorizes existing federal aid programs and the change in definition that we have requested.

The Senate's multiyear bill has been reported by the full committee. However, the Congressional response to the FHWA program has not been overwhelming and has not em-

braced all of what was requested; both bodies have retained the federal aid urban and the secondary programs. In our bill these were to terminate after 1983.

Such continued involvement, however, is not inconsistent with the current philosophy of government, which says that the federal level should be involved only in those matters that are beyond the abilities of local governments to resolve or that are in the broader national interest.

What are the likely impacts of this shift of responsibility and authority back to the state and local governments? It seems obvious that planners will be called on to make increasingly difficult choices among the various alternatives that you can consider. New directions and innovative solutions are needed, obviously, to meet the shortfall of funds. Planners are going to have to look for alternative providers for many services and new sources of revenue. With control comes responsibility and it will take ingenuity and foresightedness in trying to cope with the massive problems that we face.

Certainly the strength of the transportation system in this country rests in its diversity, in having a choice. With money in short supply, we will have to concentrate our spending on those elements that are most cost-effective in order to increase transportation capacity.

Can we afford to have the federal government fund the increasing cost of transit capital and operating costs? Can we continue to afford to build thousands of miles of costly new highways under the same laws and practices that were set back in the fifties? Certainly we will have additional capital improvements that are necessary and must be made. But alternatives and innovative solutions are going to be the call of the day.

Transit will continue to serve a most important transportation need, especially in the urban areas, and support for untraditional transportation services such as ridesharing and paratransit will become a significant part of our program and will have great interest and priority.

Utilizing federally assisted construction of HOV facilities, fringe parking, and ridesharing has gained new credibility as a legitimate element in efficient transportation systems. Like so many good ideas, it has been conceived in cooperation with the private sector. In the case of ridesharing, the private sector has managed to do what millions of dollars of federal funding and many reams of federal regulation have failed to do.

We do support ridesharing, we do support HOVs, and we will continue to insist on them in the various areas of this country. The federal government's role there should be to promote and to innovate, not simply to dictate. I do not see so much less federal involvement in the process as I do less federal intrusion and dictation about courses of action. To a very large degree it is going to be you who are in the planning area, you who are the professionals in this part of the industry, who will have the responsibility for laying the groundwork for unconventional ways of solving our transportation problems.

For too long we have been constrained by traditional thought within the highway community. It is time that we join hands and try to resolve the problems of transportation as they affect people and not seek to simply perpetuate one mode of transportation over another.

I believe that each mode has its legitimate function in our modern society. Whether transit or highway, rail, bus, vanpool, or some other private automobile mode, each has its legitimate function. FHWA will cooperate to concentrate on the

movement of people and not simply to protect a special interest.

It is clear that we must continue to emphasize HOV lanes and transit opportunity in urban areas. Certainly the ultimate funding will have to be found. In my estimation, there is nothing wrong in going to private industry, which benefits from transit and transportation facilities, to see whether they are willing to participate fiscally to make some of these transportation systems feasible. It has been done throughout this country and it is a logical cost of development.

The key to trying to find the answers is working together in a cooperative atmosphere of mutual support and I think we must do it, and I pledge to you, as Federal Highway Administrator, the FHWA will be doing its best to be responsive to you, but not to dictate. We are looking for answers, too, and so we have gone all the way by saying to you that we will eliminate the duplicative red tape that has denied your making progress in resolving projects and getting them off the ground.

We have gone through our priority reviews and have reviewed some 150 regulations. But we need your guidance. I would like to have the answer to what is the proper federal role in the planning process, how should the federal role relate to the states and the local communities? Are the MPOs legitimate creatures who should handle the planning process, or should they be subservient to those constitutionally created authorities called state and local governments? Those are some basic questions that I think must be resolved so that we might structure a program at FHWA to better respond to you who have the obligation of performance.

KENNETH TORP
Colorado Department of Highways

The subject at hand, which is urban transportation planning, is one that is topical for us in Colorado because the 1980 Census is bringing onstream new urbanized areas. We used to have four in Colorado, and we are going to have seven. So we have to rethink our approaches to transportation for such areas.

The key to good planning should be establishing a good rapport among the participating agencies rather than setting up a rigid process. There is an interim period between old and new federal regulations and guidelines, and it lends itself to flexibility in establishing a workable structure for MPOs.

I am heartened by the fact that FHWA feels that there is merit in simplicity, and this should not be overlooked. Toward this end, FHWA is currently seeking to minimize burdensome federal regulations.

The federal position on reorganizing regulations has been surfacing, and we are happy to see it from the perspective of the State Department of Highways in Colorado. Unnecessary red tape, detailed and prescriptive regulations, and the imposition of undue emphasis on federal policies not directly related to transportation must be eliminated.

The fundamental question facing us seems to be, What should be the scope of urban transportation planning? To answer this question, we need to focus on three cardinal areas. First, we need transportation plans that mesh with land use—with economic, environmental, and other functional plans. Second, we need various transportation modes to be broadly and cooperatively planned and that include capital investment, operations, and those transit system manage-

ment techniques that must be carried out in concert with each other. Third, we need state and local officials to plan in concert with citizen input. I think the officially coordinated aspect of urban transportation planning is essential.

A second question that we might ask is, What should be the appropriate level of transportation planning? Let me suggest that the Governor needs to decide where and how transportation planning is to be done, with the approval of affected local governments and with the review of the U.S. Department of Transportation (DOT) and subject, perhaps, to broad DOT guidelines that avoid requiring any specific institutional arrangements. I think that would streamline the process considerably.

Finally, what are the possible outcomes of a reduced federal role in urban transportation planning? The first thought is that there will probably be less planning and that such planning will be cost-effective. There would be a reduced focus on meeting federal requirements and more emphasis on matching our planning requirements with genuine state and local needs. We would have enhanced accountability. That is critical from my perspective. Furthermore, we would have our projects implemented more rapidly and in this economy that represents money, efficiency, and productivity. We would have improved state and local cooperation because we will no longer be able to blame the federal government for our problems.

The states need help in planning for the future, and I am not certain that our mindset about transportation planning is appropriate to the agenda of the 1980s. I think our assumption about transportation planning is that we have got to do something new, we have got to build something new, we have got to respond to growth and development in the cities and, therefore, we have to plan what to do.

Planning for the future is planning for declining resources, it is planning to do something smaller. It is planning to consume fewer resources and it is planning to do what is left as well as we possibly can in the public interest.

THOMAS M. DOWNS
District of Columbia
Department of Transportation

My comments perhaps will reflect the uniqueness of the District of Columbia, but they will also reflect some changing public attitudes about the nature of the transportation system. The public expected an improving mass transit system, they expected some improvement in air quality, and they expected us to provide for some optimum utilization of existing streets.

Each highway bill since 1970 has put increasing emphasis on these types of planning activities. Such emphasis, however, robs you of the resources to continue to make transportation system management (TSM) improvements because you are shifting away from large-scale capital programs.

We had made a suggestion at one time to the Senate that there ought to be a revised formula on PRPL money. It should put some kind of emphasis on person miles of travel in the area, a minimum floor level for PRPL—some indication of density of population and urban versus rural population. We also made the suggestion that planning research and systems management activities be eligible for funding from the entire federal aid highway program at state and local discretion, including the Interstate system. In other words, you could take

a portion of your interstate apportionment and put it into PRPL funds. The current 1.5 percent and 0.5 percent would become a base level for the program, with requirements to continue support for current funded organizations and jurisdictions, such as MPOs. States and urban areas would then have the discretion to increase their planning and research for a less capital-intensive solution as required by local circumstances.

Such a proposal is really a step, or at least I think it is, to a block grants program for the federal highway program, a direction wholly consistent with current Administration policy. It would mean that states and counties make trade-offs for allocating limited funds among planning management and capital projects, rather than that these projects be dictated by federal formulas in conflict with federal statutes and policies.

With the reduced funding levels we are facing today, all jurisdictions must meet growing transportation demands through better management of existing facilities and improved maintenance. Without planning support, these objectives cannot be met in urban areas where traffic generates approximately 55 percent of the highway trust fund revenues. That the District, at least, needs to continue the present level of planning research cannot be overemphasized.

Many people have made the assumption that they can leap to the federal role in planning without first addressing whether or not there should be a planning process in urban areas. I think there has to be an urban transportation planning process, at least in the larger urban areas where the population is more than 250,000. The planning process has to do the things that cannot be done separately. We have to have a mechanism to determine among ourselves the compatibility of our investments. For example, it does not do Virginia any good to plan a road for which the District will not provide the bridge capacity. It does not do any good to make assumptions about travel patterns that we are trying to reverse. In a complex urban area like the Washington Metropolitan Area, there is a need for a common data base on growth, land use, and patterns of travel and a forum to debate common local finance needs.

The urban planning process is also a home for specialized technologies and technicians that the local jurisdictions in the area or the states cannot either afford or do not wish to provide. Last, but not least, the process mechanism is a forum for disagreements. Without a metropolitan planning process, the Washington Metropolitan Area would never have come to grips with the construction of I-66 to the District boundary. The very existence of the urban transportation planning process ultimately allowed the local jurisdictions to come to terms with that investment.

More importantly, if there is a federal source of revenue, there probably are going to be some federal responsibilities that come with that revenue. There is a need for a federal role in determining the compatibility of the various federal investments that are made from the agencies within the DOT.

There is a need for a federal role in the development of methodologies in data processing. There is still a federal role, until the Congress changes the legislation, in air quality. There is still a federal role in energy efficiency in the transportation system as a national concern. There is still a federal role for nondiscrimination in the application of those funds.

In cities under 200,000 I am convinced that you have to have the maximum amount of flexibility, whether a city or a county wants to name itself the MPO. Somebody has to come to grips

somewhere in those cities between 50,000 and 250,000 with who is going to take some kind of lead in the transportation planning process—again, within some broad guidelines and with the maximum amount of flexibility in programming and the level of analysis.

There is a strong national need for urban transportation planning processes and organizations, a strong need to support them financially, and a recognition of what the proper federal role is.

PHILIP J. RINGO
ATE Management
and Service Company

Transportation, and particularly urban transportation, is at a major crossroads as we plunge into the 1980s. Even though I think there is a great deal of apprehension regarding the need to do "more with less," I feel that the environment that we are now entering into is in many ways healthier than the environment of the past 10 years.

From the transit operator's perspective, the experience of the past 10 years was in many ways far removed from reality. After a much needed stabilization of urban transportation systems throughout the United States, and an even more needed infusion of capital for new equipment and facilities, many transit operations embarked on what appeared to be an environment of almost unlimited expansion and growth. Money in hand, we proceeded to expand and improve service often without proper evaluation of the need and demand for such expanded service. We seldom questioned the long-range implications of increased dependence on federal subsidies and the impact that artificially low fares had on public perception and the economics of our operation. In all too many cases, we collectively did not apply sound management practices to the planning and design of our transit systems or the service pricing mechanism.

Swept up in this euphoria, we all invested time and money in projects that, in retrospect, should have received much stronger and more practical scrutiny. In the search for new solutions to this country's transit problems we discarded much of what we had learned over the past 50-60 years, and also seemed to delude ourselves that there was a magical solution, be it technological, managerial, or planning based, that would provide a miraculous cure for all of the ills of a very complex transportation problem.

The legacy of all this is, or should be, sobering. There are cynicism and skepticism at all policymaking levels regarding the ability of the transit industry to even place a reliable product on the street. Further skepticism and cynicism exist that rather than focusing on immediate practical problems, we collectively continue to search for the PRT, Hovercraft, or other Aladdin's lamp cures to the provision of urban transit in the United States.

Whether you agree or disagree with my assessment, let me try to relate what I am saying to the specific problems facing the transit operators over the next 18-36 months and try to relate those challenges to the specific planning needs of transit operators. Because of the proposed cutback in federal operating assistance, and because of the impact of increased inflation on a labor-intensive industry, most transit systems throughout the United States are faced with the prospect of

losing from 10 to 50 percent of their operating funds. Although there is a possible option of increased local and regional support for transit in place of federal subsidy, at ATE we are being asked on most of our systems to develop plans for reduction in service from 10 to 50 percent and for fare structure recommendations that will provide increased revenues with the smallest impact on ridership.

As a further requirement, we are rightly being asked to examine alternative forms of transportation, alternatives other than traditional fixed-route transit, with the hope that a combination of fixed-route service, taxi, vanpool, carpool, and other less traditional forms of transportation can provide a network that is able to respond to the broad-based mobility needs of the communities we serve.

These are the simple and compelling facts of life for a transit operator in the United States today. He or she must be able to respond in a rational way to major reductions in available resources. The days of free-fare demonstrations, crosstown route experiments, grid systems, PRTs, etc., are over.

Translating that into specific planning needs for the operator, I can identify four major areas of immediate planning need.

The first area relates to the fare policy and the general subject of user charges. There has been a great deal of research performed, but it is clear to me that a better understanding of the dynamics of fare policy applied to urban transit systems is a must both for the transit operator and the transit policymaker. For lack of such planning tools, I have seen too many systems recently suffer near collapse when poor planning has caused an increase in fare of 50-100 percent. I have also seen an almost total change in the traditional formulas that we as transit operators could apply with certainty to fare increases in the past. I have seen healthy debates regarding distance-based fares versus other forms of fare structure, but I have yet to see anyone pull together this knowledge into a coherent package that can be used at the operations and policymaking level. My suspicion, based on experience, is that a series of smaller incremental fare increases, tied in some manner to inflation, is a realistic and practical way to deal with the economics of transit in the 1980s. My further suspicion is that a two-tiered fare structure utilizing the appropriate fare marketing techniques is a way to deal with the question of transit-dependent versus choice riders. I think that many systems in the United States, in some cases by accident and by rational planning, put together fare policies and structures that are appropriate for the 1980s.

The second area is service design and evaluation. Although there has been substantial activity in this area—and in the case of service standards the development of some practical procedures and policies that can allow transit operations to make rational decisions—much more needs to be done. Transit systems and the planning sector must develop improved procedures for evaluating transit service and its impact on the urban environment. Service standards must be built on in terms of research, and a service planning product must be developed that will provide transit governing boards and operators with direction and that will give the general public the rationale behind service reductions and eliminations that are an inevitable result of the trends of the 1980s. Without these tools, transit will be faced with increasing political pressure to maintain unproductive service and will be able to provide few financial options.

The third area of concern is a combination of the first two. Transit operators and planners need to examine more closely the relationship between fare changes and service changes. In the 1970s, we usually dealt with these independently. Financial crisis meant either increase in fares or reduction in service. Now and in the future, we can expect that both of these will take place at the same time. In our experience, there are clearly trends and dynamics between these two factors that need to be understood, institutionalized, and incorporated into the planning process.

The fourth area of concern relates to the necessity to understand and develop a more cohesive network of transportation services. Although I think that transit operators have come a long way in acknowledging that there is life beyond fixed-route service, I will also tell you that I think none of us completely understands the interrelationship and potential dynamics that exist between fixed-route service and the other extremely important forms of paratransit service. For example, how can we best substitute vanpool and carpool operations when fixed-route service must be eliminated in an area? How is this best accomplished, and over what period of time and at what cost? Should fixed-route transit operations only attempt to provide service for certain trip lengths and within a certain limit of population density? At what point does a fixed-route transit system simply cease to work because of limitations on the frequency of operation? I happen to think that there are answers to these questions, and further believe they are ones that should be developed through a rational transit planning process.

In closing let me strike an optimistic note. For the first time in my memory, transit understands where it is going. It is going to have to make do with fewer resources, cannot look to a future of unlimited and unrealistic growth, and does not have the luxury of searching for esoteric and unrealistic solutions to problems that perhaps never even existed in the first place. However, I do think that over the past 10-15 years we have built a strong base from which to deal with this challenge.

ROYCE E. HANSON
National Academy of Sciences

Transportation planning ultimately is most effective when it is integrated into and a part of the overall planning process of a community that has a good planning process. Unfortunately, many of our regulations not only in transportation but also in many other areas are developed to deal with the worst case. We ought to be able to think about how we can handle the best case—or, at least, the median case—in a way that provides for a more effective, efficient, less costly process. If we recognize the validity of the comprehensive planning process where it meets those necessary federal planning requirements, we can shortcircuit a lot of wasted time and money, and we can get more for the transportation dollar that is available.

Local planning is often more comprehensive than the required transportation planning process is. It involves greater, more widespread, and more useful participation—or at least it can. It can provide a higher degree of political responsibility, and it can save time.

Where possible, state and federal plans, or the state and federal planning process, can and should be consolidated with the local process. Where it is not possible and if the planning

process can be certified or accepted by the state and federal governments as meeting the necessary federal procedural requirements, it ought to be allowed to substitute for that process.

In some cases, federal planning funds could be used through the state agency and through the MPO and the local planning agency very effectively and integrated with the process.

One very practical thing that we might do in seeking a new relationship between the federal, state, and local governments is that new locational studies should be precluded where there is an adopted master plan that meets federal process requirements.

Such process requirements might include that alternatives were seriously investigated and considered, that reasonable environmental studies were conducted, that federal environmental standards were respected and followed, that due process and participation of the public and important agencies were provided, that a decision was made based on all of the evidence, and that the decision is adequately explained either by the plan document or by the supporting record.

Another broad area to be dealt with is the change occurring in the character of our political perceptions. We were anticipating an upbeat economy, a very substantial rate of national growth, and a sense that there were really no limits to what the United States could accomplish if it set its mind to it. We are a little bit more cautious about that kind of judgment today, but at the same time there is a greater need, in a time of contracting expectations than in a time of expanding expectations, to think in long-range terms.

We are already seeing the problems that we have in not having thought through originally the depreciation of the system. Clearly, as we re-think the transportation financing process for all transportation facilities, long-term capital financing schemes need to include some kind of depreciation system so that we build into the financing network a way of replacing the system and keeping the system in good repair.

There is a great need for reliability in our incremental capacity to improve efficiency and to improve the capacity of the system, to support economic growth and change. Infrastructure and transportation in particular are key elements in the urban economy. In most of our already developed urban areas, transportation is now the most important part of the infrastructure.

A third area to examine is the movement in this country,

particularly at the local level, toward a much different form of planning than that that existed when we began the transportation planning process as a part of the federal requirements. Most of our local master plans were what I would call in-state plans. They painted a somewhat irrelevant picture of an improbable future. Generally, it did not quite make it. Planners and comprehensive planning agencies have begun to look at the whole process quite differently in the last 10 years. We are in an entirely new generation of planning, which is going to get more complicated and more sophisticated, at the local level in particular.

This is looking not only at land use but also at density and at facilities.

Planning is becoming a much more dynamic midrange exercise at the local level, much more integrated with all of the other facets that ultimately affect and are affected by the efficiency and adequacy of the transportation system. We are planning for both facilities and processes now.

We are also beginning to understand that the character of the city of today, and particularly the character of the city of tomorrow, will be much different than the cities we have assumed in the past and that, in many cases, have not developed.

With the decline of manufacturing as a part of the economic activity of the country in terms of number of people employed, and its relative decline even in terms of income produced, the growth of service industries means that the character of cities is taking on quite a different shape.

So, when you put together the change in the character of planning and the change in the character of cities, it suggests to me that it is even more imperative that transportation planning be looked at within the broader planning and development context.

Finally, the partnership between federal, state, and local governments has been expressed in almost every way possible. Everybody seems to believe it, but we have got to make that leap from faith to action. In areas such as transportation planning, in areas such as considering the future of our urban places, we still lack an integrated federal approach to the making of policy.

The concern and the interest expressed on some of the points raised here need to be translated into a new policy formulation process within the federal system, so that we can sort out some of these major questions of priorities, both at the national and at the regional level.

Workshop Summaries

The reports that follow were prepared by the presiding officers of each of the five workshop sessions. They summarize the principal highlights of the participants' examination of (a) long-range regional transportation planning; (b) project planning—evaluation of alternatives and impacts; (c) planning for transportation management and operations; (d) planning for financing, implementation, and evaluation; and (e) the future of the urban transportation planning process.

Long-Range Regional Transportation Planning

Gordon A. Shunk

The workshop on long-range regional transportation planning in the 1980s considered the time frame of regional transportation planning and prepared a list of recommended improvements in transportation analysis methodology to meet the anticipated needs. Discussions were organized to define the most important functions of a long-range or regional nature. Significant issues to be addressed by those functions were then identified, and important considerations and products for those planning efforts were specified. Needed improvements in current methods were then proposed along with necessary research and development.

The proposals of this workshop are especially important because of the broad constituency that is represented by agreement among the participants. Six each were from state departments of transportation and metropolitan planning organizations. Most of these agencies have been active leaders in long-range regional transportation planning. The other participants represented a nearly complete spectrum of other interested groups: cities, associations, consultants, universities, and the federal government.

ROLE FOR THE 1980s

The role of regional transportation planning in the new decade will be to provide technical support for decisions by local elected officials. In this context the process might be called regional transportation policy analysis. Decisions will be related to facilities or services that are both regional and local in scope. Analytical planning efforts will usually be specialized and dictated by particular problems and decisions affected. Preparation of long-range plans will give way to maintenance and updating of previous long-range plans and to more consideration of intermediate plans and staging.

The planning time frame will be a function of the problem addressed. Short-range planning (time frame of less than 5 years) currently dominates transportation analysis, but there will still be considerable concern for strategies in the 5- to

15-year period. The goal-oriented 20-year plan is also an important factor in nearer-term decisions. As a practical matter, available financing will often dictate the time frame of analysis.

Plan Maintenance

Maintenance of the regional transportation plan is a function that needs to be continued. The regional plan provides a context or framework within which transportation developments occur; the plan provides direction for transportation improvements. Maintaining the plan involves updating to reflect current concerns and needs and utilizing or preparing updated comprehensive planning information. The revised plan should reflect new policies and constraints that have become effective or will do so within the affected planning horizon. The plan should include both short- and long-range actions and policies. It should consider available or anticipated resources: natural, social, financial, and economic. The plan revision should also address institutional and organizational considerations that affect the infrastructure for developing and operating transportation services. Above all, the plan should be a dynamic instrument that anticipates change, but also is capable of responding to change that is not anticipated. The plan should also be relevant both to current issues and to the manner in which the plan is used by government and the public. It should not be developed along rigid guidelines only for purposes of its own existence. The revised plan should include the results of any refined technical analysis conducted since its previous revision, particularly updated regional travel demand. However, it will not usually require extensive technical analyses of the type required for developing original plans. The plan should be prepared, presented, and used in a context that permits and responds readily to expeditious updating.

Subarea Analysis

Subarea analysis addresses the need for detailed analysis and planning within the context of the regional plan. Such refinement will become more important as regional plans become more general. Subarea and corridor planning are the first steps in the detailed analysis that leads to project development. Subarea planning should consider a full range of alternatives, especially options that reflect changes or anomalies in traditional assumptions. Among these alternatives should be statutory, organizational, and institutional modifications as well as availability of natural, financial, and human resources. The subarea analysis process should be carefully designed to meet the needs for which its results are intended and should not be overly detailed because of regulatory requirements or analytical attractiveness. Above all, these analyses must be prepared in a timely manner to respond expeditiously to concerns of decisionmakers. The results of subarea analyses could include recommendations for both policies and action, as well as prioritizing various actions.

Problem Analysis

Problem analysis is performed in response to particular concerns, usually those of elected officials or other management, about specific problems, situations, or conditions. Much of this kind of analysis yields short-range solutions, but there can also be important longer-range considerations and implications. This function differs from subarea analysis in that it may be more detailed, localized, and site-specific. It differs from policy analysis because problem analysis responds in a manner tailored to a particular problem rather than to a general class of problems. Problem analysis is solution-oriented and should include identifying effects of recommended actions.

Policy Analysis

Policy analysis is emerging as an important activity of the regional transportation planning process. Its importance has increased due to reduced federal proscriptive involvement, financial constraints, and resource limitations, which together have made local officials more aware of needs to assure efficient and cost-effective transportation development. Policy analysis is the process of (a) identifying if and what kind of broad, directive guidance is needed in a particular situation and (b) preparing information that can be used to decide what those policies should be. The policy analysis process involves issue clarification, consideration of a full range of alternative policies, identification of effects and costs of the alternatives, and recommended policies and policy implementation strategies. The analysis of effects should consider full costs, life-cycle costing, and economic impact evaluation of other than cost-associated factors. The process should consider the role or use of the policy being addressed as well as associated organizational and institutional factors and effects and laws or regulations that impinge on the results. The process must also consider the time available for analysis in order to provide information expeditiously.

Strategic Planning

Strategic planning will occur in both the long-range and the short-range time frames. In fact, most short-range strategies have longer-term ramifications that should be considered as part of their development, and vice versa. Strategic planning refers to a broad range of activities that focus on defining how to accomplish a desired objective and/or how to respond to a particular situation. The problem identification and description steps are especially important in order to assure that the strategies defined focus on the problems of interest. The process must consider a full range of alternatives, especially those involving less conventional strategies such as modified institutional factors and organizational arrangements. In many strategies the key activities will be coordinating or negotiating with and among various government and private entities. Another key aspect of strategic planning is identifying and analyzing trends and determining their implications. The nature and speed of change in such trends are important determinants in the design of strategies. Assessment of uncertainty or risk is another key consideration for strategy development. The uncertainty of both trend extrapolation and other forecasts, including analytical results, may be sufficient to signifi-

cantly affect the probability of achieving anticipated results and thereby risk the success of the chosen strategy. Strategy development should carefully consider the use of results of the process, the timing for action on the strategy, and the need for change to law and regulations.

Impact Analysis

Impact analysis provides for estimating the effects of transportation and service changes before implementation as well as monitoring effects of such changes after implementation. The process should include interpreting the implications of impacts, i.e., demonstrating how and why effects occur, who is affected, and why the effects are important. This activity is important because it identifies weaknesses in assumptions, data, and processes that should be remedied in order to provide better information for use in future transportation decisions. The impact analysis process should be carefully designed to answer specific questions, not merely to broadly identify impacts. This activity should also be designed to recommend policies and actions for guidance of future transportation analyses.

Goods Movement

Interest in movement of freight within, to, and from urban areas has been increasing and will continue to grow. This is due in large part to increased costs of fuel and labor but also to the effects of trucks on traffic congestion on roads and in activity centers. Analysis and planning for goods movement must address a considerable institutional problem because most goods transportation is provided by the private sector. This presents the dual difficulty of obtaining reliable data and negotiating an acceptable solution to the problem.

Information Resource

The planning process provides a considerable resource for information and procedures that can be used by the public and government agencies. A major service, albeit an obligation of planning agencies, will be to prepare and provide long-range travel and transportation information. Such agencies can also provide technical capabilities to conduct or assist with analysis or to train analysts. The information and procedures are primarily oriented to travel demand forecasting and transportation facility characteristics and usage, but comprehensive planning data, financial analysis, and impact assessments are also important resources. These efforts can consume considerable time, funds, and staff resources so it is important for agencies involved to adequately plan for the time required. In preparing to supply these services, the quality, accuracy, and usefulness of data and procedures must be carefully assessed because of the credibility they have for both the process and the agency.

Coordination

A major activity of long-range planning will be coordination among participants and constituent agencies. This is neces-

sary to assure technical consistency and credibility of the process. Coordinating planning activities for the short and long range will also be important, especially to the extent that these activities may be the responsibility of different entities. The coordination process must recognize the roles, interests, and concerns of various participants in the planning process, especially as the organizations are interrelated in the total institutional structure. Particularly important activities in the coordination effort are sensitive mediation and negotiation because they are so often necessary, even in smaller conflicts, to accomplish intended implementation results. A newly emerging role is brokering, an activity in which the broker seeks out a match between a need and a resource to provide transportation services. Many of these coordination activities occur in the very near term, on a day-to-day basis, but they often address longer-range problems and solutions or short-range solutions with longer-range implications.

RECOMMENDED REVISION AND DEVELOPMENT

The workshop identified 12 issue areas that are likely to be faced by transportation organizations in the new decade. For each of these areas, existing methodology was cataloged and its capability to meet anticipated needs was assessed. Needed revisions in existing methods were then proposed and, where greater improvement or more work seemed needed, recommended research and development were identified.

Land Use

Revisions in current techniques include the following. More factors than transportation service may need to be incorporated in the analytical techniques. Demographic forecasts should account for life-style and life-cycle influences as well as increased numbers of women in the labor force. Research and development are likely to require the development of a better understanding of quantitative patterns and trends, particularly relationships between separate metropolitan areas and different national regions, as well as a better understanding of shifts within cities and of the relationship to changes in transportation service. Demographic forecasts need to be improved to reflect the effects of improved travel opportunity, i.e., transportation service.

Financial Forecasting

Revisions in current procedures are needed to improve capabilities that will take into account the effects of inflation and diesel-powered trucks, as well as the cost of money in the long term. Development is needed to permit considering effects of fleet mix as related to consumer economics and choice of motor vehicle.

Costs of Operation and Construction

Revisions are needed to improve the manner of allocating costs to beneficiaries of transportation investments, to im-

prove methods of estimating and forecasting maintenance and rehabilitation costs, and to facilitate life-cycle costing for various modes and facilities independently and in the aggregate. Revisions are also needed in approaches to assess and improve transit productivity. Development needs are for methods of accurately estimating or anticipating opportunity cost, for improved maintenance practices and ways to estimate their cost, and for techniques to assist in analyses leading to investment optimization, i.e., identifying trade-offs associated with alternative strategies to invest in transportation improvements.

Energy

Current fuel-use estimating procedures should be improved to better reflect increased engine efficiency in newer vehicles. The effects of increased efficiency on vehicle use are proposed as a subject for further research to develop procedures that accurately reflect anticipated feedback to the travel-demand stimulus. Development is also needed to improve information and procedures for estimating indirect energy consumption and for identifying cost transfers in the energy use structure.

Air Quality

Improved accuracy is needed to measure and estimate carbon monoxide emissions and concentrations. Current estimates are too inaccurate or unreliable to be used for legal action. This will require both improved data and better monitoring procedures. The need for increased accuracy may require more research than is implied in simple revisions of current techniques.

Safety

Revisions needed in current procedures are improved data about vehicle characteristics and crash capabilities, as well as reflected changes in vehicle mix. Development needs are for information and procedures that reflect changing demographics, e.g., more women in the labor force, and the effects of safety policies such as passive restraints.

Technology

Development needs identified were for research on communications as a substitute for transportation, alternative vehicle fuels, improved propulsion systems, and changes in vehicle size.

Resources: Time, Human, and Material

Current approaches need to be improved to better reflect time values, to better represent location decisions, and to consider trade-offs within household time budgets and personal or family activity schedules. Research and development should concentrate on improved methods for understanding and repre-

senting time-space trade-offs made by people when deciding to locate and travel. There are also development needs associated with the availability of material resources and the usefulness or reasonableness of using alternative materials.

Deregulation

Research is needed to identify direct and indirect effects of deregulation of trucking, air, rail, and water transportation. The results of this research are necessary to develop procedures for estimating impacts of further regulatory change.

Equity

Current techniques related to the equity factor could be improved by identifying strategies for mainstreaming disadvantaged segments of the population. Research is needed to identify effects of shifts in consumer demand. The results of this research may be useful for market segmentation and for achieving future market stability.

Public Expectations

This issue is related to what the community desires or anticipates from both planning and transportation improvements. It involves community participation activity as well as citizen involvement. The proposed revisions in current methods include increased emphasis on public education and citizen participation. There is also need for approaches to heighten citizen awareness of planning activity. This will involve effective use of communications media to inform the community. Finally, there is a need to effect interaction between what the community expects from services and the forecast effects of those services, i.e., an approach to assure that community expectations are consistent with what is forecast and promised. Development needs for this issue are in the area of communication techniques and technology.

Travel Forecasting

The traditional approaches to travel forecasting need improved representation of speed, capacity, and access in computerized networks; improved updated trip-generation rates; capabilities for multipath consideration in mode-split models; procedures for microcomputers; data base management procedures; and traffic simulation improvements, including better equilibration and hierarchical strategies. Development needs appear to be confined to improved traffic assignment algorithms.

Multinomial travel forecasting techniques require better packaging and training to improve their use. Improvements are also needed in network representations; the transferability of these techniques should be examined and improved as necessary. Research should concentrate on representing and integrating constraints that reflect modal and facility capacity. Research is also needed to improve the characteristics or variables included in such models.

Household-based and pivot-point forecasting needs include basic research and development to estimate generation rates, to identify data requirements, and to represent non-system options. The limitations of these techniques, particularly pivot point, should also be identified.

FEDERAL RESPONSIBILITIES

The workshop addressed the assignment of responsibilities for methodology revisions, research, and development in order to initiate activity to effect recommended changes. It was felt that the federal government should be responsible for developmental research in areas of interest nationwide or for issues related to national goals. This responsibility could be through contracting or funding contracts with other organizations. The federal government should also serve as the "marketing agent" to publicize research results and new techniques generated by research sponsored by other organizations. In these efforts the federal agencies should make best use of and encourage activities of all transportation research organizations, both in and outside the government.

REGULATORY REVISION

The workshop discussed the existing transportation planning regulations only and prepared the following recommendations for revision.

MPO

The MPO should be comprised primarily of local elected officials and should be the group responsible for regional transportation policy. It should exist as a separate entity in urban areas where there is more than one local government unit.

Requirements

Federal requirements for transportation analysis, planning, and monitoring should depend on the size of the urban area. Smaller urban areas should have fewer and more flexible requirements as to what they must do and how often. This relates to both regulatory and technical aspects of the process.

Certification

Once the planning process for an urban area is certified, it should remain so until there is a demonstrated basis for decertification. Periodic recertification should not be required.

Regional Plan

A regional transportation plan with short- and long-range elements should still be required. The nature of the plan's contents should be the responsibility of the MPO board and should be structured in only the most general terms by the federal

government. The plan should be reviewed periodically and updated where necessary.

Transportation Improvement Program

There should be a transportation improvement program (TIP) for the forthcoming 5-year period with particular concentration and detail on the annual element. The content of the TIP should be much more flexible than it is now and should be the responsibility of the MPO board.

Unified Planning Work Program

The unified planning work program (UPWP) should be prepared in sufficient detail to demonstrate how funding will be allocated. Components of the program currently required should be optional at the discretion of the MPO board if they are not necessary to support the description of fund allocation.

Section 8 Funds

Section 8 funds should be allocated without a grant application, primarily on the basis of a formula, so that fund availability is reasonably predictable. A small portion of Section 8 funds should be retained for discretionary allocation to finance special purpose studies such as corridor analysis.

A-95 Review

Review of the plan, TIP, and UPWP in the A-95 process should not be required if there is a memorandum of understanding that delegates responsibilities between the MPO and the A-95 agency.

State Implementation Plan Conformity

Requirements for a state implementation plan should be dropped.

Technical Requirements

Federal requirements for the planning process should be dropped in favor of guidelines and recommended alternative methodologies.

Project Planning: Evaluation of Alternatives and Impacts

Hal Kassoff

The objectives of the workshop on project planning were (a) to assess current practices in this area; (b) to identify strengths and weaknesses in planning methods and requirements; and

(c) to recommend improvements in the process. First, the workshop defined project planning as the process of developing sufficient information about the feasibility, costs, benefits, and environmental effects of alternative transportation improvements and of making an informed decision about whether and how to proceed with implementation. The workshop maintained that the process and act of decisionmaking are the culmination of project planning.

Methodology

In the areas investigated by workshop participants, current methodology was described as well-developed. However, better, and more focused, application of the tools that exist, as well as significant changes in federal requirements that have dominated the project planning process, are needed.

The workshop developed a guide for requirements in the 1980s, which was based on the following seven points of reference.

First, decisions on whether and how to implement significant transportation improvements should be part of the project planning process.

Second, to the extent possible, project planning should address alternative transportation improvements within a framework that reflects public policy, plans, and objectives. The project planning process should be capable of responding to guidance from elected officials and policymakers, whether or not that guidance went through a formal systems planning framework.

Third, the project planning process should be flexible and responsive. Participants in project planning are dealing with a process of information development for decisionmaking and are examining a series of alternatives. Planners have to respond not only to their own findings but also to the participation of other interested parties.

Fourth, the project planning process should be guided by those who have a decisionmaking responsibility for implementation.

Fifth, the parties that are significantly affected by any of the probable outcomes of project planning must be involved in the process—citizens, elected officials, fellow bureaucrats.

Sixth, the level of effort in project planning should be governed by the scale and complexity of the project.

Seventh, the technical process must be focused toward providing information needed for timely, clear-cut and well-founded decisions. Although a great amount and diversity of information are generated, occasionally sight is lost of the fact that the information is of value only in that it bears on the final decision and not in simply satisfying another checklist.

The state of the art in traffic forecasting and in travel demand forecasting, the workshop agreed, is adequate to project planning, although improvements in key areas are needed. A major problem is in the application phase.

Traffic information should be developed that will be used in the decision process. The scope, scale, and time frame of the travel demand process must be in balance with the project. The travel demand process must be streamlined.

Project planning travel estimates should be performed in a manner consistent with system-level estimates. Base-year validation forecasts should be incorporated in any project planning forecast. The procedures used in a project planning

study should be able to adequately forecast differences in travel demand between alternatives. This is considered a key problem area, both in how the methodology is applied and where the methodology often fails.

Refinements and reasonableness checks of computer forecasts should be made standard practice, with special attention to MPO-produced travel forecasts. Input assumptions such as land use network and cost of travel should be more thoroughly examined prior to performing travel demand estimates. The best, objective local area estimates of land use and demographic activity should be used as input to project planning.

Traffic data that are presented should be directly related to the key issues involved in the project planning effort and should be tailored to the client—the key actor or decisionmaker—for whom it is being developed, be effectively and concisely packaged, and be presented to the client in understandable terms.

The U.S. DOT should develop and teach courses regarding problems, limitations, proper use, and interpretation of travel demand forecast data. The U.S. DOT and TRB should increase efforts in disseminating information and in educating state, regional, and local staffs about methodology, particularly methodology in the area of TSM and assessment of policy alternatives.

Better methods are needed for forecasting changes in time-of-day distribution of travel, particularly where peak-hour capacity is not now nor will it be ample in the future. Travel demand forecasts should deal with the issue of uncertainty and the effect that changes in key assumptions would have on travel demand forecasts.

If key assumptions made as a basis for travel demand forecasting change in the middle of this extremely lengthy project development process, forecasts should be re-done only if these changes could be expected to affect the final decision. The amount and detail of traffic data for environmental models should be carefully reviewed and reduced where possible.

Better procedures to forecast truck travel need to be developed.

The U.S. DOT should carefully assess the implications and costs to state and local staffs of no longer supporting analysis packages extensively used by those staffs.

Impact Assessment

The philosophical basis and requirements set forth in the National Environmental Policy Act represent a valid framework for project planning. While an adequate set of analysis tools exists to do impact assessment, some of the recommendations offered here concerning impact assessment have to do with the alternatives developed and the process itself.

Alternatives that have an adverse effect on critical environmental areas should be avoided where possible. The workshop agreed that the ability to make trade-offs must be retained. Alternatives should generally include low-cost, operationally-oriented options such as TSM, as well as a realistic no-build option that represents what actually would be done out in the field.

There must be flexibility in the application of physical design standards, and those involved in project planning must inter-

act vigorously with engineers on this point. The levels and methods used in environmental assessment should be commensurate with the scope of the project and the key impacts affecting the decision. Inconsistencies in the interpretation and application of technical methods should be identified and eliminated.

Evaluation

Alternatives should be developed that will respond favorably to the key criteria used in the evaluation process. These evaluation criteria should be established at the outset and represent only a range of realistic options.

In developing alternatives, any overemphasis should be avoided on standards and constraints, infeasible or poorly developed alternatives, or reliance on expensive impact mitigation measures that, in some cases, end up ruling out the project because of their own impacts or costs.

The evaluation process should focus on critical differences among alternatives. Differences represent the choice variables in the decisionmaking process. The evaluation process should identify pitfalls and opportunities; make a general statement; recognize efficiency, effectiveness, and impacts; properly account for the timestreams of costs, benefits, and impacts. Variation in timestreams can affect the ultimate outcome (if the analysis is done correctly) and provide information that is comprehensible and easy to use and apply.

The evaluation process should be a conflict resolution process.

The evaluation process itself should be cost-effective. The process should recognize risk and uncertainty. Neat matrices with nice numbers entered to the fifth significant figure do not always convey the proper message about risk and uncertainty.

In addition, the planner needs to guide the decisionmaker by conducting evaluation consistent with the above-stated technical points and by being responsive to that decisionmaker. Good working relationships need to be developed with decisionmakers, within organizations, and with elected officials.

Federal Requirements

The project planning process is too cumbersome and time-consuming. The key problems involve overly detailed and restricted federal requirements and unreasonably long review processes. Federal regulations must be streamlined and made more flexible.

Certification acceptance procedures should be applied to project planning, delegating authority to those states and implementing agencies at the local and regional levels that can demonstrate the ability to independently conduct the project planning process in a manner consistent with the National Environmental Policy Act and appropriate regulations. The certification acceptance process should be subject to procedural reviews and performance audits. The environmental assessment process should be used to provide the technical data for federal permits instead of having duplicative processes, for example, in the area of 404 permits, Coast Guard permits, and the like.

The UMTA and FHWA procedures that govern the environmental assessment process should be the same wherever possible. In both agencies, the process should culminate in a decision regarding project implementation, not just a funding decision.

Federal requirements should provide flexibility in the institutional arrangements in which project planning takes place and the techniques that are used. There are many differences among the states and urbanized areas that preclude a standardized approach.

Funding mechanisms should encourage sound decision-making and lead to efficiency. It was observed, however, that in many instances funding mechanisms, such as discretionary programs, can distort the objective outcome of the project planning process.

Where certification acceptance is not applied, the federal government should use process reviews rather than a project-by-project, step-by-step approach wherever possible. The FHWA, UMTA, and other federal agencies involved in project planning should decentralize the review and oversight process where possible. They should avoid the current practice of sequential, multiple-layer reviews.

Where multiple-level reviews are necessary, they should be conducted concurrently. There should be research and technical assistance training to improve the state of the art. The lack of consistency in interpretation in federal policy and regulations across the country was identified as a major problem within, as well as between, federal agencies.

Duplicative, overly restrictive, and irrelevant environmental requirements should be eliminated, such as using the 106 historic preservation process instead of the 4F process for addressing historic sites.

Federal regulations should be sufficiently flexible to permit an implementing agency to incorporate into its project planning process the results of a well-documented, comprehensive planning process that has developed specific transportation improvement proposals. These proposals must have been based on a sufficiently broad and valid set of criteria and objective information and the involvement of affected parties.

Planning for Transportation Management and Operations

KENNETH W. HEATHINGTON

The workshop on planning for transportation management and operations took note of the changing environment in the transportation field that has greatly altered the needs of decisionmakers. With the shifting of the majority of public transportation services in the 1960s into the public sector and with the reduction of the large construction programs in the highway field, individuals responsible for transportation activities at the state and local levels of government find themselves facing a different set of issues. Prior management requirements were oriented toward facility planning, but future requirements will be directed toward the efficient, effective, and economical management of existing systems, both physical and operational. Most likely there will be a continual merging of

public transportation operations and traffic engineering activities over the next decade, even though the amount of funds allocated for each of these areas may be substantially reduced.

As the emphasis is changed in the transportation field, new or different skills will be required for managing resources. Since the emphasis will change from design, construction, and acquisition of transit operating properties, the skills needed for day-to-day management will be quite different. Thus, transportation personnel, both academic and field practitioners, must reorient their thinking and their training programs in order to perform successfully in this new environment. Individuals coming into the transportation field must be provided with an appropriate mix of new skills to operate in this new environment. In addition, there is a need for the reorientation and retraining of individuals already in the field to meet the challenges of the different environment.

REVIEW OF URBAN TRANSPORTATION PLANNING FUNCTION

The historical role of the urban transportation planner required certain skills and expertise. The role was oriented toward long-range planning; that is, the development of 20- to 25-year transportation plans. The skills needed were in the areas of forecasting, model development, alternatives analysis and evaluation, and long-range plan development. Very few requirements, if any, were imposed on the urban transportation planner for implementing the plans that were developed. It is now seen that, for the 1980s, new roles are emerging for the urban transportation planner. These new roles will require additional and/or different skills and expertise than required for long-range planning activities.

The urban transportation planner will be moving into the management and operation of transportation facilities and services. The value of urban transportation planning will increasingly be measured in light of its ability to provide meaningful information to management. There will be less need for the development of long-range plans, although there will most likely be some updating of existing plans. The focus increasingly will be one of providing support for short-range decision-making. The skills and expertise required for the urban transportation planner to operate in the 1980s will vary depending on the organizational level at which he or she operates. To enhance the utility of planning, the planning professional will need to be linked with the decisionmaking and production processes of an agency.

While there definitely will be a need for transportation planning functions in the 1980s, these functions will vary substantially from those required during the past 20-30 years. Figure 1 outlines the functional activities required at different organizational levels for urban transportation planning in the coming decade. It is believed that there will be an urban transportation planning function at a level consistent with the metropolitan planning organization (MPO). At this level, there will still be data inventories that will enable a wide variety of analyses. In addition, there should be some form of performance monitoring of transportation facilities and services. This performance monitoring may be conducted not only on a specific facility or system, but also on a regional basis. Some of the data that will be collected and from which projections will be made can aid in

marketing functions of various transportation and non-transportation agencies in both the public and the private sectors. It is envisioned that, at the MPO/regional level, marketing would not be conducted in the traditional sense but in the sense that information would be available that could be used for marketing purposes by agencies with responsibilities for day-to-day operations.

The major contribution that an MPO or regional level of urban transportation planning can provide is information coordination and dissemination. It is not cost-effective for each individual operating agency to maintain large data banks. Likewise, it is often difficult and quite costly to use data bases from a multiple number of agencies to provide adequate information needed for operations over a regional area. It would seem to be an appropriate role for an MPO/regional level of urban transportation planning to coordinate and disseminate information on a regional as well as a local basis.

Also seen from Figure 1 is that the transportation planning function found at the MPO/regional level should be supportive of both the public and private sectors at the management and operational levels. Implementing agencies, such as a state department of transportation, public transportation operation, and city/county traffic engineering department, as well as utilities and private carriers, all have needs for information that can be organized and maintained at the MPO/regional level.

The urban transportation planning function at the MPO/regional level of planning should play a very important role in the 1980s. However, this role may be somewhat different than that defined for an MPO in the past few years. The urban transportation planning function at the MPO/regional level must become more market-oriented by meeting the desires or needs of its clients. The MPO should have staff skills and provide analyses to assure consistent regional data bases and plans. It should provide control totals and major transportation

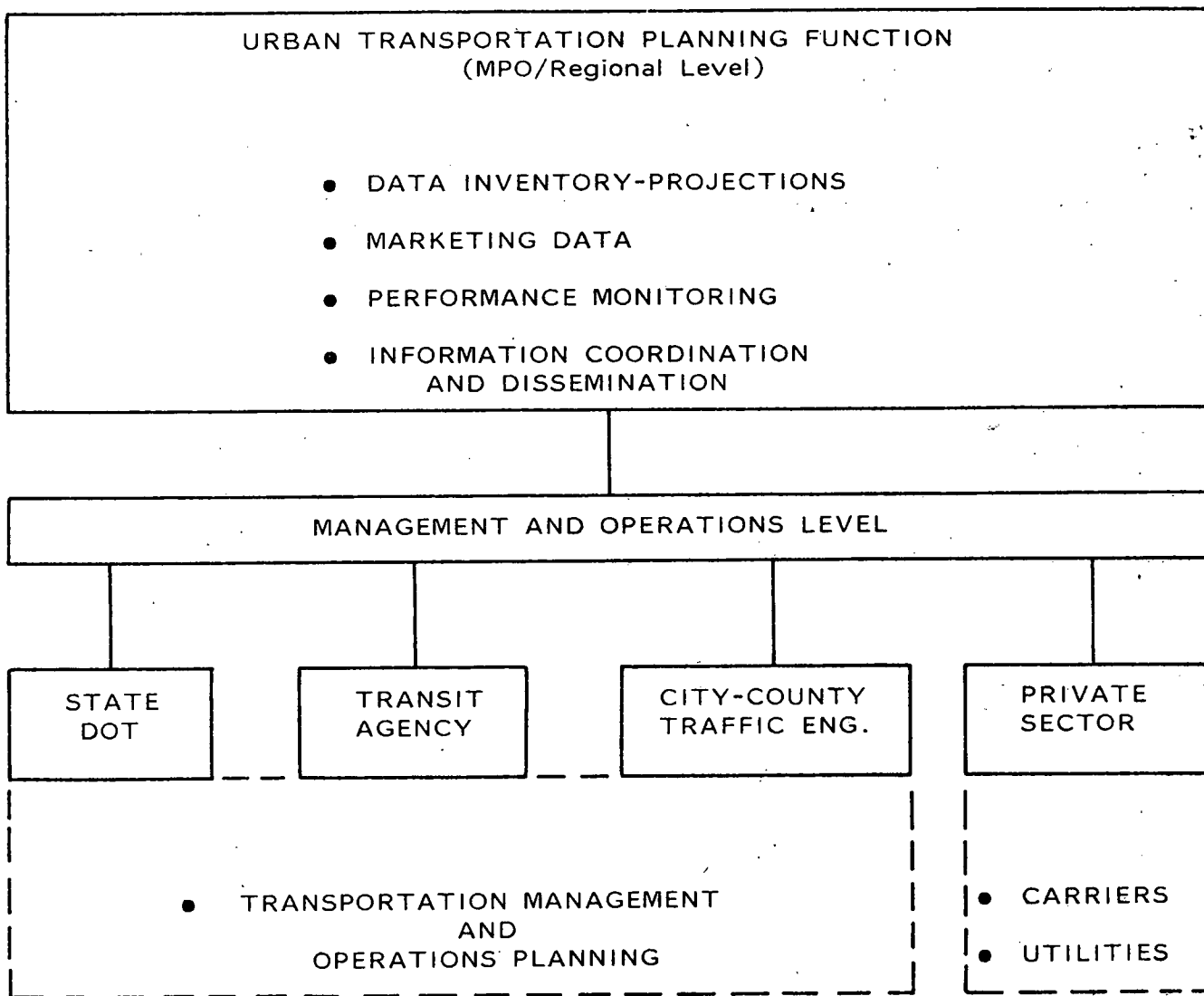


Figure 1.
Organizational roles and responsibilities in the 1980s.

network flows across jurisdictional boundaries, for example, external-to-external and external-to-internal vehicle or person flows on major facilities. The MPO should maintain a current land use and zoning data base, which is essential to short-range market research and site or corridor impact studies. Where the MPO supports regional forecasts, they should be a function of future growth projections with more long-range planning done in higher-growth areas.

Major study activity will be increasingly decentralized to treat specific situations, problems, or economic objectives and to establish project implementation schedules. The MPO can have a major influence on the scheduling of facility construction and major capacity management projects since many subjurisdictional boundaries will be crossed. Where local agencies are not prepared to execute the study, the MPO may be asked (or contracted) to do it. Data collected or generated as a result of localized studies may be passed to the MPO to use in updating the regional data base.

Some question has arisen over whether or not a transportation planning function at the MPO/regional level should be a requirement; but, perhaps, this function should exist through the MPO's ability to attract clients that would financially support its services. The transportation planning function at the MPO/regional level must identify and seek out clients with needs for which services can be provided and for which a client is willing to pay. The transportation planning function at the MPO/regional level should not be a policing activity as is mandated by the federal government in certain instances at the present time (i.e., Section 504, Clean Air Act requirements, etc.). It is also recognized that the transportation planning function at the MPO/regional level should be provided adequate resources and capabilities in order to carry out its mission. By becoming responsive to the needs of its clients and potential clients, adequate resources should be available from clients.

Perhaps the certification of MPOs should be changed. Instead of being based on federal bureaucrats' judgment of how well the MPO is meeting the long list of federal regulations, certification should be based on the satisfaction level of client agencies. For example, certification might be based on (a) minimum federal requirements (i.e., plan, transportation improvement plan and memo of understanding), (b) financial support from client agencies, and (c) periodic questionnaires to the participating politicians and technicians in each client agency.

The urban transportation planning process can be unified more readily through the organizational definition of functional activities and responsibilities. Too often there has been an overlap in functional areas and a lack of orientation toward meeting clients' needs. In addition, there is often outright confusion over responsibilities, jurisdictions, etc. If requirements are dropped for a transportation planning function at the MPO/regional level, the transportation planning function will be forced to become user-oriented in order to maintain economic viability.

FUTURE ROLES FOR URBAN TRANSPORTATION PLANNING IN MANAGEMENT AND OPERATIONS

There will be a role in the management and operations of transportation facilities and services for individuals with an

urban transportation planning background. However, the skills and training required for these individuals will be somewhat different than have been required in the past. There are several areas in which an urban transportation planner may function in the 1980s, but only if certain skills have been acquired.

Operations Planning

The urban transportation planner will find that there are opportunities for employment in activities that require day-to-day operational planning. This will be very different from the long-range planning to which he or she may have become accustomed. The day-to-day planning will involve not only facilities and equipment but also personnel. The scheduling of activities will be a part of an individual's job requirements as will evaluation of different strategies for efficient, effective, and economical operations.

Marketing

The transportation planner, most likely, will not be expected to perform as one having substantial expertise in the marketing area. However, the urban transportation planner will have to work with marketing personnel and to be able to interface with them on projects that require a marketing function. Included in these marketing activities are such things as product planning, product development, product testing, pricing, and promotion. By having an appreciation for marketing and its contribution to management and operations, the urban transportation planner can make a better contribution to the organization.

Financial Management

The management of resources in the public sector will become increasingly more important. A large effort will be put forth in the financial management of both facilities and services. In order to be able to contribute effectively to management and operations, the urban transportation planner must be able to perform in a financial management concept of operations. Without an appreciation for financial management, it will be difficult for the urban transportation planner to be integrated fully into the agency in which he or she may be employed.

Safety Management

In the management and operations area, safety is a very important consideration. The urban transportation planner must recognize the impact that good safety management has on the organization as a whole and on the health and well-being of the individual employee. The urban transportation planner not only must be cognizant of the legal requirements for safety but also must be oriented toward management safety to ensure productive and profitable operations.

Maintenance Management

Without large amounts of resources available for new construction, there will be a need for ongoing maintenance of

existing facilities and equipment. This is especially true of the Interstate highway system. Enormous costs will be involved in maintaining present transportation facilities. Without proper maintenance management, the costs can become so astronomical that it will be virtually impossible to sustain adequately any reasonable level of service for these facilities. The urban transportation planner must be able to perform in an environment that is not building new facilities but is orienting its resources toward maintaining an existing system or service. The transportation planner must be able to provide information that will readily relate to the decisionmaking requirements for maintaining systems and services.

Human Resources Management

Perhaps at no other time in history has the management of human resources been so important to organizations in both the public and the private sectors. Productivity has held constant or even declined in certain sectors during the past decade. Some of this can be attributed to the inability to manage efficiently the human resources available to an organization. Labor restrictions, lack of incentives for increasing productivity, lack of pride in workmanship, and a host of other things have all contributed to the inefficient management of human resources. The urban transportation planner must be able to utilize effectively the limited human resources available. This is an important function for any organization, and it will continue to be so in the coming years.

Performance Monitoring

Increasing attention must be given to monitoring the performance of facilities and services in the transportation area. The urban transportation planner must be familiar with performance measurements and the manner in which they can be used to improve operations. The urban transportation planner must be familiar with measurement criteria and with the standards that will be used for comparison.

Management Accounting

Management accounting may be described as the preparation, interpretation, and dissemination of financial data (sales, operating capital, overhead, and other costs) to aid management of an entity in achieving its financial goals. The management accountant also provides budgets against which financial performance is measured and predicts, through pro forma projections, likely financial results based on specified operating scenarios, economic climates, and tax laws. Organizational unit performance may be evaluated with respect to system efficiency and effectiveness. The urban transportation planner must be able to function in an environment that will become even more management-accounting-oriented.

Required Management Techniques and Skills

As indicated above, the skills of the urban transportation planner required to function in the management and operations

environment will be different from those required for long-range planning. Several skills should be acquired to aid in performing at the management and operational levels. The analytical skills required are typical of those found in experienced transportation system planners. Further skills are required in the areas of organizational design and the basic concepts of management. Several of the more important skills needed in the 1980s are discussed below.

Engineering. The urban transportation planner would do well to have an engineering background. This permits the use of the mathematical and design skills that are often required in the management and operations area of transportation. Some of the work that a day-to-day operations planner might be doing would require an engineering background, whether the operations planner is in basic traffic engineering or perhaps with a public transportation service. Often specifications have to be prepared, and supervision must be provided for the completion and/or maintenance of equipment and facilities.

Transportation Background. The urban transportation planner should have a background in the fundamentals of transportation. There will likely be more integration of activities from the traffic engineering or highway area with the public transportation service area. There is a need for individuals who have a background in these areas and an appreciation for the contributions that can be made from the merging of certain activities in transportation.

Economic and Financial Analysis. The day-to-day operations in the transportation field in the 1980s, perhaps, will be more concerned with economic and financial aspects than at any time in the prior 20 years. Although economic and financial aspects of operations are always important, the future outlook relative to limited resources will make it even more important that the urban transportation planner not only have skills in these areas but also have a definite appreciation for their need. More decisions in the 1980s will be made on economic and/or financial bases than on other aspects that have been used in the more recent past. Thus, the urban transportation planner must be reasonably proficient in this area.

Management Accounting. The ability to analyze accounting data to improve the management and thus enhance the profitability of an organization is very important. The urban transportation planner must be cognizant of the accounting needs and requirements of organizations and agencies in both the public and the private sectors. This skill becomes even more important if the urban transportation planner desires to move into management.

Marketing. It is not intended that the urban transportation planner be highly proficient in the marketing area, but he or she must have an appreciation for the contributions that marketing can make to an organization. Thus, urban transportation planners should have some skills in the marketing area so that they may provide support to personnel having responsibilities for product planning, product development, product testing, pricing, and promotion.

Legal Aspects. It is imperative within any organization that one be cognizant of certain legal aspects. Labor agreements, liability issues, contracts, and a host of other legal-oriented activities normally encountered in the day-to-day operations of any organization are critical to the success of that organization. The urban transportation planner must be cognizant of the legal ramifications of his or her actions as well as proposed

policies or actions. Therefore, some skills in this area are needed.

Human Resources. The ability to use human resources efficiently is becoming more important each year. Fringe benefits, continuing education, retraining, and many other aspects related to human resources and human development must be understood by the urban transportation planner. The effective utilization of human resources will determine the economic viability of any organization. Therefore, the urban transportation planner must develop skills in this area.

Communications. Perhaps the single most important element in any organization is communications. This includes both verbal and written communications at all levels of the organizational structure. The urban transportation planner must communicate effectively, both verbally and in writing, or he or she will not be able to provide the necessary support required of any employee, particularly that of an employee working as an analyst. It is only through effective communication that analysis can be utilized to improve the decisionmaking process. These skills are not necessarily easily obtained, but the urban transportation planner must work toward this end.

Electronic Data Processing/Management Information Systems. There will be increasingly more use of computers, word processors, and other types of electronic data processors by management. Management information systems will become more responsive as the cost of developing these systems is reduced through more efficient and less costly hardware. Very few employees, especially urban transportation planners functioning as analysts, can hope to achieve their potential without skills in this area. Skills in this area become a necessity, and the demand for these skills will increase in the 1980s.

Operations Research and Statistics. The urban transportation planner must be able to analyze data statistically and to develop optimum strategies for use by management. Thus, it will become important in the 1980s for the urban transportation planner to have a background in operations research and statistics. The ability to interpret and portray data accurately and to determine optimal operational strategies is essential. Of necessity, the urban transportation planner will be required to conduct his or her work based on techniques from operations research and statistics.

Skills Acquisition. As discussed above, several new skills will be needed by the transportation planner in the 1980s. Some of the analytical skills have already been obtained by the experienced transportation planner, and the other skills will need to be added through various forms of training. Individuals with skills as described above are available, but at salaries much above those normally prevailing in many public-sector jobs. The result is that there are shortages of such skills now showing up in individuals who can be attracted by the current salaries paid by various public agencies. It is not believed that the market will soften for these skills in the 1980s, thus leading to a reduction in salaries. Therefore, universities as well as public agencies should give thought to ways in which these skills that combine the technical and business aspects of transportation can be provided to the public sector. The public sector greatly needs more individuals with the skills described above, but the public-sector salary structure does not support the employment of individuals with those skills.

DATA REQUIREMENTS FOR EFFECTIVE DECISIONMAKING

It would be expected that, if the environment in which decisions are made changes, the data requirements for effective decisionmaking will change. A review was made of the data requirements for management and operations that will be needed in the 1980s. This review is depicted in Figure 2. Four basic types of data will be needed—(a) inventory, (b) cost/management, (c) performance, and (d) marketing. It is also seen from Figure 2 that some of the data may be needed on a continuous basis; some data will be needed on a surveillance (sampling) basis; and some data will be project-specific. Some of the data will be needed to assist in the personnel area of management and operations; other data will be needed relative to current assets. Some data will be needed for maintenance, operations, and capital improvements. The data requirements will change depending on the organization or agency under consideration.

Figure 2 shows that inventory data, as an example, should be collected on a continuous basis relative to personnel, current assets, maintenance, and operations. However, for capital improvements, which are not always an ongoing activity, a surveillance or even project-specific inventory should be able to meet the needs in the management and operations area. In the cost/management area, continuous data are needed in all areas, but there may be some project-specific requirements in current assets. The performance data requirements will vary somewhat depending on the specific organization. As an example, there is a need for continuous performance measures on personnel and capital improvements. However, relative to current assets, maintenance, and operations, some form of surveillance may be needed to provide adequate data. In the marketing area, most of the data needs will be project-specific. It is difficult to maintain a continuing data base for marketing programs as market segments change with time and with products or services.

As the arrow indicates in Figure 2, the systematic collection and maintenance of data are less likely to exist as one goes down the data requirements; that is, performance and marketing data are less likely to be readily available than are traditional inventory data that have been collected over the years.

Care must be exercised in the development of data-collection programs. It is well noted in the public sector that data often are collected for the simple purpose of collecting data. This luxury most likely will not be afforded in the future. Thus, the organization that wants to be economically viable must give attention to data-collection needs and to the amount of data that are required. In general it may be said that the minimum data required (i.e., continuous, sampling, or project-specific) to provide for effective decisionmaking is the amount that should be collected.

PERFORMANCE MEASURES

Interest in developing performance measures increased in the 1970s, and it is envisioned that there will be a continuing reliance on performance measures in the 1980s. Past performance measures (e.g., Section 15 of the Urban Mass Transportation Act, HPMS, etc.) are numerous and in most cases

	PERSONNEL	CURRENT ASSETS	MAINTENANCE	OPERATIONS	CAPITAL IMPROVEMENTS	ETC.
INVENTORY	C	C	C	C	S, P	
COSTS/MANAGEMENT	C	C, P	C	C	C	
PERFORMANCE	C	S	S	S, P	C	
MARKETING	P	P	P	S, P	P	

↓
 Less Likely to Exist at Present

C = Continuous
 S = Surveillance (Sampling)
 P = Project Specific

Figure 2.
Data requirements for management and operations.

provide a good universe. It is not envisioned that additional performance measures should be developed, particularly those that would require additional data collecting. However, it is believed that performance measures have been developed without establishing appropriate objectives. Performance measures established in this fashion tend to be ineffective. Often operational objectives are lacking, so performance measures cannot be used to evaluate whether or not the facility or service is accomplishing its objectives.

There must be an integration of performance measures into the management functions of an organization. The performance measures must have higher-echelon support if they are to be meaningful and if they are to contribute to improving the operations of any organization or firm. In some instances it appears that performance measures have been given only lip service by top management, particularly in the public sector.

In developing performance measures, consideration should be given to the movement of both people and goods. In the past, more emphasis has been placed on the movement of people; however, there are many instances where the movement of goods has become a very serious problem. This is particularly true for some of the very large urban metropolitan areas. The integration of both people and goods in developing performance measures is needed.

In addition, the measurement of regional performance measures should be explored. Transportation services should perform on a regional basis, and simply developing performance measures for subsectors of the region or subsystems of the

total transportation system provides for a suboptimal analysis of the unity of the transportation system for the region.

Evaluations should be made relative to investment opportunities for all assets. Many public bodies may have a tremendous investment in physical plants, but evaluations for a return on one's investment do not include these large assets. It is recognized, however, that there are certain restrictions on investments for the public sector; that is, the public sector is not able to invest in all areas in which a private firm might invest. Yet, it is felt that there are areas in which a public body might invest that have not yet been explored.

Performance measures should be considered in light of attracting private capital. In the 1980s the emphasis will be on the private sector. If a public body intends to operate in that environment, performance measures should be developed that would encourage private capital to invest in the public-sector operations. This may not be an easy task, but it must be considered in light of the environment under which public bodies will be operating.

It is recognized that the value of performance measures will vary from one area to another. It is not expected that a performance measure taken in Chicago should be equal to that taken in Miami. In addition, while many performance measures should be standard across areas, some performance measures are unique to specific areas. That is, a recreational area may have specific characteristics that would be unique to it but not to other metropolitan areas. Therefore, one cannot attempt to standardize all performance measures across all areas.

Performance measures should be developed to encourage total effective utilization of transportation suppliers. Often performance measures are limited to a particular set of conditions that may exclude many of the transportation suppliers in a given urban area. It is the effective utilization of all transportation suppliers that tends to make the transportation system perform efficiently, effectively, and economically. The public sector must be cognizant of the new environment under which it is to operate and must attempt to integrate the private and public sectors where appropriate.

Performance measures should be developed for the planning process itself. Planning has been under a lot of criticism in the past several years. Some of the criticism is well deserved. Few, if any, performance measures have been adopted for the planning process in order to evaluate the process from other than an internal viewpoint. The planning process must be oriented toward client needs and cannot view itself purely as an end in and of itself. Therefore, performance measures for the planning process are needed that would view the process from both internal and external points of view.

STRATEGIES FOR ALLOCATION OF RESOURCES

More emphasis will be placed on the efficient allocation of resources in the 1980s than has been done for many years. This is due for the most part to the reduction of available resources for transportation activities. It will be important for the urban transportation planner to be cognizant of the need to allocate resources efficiently. It is important for the urban transportation planner to have skills in the areas discussed above. If the above functions can be completed successfully by utilizing appropriate skills, there should be a proper allocation of resources. Unless the urban transportation planner is willing to attain the skills needed for the successful completion of the above functions, he or she most likely will not be successful in the management and operations area of the transportation field. There is a need for the urban transportation planner in the management and operations area, but he or she must acquire new skills in order to function appropriately.

Planning for Financing, Implementation, and Evaluation

Paul N. Bay

The overall objectives of the workshop on planning for financing, implementation, and evaluation were (a) to define the major planning needs of the 1980s in planning, programming, budgeting, and implementing projects or services; (b) to define the tools or methods needed for financial planning, implementation, and ongoing evaluation; and (c) to recommend changes in the federal regulations that would improve the processes of financial planning, programming, budgeting, implementation, and evaluation. This workshop as a whole reviewed and determined the general findings and major planning needs of the 1980s. However, two subcommittees or task forces were

formed to separately address tools and methods and federal regulations. The recommendations of these two task forces were then reviewed, modified, and adopted by the workshop as a whole. In addition, the workshop identified nine issue areas during the course of discussion, and these are summarized below.

ISSUES IDENTIFIED

During the past 10 years, significant changes have taken place in transportation costs. Those changes require some entirely new approaches to planning, budgeting, and implementing projects and services. Better evaluation of completed projects and ongoing services is increasingly being demanded by a public concerned about cost effectiveness. Some new tools are beginning to be used, but more are needed. The following nine areas were considered.

1. *Uncertainty and shortfalls in funding.* In years past, highway revenues had a high degree of predictability from year to year, and costs were reasonably stable. Transit operating revenues came primarily from farebox receipts, and, in the early years of federal capital funding for transit, basic capital needs were assured of being met. For many reasons, these statements are no longer true. Traditional financial planning and programming methods—largely still in use—do not allow for the dynamics of year-to-year fluctuations in revenues, nor for the evaluation of risk and uncertainty inherent in cost estimation, nor yet for the probability of greatly straitened circumstances in the future.

2. *Analysis of trends in prices and revenues.* Much greater sophistication is necessary in methods for forecasting tax revenues and their relationship to the economy and to fuel prices. Similarly, techniques for pricing transit services must take into account many more complex factors than the simple price/demand elasticity curves of the past, including consumer price index (CPI), labor contracts, the cost of money, issues of equity, and long-term strategy for dealing with price increases. Estimating construction costs will also require better analysis of the construction cost index, the CPI, and labor contract dates.

3. *Capital costs versus rehabilitation versus long-term maintenance.* Two recent trends run counter to each other—the high cost of labor tends to call for more capital-intensive solutions, and the shortage of capital funds tends to call for “fix-it-up, wear-it-out” solutions. It is clear, however, that a significantly larger share of the transportation budget in both highway and transit is going toward maintenance and operations, and more management attention must be given to reducing total costs. Thus, improved engineering economy methods applied to life-cycle costing appear to be badly needed.

4. *Implementation in a multiple-jurisdiction setting.* Changing roles of federal, state, regional, and local governments in transportation finance have fractionalized and diffused the decisionmaking process. Most major projects must pass at least three levels of government no matter who the implementing agency is. Together with funding uncertainties, this setting makes the traditional, rather static methods of programming project implementation too cumbersome. New programming approaches that avoid costly delays by coordinating approvals and funding are highly desirable. Programming involving both highway and transit modes and

multiple funding sources for a single project especially need attention.

5. *Management of program implementation.* As construction inflation drastically affects the cost of completed projects, and approval and regulatory constraints affect the time needed to implement them, there is need for more careful application of cost and schedule controls and other program management techniques. Especially needed are some less-sophisticated techniques than those used on very large, multi-year programs—techniques amenable to use by smaller agencies or individuals not highly trained in EDP methods. Implementation of TSM and transit productivity improvements are a special challenge.

6. *Innovative financial planning.* As traditional funding sources dry up, new approaches to financing capital and operating requirements are being sought, especially those that involve the private sector. Methods of developing such potential new sources of funds and still protecting the public interest require skills not usually expected in the traditional transportation manager.

7. *Evaluation and monitoring of expenditures and performance.* Greater public cost-consciousness requires continuing reassessment of how well completed projects and ongoing services meet the needs of the public in the total transportation system. Evaluation methods that are ongoing, pragmatic, understandable, and provide a feedback loop into the programming cycle are needed. Improved evaluation measures and performance indicators, together with better methods of acquiring and using the data, are needed.

8. *Improved cost responsibility allocation.* As new sources of financing are considered, more effort needs to be directed toward identifying benefits and beneficiaries and direct and indirect impacts of taxes and user charges on segments of the regional economy.

9. *Strategic planning.* Assessment of transportation decisions in the public sector might benefit from use of the strategic planning techniques used in the private sector, including evaluation of risks, opportunities, and uncertainty, as well as development of management control strategies for financing, pricing, programming, and implementation. Many of the preceding eight issues have components that are included in the concept of strategic planning.

MAJOR PLANNING NEEDS

The workshop identified eight major planning needs of the 1980s. They are as follows:

1. Transportation managers familiar with the fields of engineering economy, finance, program and project management, pricing theory, risk and uncertainty, decisionmaking, and with classical transportation planning methods and operations;
2. A planning process that is directly tied to decisions on investments, services, and pricing;
3. Greater flexibility in financing approaches, including public-sector/private-sector sharing of costs, loosening up of present modal and categorical funding constraints, borrowing and tax-incentive approaches, and new looks at the traditional split between capital funding and maintenance/operations funding;

4. Some stable, predictable level of funding, with an appropriate mix of categorical funds and discretionary funds;
5. Development and application of new tools for management control of transportation decisions, including financial forecasting models, engineering economy models, pricing and cost-allocation models, decision support systems, and program and project management control systems;
6. Improved performance indicators and measurements to provide realistic monitoring and evaluation of implemented services and projects, with feedback into the programming and budgeting process;
7. Better understanding of the direct and indirect impacts of alternative taxes, user fees, and financing plans on the regional economy and its various segments; and
8. A stable, intergovernmental decision structure, with roles defined, understood, and developed as appropriate within each urban area.

FEDERAL REGULATIONS (Harvey Haack, Task Force Chairman)

The task force on federal regulations agreed that urban transportation planning regulations should be as simple and straightforward as possible. Toward this goal it recommends that the regulations be organized into three parts: (a) a statement of national goals, (b) urban transportation planning requirements, and (c) guidelines and advisory information.

The task force attempted to separate those elements and/or products of the planning process that should be a part of federal law from those elements/products of the process that are important to the process but should *not* be made a part of the law through rule and regulation. To do otherwise opens the door to judicial decisionmaking based on regulations/requirements developed at the national level rather than more sensitive decisionmaking at the regional level.

Current urban planning requirements were separated into (a) national goals, (b) requirements to carry out Section 134 of Title 23 and Section 8 of Title 49, and (c) elements of the planning process that are important to the process but should not be given the stature of federal law through regulatory requirement.

National Goals

The following federal requirements were identified as national goals:

1. Consider social, economic, and environmental effects in planning, programming, and implementing transportation improvements;
2. Improve air quality through various transportation control measures;
3. Ensure public involvement in the transportation planning, programming, and implementation process;
4. Ensure that no person shall on the grounds of race, color, sex, national origin, or physical handicap be excluded from participation in, be denied benefits of, or be otherwise subjected to discrimination through the urban transportation planning process;

5. Include special efforts to plan public transportation facilities and services that can effectively be utilized by elderly and handicapped persons; and
6. Provide for consideration of energy conservation.

The national goal of energy conservation has particular significance to issues associated with planning for financing, implementing, and evaluating urban transportation improvements. Gasoline consumption is a basic determinant of motor fuel tax revenues. Both the price of gasoline and the price of asphalt provide examples of energy-related factors of transportation critical to planning finance, implementation, and evaluation. Other financial, implementation, and evaluation issues related to national energy goals and policies are (a) capital cost versus rehabilitation versus long-term maintenance, (b) implementation in multijurisdictional settings, (c) financial planning, (d) cost-allocation studies, and (e) overall strategic planning.

Urban Transportation Planning Requirements

After separating federal requirements into national goals and those elements of the planning process important to planning but not requiring the stature of federal regulation, the task force identified four current federal requirements especially important to planning for financing, implementation, and evaluation:

1. Development of a transportation plan that has both a short-range and a long-range element.
2. Development of a transportation improvement program that includes an annual element (the program shall be a staged multiyear program of transportation improvement projects consistent with the transportation plan);
3. Establishment of a forum for cooperative decisionmaking by principal elected officials of general purpose local government; and
4. Involvement of appropriate public and private transportation providers.

While not so directly related to issues associated with planning for financing, implementation, and evaluation of transportation improvements, the task force believed that the following requirements were essential to a continuing, cooperative planning process:

1. A memorandum of understanding that describes roles and defines responsibilities for carrying out transportation planning and programming;
2. A unified planning work program that describes all urban transportation and transportation-related planning activities scheduled for the area; and
3. A federal certification procedure for the evaluation of the transportation planning process to determine if the process meets federal requirements.

Guidelines/Advisory Information

It was the consensus of the task force that six of the elements of the planning process as described in Section 450.120 should be deleted as federal requirements. These elements were identified as being important elements of the planning

process but did not necessarily follow from Section 134 of Title 23 and Section 8 of Title 49. These are as follows:

1. 450.120(a)(8)(i)—an analysis of existing conditions of travel, transportation facilities, vehicle fuel consumption, and systems management;
2. 450.120(a)(8)(ii) A, B, and C—relationship to an evaluation of alternative TSM improvements in the development of the transportation plan;
3. 450.120(a)(8)(iii)—relationship to projections of urban area economic, demographic, and land use activities and transportation demand forecasts;
4. 450.120(a)(8)(iv)—relationship to analysis of alternative transportation investments or strategies and to developing the long-range element of the transportation plan;
5. 450.120(a)(8)(v)—relationship to conduct of corridor, transit technology, and staging studies.
6. 450.120(a)(8)(iv)—relationship to monitoring and updating basic travel and network data, as well as plan reappraisal.

It was assumed that a plan would be a matter of federal regulation, and that all six elements would be necessary to the development and continuous or periodic update of the plan. Therefore it appeared to be unnecessary for federal regulations to require each element as described. Federal regulations would be too prescriptive and reduce the ability of each area to judge and accommodate its own needs in providing data and analysis needed to develop the plan. Furthermore, if these elements were to continue as a matter of regulation (in effect have the force of law), some of the plans would be determined in the courts.

Therefore the regulations (when revised) should include guidelines or advisory information that touch on each of the elements deleted from the planning process described in Section 450.120 of the Rules and Regulations (August 6, 1981).

Guidelines and advisory information should describe the six elements, discuss possible scope of data collection or analysis activities, and discuss possible roles and responsibilities of participating agencies.

Other Federal Regulations

While the workshop did not review and specifically address federal requirements beyond those for transportation planning (Section 134 of Title 23 and Section 8 of Title 49), it was acknowledged that a large number of regulations exist that have great impact on transportation financing and implementation decisions. The workshop felt that many of these other regulations need to be carefully reviewed and overhauled. In some cases, legislative changes may be required. Examples include those regulations relating to EIS preparation and review, procurement and life-cycle costing, and labor protection [Section B(c) of the UMTA Act].

PLANNING METHODS AND PRACTICES (Mike Walton, Task Force Chairman)

The workshop task force on planning methods and practices determined that the need existed to find or train transportation managers with skills in finance, engineering economy, pro-

gram management, and project control. It also maintained the need to start using some existing techniques and methods that are not typically applied in public-sector transportation decisionmaking. These include the following:

1. Engineering economy comparisons of capital investments under alternative life-cycles, rehabilitation and maintenance schedules, labor-cost assumptions, and operating costs — all crucial now for both highway and transit;
2. Risk and uncertainty analyses of major investments or programs with uncertain funding streams, e.g., evaluation of costs of delay or abandonment;
3. The MIS and decision support systems for program management, budget and schedule control, and performance monitoring; and
4. Pricing analyses, including elasticity and direct and indirect impacts.

Some specific new methods and techniques need to be developed and applied including the following:

1. Financial forecasting models to project trends in tax revenues, user fees, costs and cash flows under various assumptions of changes in external variables (such as the economy) and policy variables (such as pricing, levels of service, rate of program expenditures, start-up and finish schedules of construction contracts, etc.);
2. Ways to plug into regional or national econometric models, where available, to better forecast local changes in CPI, construction cost index, labor costs and tax revenues (these then can serve as inputs to agency forecasts);
3. Improved methods to get reliable life-cycle cost data for pavements, bridges, transit rolling stock, and other capital facilities and equipment (needed for sound engineering economy decision analyses about investment, procurement, rehabilitation, and maintenance programs);
4. Innovative financing techniques, including private-sector participation in funding through mutual interest negotiations, borrowing and bonding, cash management, tax incentives, and leasebacks, etc.; and
5. Cost responsibility allocation models to better identify direct and indirect impacts of various new financing and tax or user charge alternatives under consideration (who pays and who gets, and how does it affect the regional economy or segments of it).

The group also noted an urgent need for simplified methods of doing the things listed above, both for existing tools and for needed new tools. In addition, research and development of these tools should be supported by federal assistance, but assigned to implementing agencies who will actually use them.

Future of the Urban Transportation Planning Process

Joseph L. Schofer

The workshop on the future of the urban transportation planning process explored the general attributes of the urban transportation process as it is most likely to, and as it should

most desirably, evolve in the coming decades. Particular concern was devoted to the broad issues and problems associated with the process today. These include apparent mismatches between planning products and decisionmaker needs, deficiencies in planning methods and the uncertainty associated with future transportation system requirements and performance (and forecasts of that performance), characteristics of the emerging market for planning products, and appropriate styles and modes of behavior for transportation planners.

Because of the size of this workshop and the complexity of issues it faced, the group first met as a whole to refine its objectives and then reassembled into three smaller workshops with the following discussion topics: Future Institutional Responsibilities for Transportation Planning, Including the Federal Role (Robert E. Paaswell, Chairman); Emerging Clients, Markets, Strategies, Tactics, and Products of Transportation Planning (David F. Schulz, Chairman); and Role of Methods and Models in Future Urban Transportation Planning Activities (Joel Horowitz, Chairman). The small group discussions focused initially on matching clients with existing and future planning products as a function of the level and scale of planning; exploration of potential roles and styles for planning professionals; and assessment of the current and potential applications of quantitative models and other tools and methods in transportation planning. These discussions broadened in scope as the conference proceeded. The results of the small group deliberations were brought back to the entire workshop for discussion, refinement, and consensus. This report presents the integrated recommendations and observations of the full workshop.

GENERAL FINDINGS

The workshop concluded that the environment of, and thus the market for, urban transportation planning is changing. The federal effort to regulate, and thus control, the detailed attributes of urban transportation planning has begun to be reduced. Non-federal decisionmakers are likely to play an increasingly important role in determining planning process and product requirements. Such decisionmakers will be more concerned with meeting their own, short-range perceived needs, rather than federally specified requirements. This suggests the demand for more diversity in planning activities among cities, but not the absolute decline in the demand for transportation services. Indeed, in the face of scarce resources and increasing costs, the need for careful planning will probably increase. Yet the issues and problems, as well as the clients, to which transportation planning responds are changing at the national scale and are increasingly varied among cities.

To survive, and to be effective in supporting transportation management and investment choices, planners must not only recognize the changing market for their products, they must also adapt their efforts in important ways. In general terms, this adaptation must take the form of modifying products, processes, and tools to meet the issues of today and tomorrow. These issues include rehabilitation and cutback management in older cities, and managing continued growth in newer cities. Serving the market, however, does not mean abandoning our more traditional products that no longer seem to be of interest to some decisionmakers (e.g., 3-C long-range planning).

Where the essence of such products is still of importance, transportation planners must find ways of re-orienting them so that they once again become salient to the clients and context. To accomplish this, the planners themselves must take a strong initiative, and federal government must provide support in the form of both resources and a relaxed regulatory environment to encourage locally appropriate planning functions.

Not only is there a need for a diversity of planning products across cities, but there is also a need for increased diversity in the tools, methods, and skills used by transportation planners. This calls both for increased personal flexibility and a willingness to innovate and adapt and for additional inservice training and research and development support to make such adaptation possible. The following specific recommendations reinforce these general findings.

SPECIFIC FINDINGS AND RECOMMENDATIONS

There is a continuing need for systematic urban transportation planning in the major urban regions of the United States. This need should be met through the application of federal, state, regional, and local resources to several important activity components of transportation planning. Such planning should continue to be conducted in a multijurisdictional framework where appropriate because of the nature of facilities and services, their impacts, and the sources of funding applied to them.

The nature and scope of urban transportation planning must be allowed and encouraged to vary with the characteristics and needs of the local context. In particular, there appear to be important reasons to conduct planning differently in low or no-growth areas than in more rapidly growing regions.

The federal government should continue to support urban transportation planning, while facilitating local variation in the specific attributes of the process, in at least the following ways:

1. Mandating a generalized transportation planning process in urbanized areas larger than some threshold size—a size greater than 50,000 but smaller than 250,000;
2. Establishing and applying regulations and requirements to encourage locally responsive urban transportation planning (regulations should focus on products and processes that are truly significant to all urban regions larger than the established threshold size);
3. Establishing guidelines—as opposed to more strict regulations—for products and process components that

need to be produced only at local option (these guidelines should not become de facto regulations—for example, guidelines should suggest how specific tasks might best be approached if local agencies accept the need for these activities); and

4. Continuing to distribute PL and UMTA funds to support planning, technical assistance, training, and research and development focusing on tools and methods.

The focus of urban transportation planning should be some kind of regional forum, like the current MPOs. This regional orientation is important because many components of the urban transportation system have regional significance, impacts, and costs. However, other agencies should be actively involved in the process, and should hold differing responsibilities as a function of the issues and projects considered. In particular, the leadership role in planning should be closely related to responsibilities for implementation. A more specific set of suggestions for the sharing of planning tasks is given in Table 1, which recognizes six types (levels) of planning and six levels of public agencies.

The transportation improvement program continues to be a viable mechanism for achieving intergovernmental agreement on project priorities in support of federal funding requests. Although the setting of priorities is generally a regional function, budgeting for specific, local projects should originate with local jurisdictions. This should reflect a “bottom-up” approach to priority setting.

Some planning activities and products that are now defined as federal requirements should become recommendations (supported by procedural guidelines). These tasks are those that become significant only if they are strongly linked to locally defined goals. Specific examples of such tasks include air quality planning and special planning efforts to meet the needs of the elderly and the handicapped. This will help assure that the planning accomplished is most responsive to local needs and interests.

Planning Model

Considerable discussion was devoted to a revised, and more responsive, model for the urban transportation planning process—a model that reflects the evolving market for planning and the special needs of different cities. The elements of this process are described below.

There was general agreement that it is highly desirable to pursue some form of ongoing, long-range planning. Consider-

TABLE 1. Suggested responsibilities for components of the urban transportation planning process.

Agency	Strategic and Policy Planning	Long-Range System Planning	Subarea and Corridor Planning	Short-Range and Project Planning	Programming		Project Development
					Priority Coordination	Budgeting	
Federal	F	F	F	F	F	F	F
State	P	P	L/P	L/P	P	L	L
Region	L	L	P/L	P/L	L	P	S
County	P	P	P/L	L/P	P	L	L
City	P	P	P/L	L/P	P	L	L
Operating agency	P	P	L/P	L/P	P	L	L

Note: L = lead role; P = participant role, and F = financial support.

able discussion went into selecting an appropriate name for this component of the planning process because members of the workshop were concerned about the increasingly negative image of the current form of long-range planning. Consensus was achieved on the term "strategic planning process" to denote an activity that looks ahead in a time frame of 10-30 years and that has attributes that may vary considerably among regions as a function of local needs and characteristics. Once again, this variability is likely to be related to the recent and expected growth rate of each region. Strategic planning should not be federally required but it should be strongly supported by the federal government with both technical guidance and financial assistance.

Strategic planning may take several widely different forms. In rapidly growing regions, it may continue to deal with testing and evaluating alternative facilities and technology proposals. In other, more slowly growing regions, strategic planning may appropriately be non-modal, non-facility-oriented, and more oriented toward scanning the horizon and exploring alternative futures for the region to develop a strong understanding of emerging issues, problems, and needs. In some contexts, strategic planning may be conducted in a "comprehensive" way and may extend beyond transportation. In all cases where strategic planning is conducted, it should focus on major, emerging socioeconomic and land use development trends, particularly the kinds of changing population attributes, and their effects on travel requirements, as expressed in the keynote paper delivered by Martin Wachs. The principle behind this notion is that it is becoming increasingly important, as changes in fundamental social, economic, and transportation relationships occur, to capture such trends and make direct use of them in the preparation for more specific, facility- and project-oriented transportation planning to take place in other phases of the process.

Therefore, it becomes possible to understand the philosophy behind strategic planning as defined in this workshop by viewing it as a process for developing a background for facility and service planning. It should establish a relevant decision space for system planning, which is the next phase of the proposed overall transportation planning process.

System planning was defined as the next level in the planning process, and, again, a range of definitions, variable with the context, was established for this task. However, as differentiated from strategic planning, system planning was seen as an activity that should be federally mandated to serve at the very least as a process for systematically testing major actions that eventually would become candidates for entering the transportation improvement program.

System planning would serve as a more direct substitute for both the existing long-range planning process and transportation system management planning and the transit development plan. However, this new concept of system planning would be more closely tied to the product needs of the local decisionmakers—that is, it would focus more directly on potentially implementable solutions.

In understanding the concept of systems planning, it is useful to recognize the diversity of perspectives on this task developed within the workshop. Some, representing the views of developed, slow-growth communities, saw the process as being quite specific and focused on particular facilities, the solutions to current problems, treating rehabilitation needs, and acting to meet the transportation requirements of ex-

pected, near-term urban development and redevelopment in the region. From this perspective, the time horizon for system planning was seen as being variable between 5 and 15 years. Both problems and solutions considered in system planning would come largely from related subarea and corridor studies.

Other workshop participants, recognizing the perspectives of more rapidly growing regions, saw system planning as being more general, leaving open more options, not focused on specific facilities to the same degree as the first group desired, and having a somewhat longer time frame period. From this perspective, system planning would lead to, rather than be fed by, subarea and corridor studies.

Regarding the nature of system planning, workshop participants agreed that

1. There should be a federally mandated system planning process that serves as a test bed for major elements moving into the TIP.
2. System planning should have a flexible time frame, determined by local requirements, ranging from 5 to 20 years.
3. There should be a clearly specified option for pursuing more general and more open (i.e., non-facility-specific) system planning, especially within the time frame of 10-20 years.
4. System planning should interact in meaningful ways with corridor, subarea, and project planning.
5. System planning should have a multimodal orientation and should include consideration of TSM and 4-R options.
6. A "bottom-up" approach was viewed as the most appropriate way to conduct system planning, especially for the near-term part of the time horizon. That is, ideas, problems, and options from lower-level planning efforts should be fed into system planning for testing and evaluation at a regional scale.
7. System planning should be realistically financially constrained, which tends to differentiate it from strategic planning.
8. Particularly in slow-growth areas, system planning should be explicitly concerned with existing conditions and the implications of the remaining life of in-place components.

The need for subarea, corridor, and project planning continues to exist and should be met within the context of future urban transportation planning processes. This need should be supported by federal regulations, procedural guidelines, and funding.

An integrated regional investment programming process, producing a TIP to cover a time frame of 1-5 years, also continues to be important and merits both federal mandate and financial support. This investment program should represent a regional agreement on priorities, with local governments taking the lead responsibility for setting their own priorities and budgeting for those projects that are entirely local in their attributes. Table 1 summarizes the various levels recognized as being important to future urban transportation planning processes, and indicates how responsibilities for these processes should be shared among various governments.

Planning Tools

To conduct effective and efficient urban transportation planning within this structure, there is a continuing need to develop

and to implement more effective and responsive tools for planning. While discussions of tools in this workshop focused principally on quantitative models, it was clearly recognized that a wide variety of skills will be required of planners to meet the requirements likely to face them. These include skills related to communications, negotiations, design, brokerage, conflict resolution, consensus building, education, and coordination. Although it is likely to be the rare case that one individual will combine all of these skills and have an ability to manage the application of quantitative models, the presence of a broad skill mix such as this is likely to be essential to the success of planning efforts in larger metropolitan areas. This suggests the need for training a wider variety of professionals to enter the field of transportation planning, as well as the importance of providing in-serve training opportunities for practicing professionals.

It was recognized by participants in the workshop that a broad variety of analytic tools exist for dealing with transportation planning problems, ranging widely in sophistication and computational requirements. A serious concern was expressed that the rate of innovation in the development and use of analytic tools has decreased in the field, in part due to the ready availability of federally sponsored tools and the relatively strong guidance provided by the federal government regarding the use of specific tools and methods. Furthermore, there appear to be few rewards but many risks associated with attempting to develop and apply new tools. The result is an increasing degree of rigidity in the process of selecting tools to use in solving particular problems. There is a clear need to encourage diversity in both the planning process and the use of tools to assure that methods applied fit appropriately to the problems at hand, which clearly vary from community to community. The federal government has an important role to play in encouraging diversity and innovation, both by funding research and development efforts and by underwriting some of the risks involved in implementation of new tools.

Some examples of methodological problem areas meriting further research and development efforts include the following:

1. Efficient methods for subarea and subregional planning, including microscale modeling to estimate equilibrium flows in small areas recognizing the relationship of those areas to the surrounding region;
2. Methods for predicting non-work and off-peak-period travel, and the linkage between such trips and peak-period movements;
3. Efficient procedures for conducting inventories of system conditions and estimating "needs" in ways that are less subject to judgmental and political biases;
4. Methods to anticipate the intermediate and long-range implications of short-range actions;

5. Methods to estimate the effects of actions to increase the use of flexible work hours and other peak-spreading policies; and
6. Efficient methods for conducting financial planning and investment programming.

In general, the workshop agreed that there is an important federal mandate to support urban transportation planning by investing in such research not only for the purpose of developing new and more responsive tools, but also to retain the interest of researchers in the field and to help those researchers in academic environments train new professionals. Without a continuation of federal research funds, it appears highly likely that many of our most successful researchers will find other activities in which to engage, eventually cutting off the production of new and improved methods and ideas. Furthermore, it is important to recognize the strong relationship between support for research and the production of trained students, who receive both financial assistance and important opportunities for learning through the academic research process. Such training activities, of course, should also extend to practicing professionals so that they may find it easier to keep up to date with the most recent methodological innovations and thereby produce more responsive products in more efficient ways.

Perhaps the most important problem identified during the discussion of tools and methods within this workshop is the unmet need to support a more active technology transfer program to move the best available research tools into professional practice. This is a particularly challenging problem without an obvious solution. It was viewed as especially difficult because of the widening gap between researchers and practitioners. This gap makes it difficult for researchers to understand the practical needs and constraints of the profession, and for practitioners to understand the characteristics of newly developed methods. The federal government has a special role to play in dealing with this problem, which should focus first on providing practitioners with increased incentives and decreased risks associated with applying innovative techniques. This role must include continuing research support as well as providing forums and communications channels through which practitioners and researchers can interact on an ongoing basis.

More specifically, the participants in the workshop recommended more support for effective continuing education that serves to link the developers of new methods with potential users of those methods. It may also be useful to underwrite the development of frequently updated practitioners' guides to tools and methods, possibly in the form of "consumer reports" that may serve to help users make choices about new techniques appropriate to their specific problem.

Part 3: Resource Papers

Transportation Planning: A Unified Approach

John R. Hamburg

In the 1950s, a transportation planner was expected to consider alternative courses of action affecting the movement of persons and goods and to recommend one or a set of actions that seemed appropriate. This recommended act, or set of actions, constituted a plan—hence, the term, transportation planner.

Today, in the 1980s, we are reassessing the role of transportation planners and the tools of their trade. But things really have not changed that much. The particular courses of action that first pop into a transportation planner's mind have followed the trend of changing emphasis since World War II: Interstate highways, urban freeways, rail rapid transit, topics, TCM, TSM, and bike and pedestrian ways. Ultimately, however, the transportation planner has had to provide (a) a product (an estimate of the amount of travel on one or more facilities or services during a specific time period) and (b) an assessment of the impact of that travel in terms of a number of specific criteria or goal performance levels (e.g., travel time, travel cost, facility or service cost, air quality, safety, energy consumption, etc.).

How do we add up performance? How can we evaluate alternative actions in terms of performance against goals? Well, if each goal performance could be expressed in common units, evaluation would be trivial; otherwise it is harder. Recent federal government policies appear to have given new life to the least-cost approach.

Our perception and definition of the actions that affect the movement of people and goods have become richer and more complex. Transportation planning has gone beyond purchasing new transportation system capacity by the addition of new freeways and transit facilities. But there will be new freeways and rapid transit lines built in the next 20 years when and where they are needed, regardless of whether the funding is labeled federal, state, or local. How did we fall into the notion that there was any such thing as "federal" dollars? I thought the money was collected from people and businesses in the form of taxes and fees. A transportation investment should be justified in terms of its return to the people who must pay for it.

Certainly we have seen a recognition of the need that existing transportation system management must be improved that the near-term, short-range traffic problems must be addressed, and that the problems of specific corridors and sub-regions or local jurisdictions should receive detailed study.

It is not this expanded view of the range of responsibilities of the transportation planner that concerns me. Rather my concern is that with each new insight into the etiology of traffic congestion, air pollution, energy consumption, etc., a new

program and methodology sprang up. Transportation planning has been fragmented into multiple programs, funding, and methodologies.

When I speak of a unified approach to transportation planning, I mean a unification of the methodology of the transportation planning process. This unity would extend from short range to long range—project to corridor to jurisdiction to region—and TSM to system planning.

It is hard to remember exactly when it first became clear that a unified approach was not only possible but necessary. In a paper entitled, *Integrating TSM into the Overall Transportation Planning Process*, delivered to the TSM Conference at Arlington, Texas, in November 1979, a three-stage approach was suggested:

- Establishing a Regional Context within which detailed subregional (corridor) plans can be developed. This includes an assessment of growth in population and employment, the establishment of regional TSM actions which can be expected to be implemented and the identification of committed transportation facilities which will be in place.
- Development of Sub-area (Corridor) Transportation Policies and Plans within the constraints of regional growth and transportation actions.
- Synthesis of an Overall Regional Transportation Plan from the policies and plans developed for each of the sub-areas of the region.

We believe that this approach could represent a major breakthrough in the planning process. Prior approaches to long-range regional transportation planning proposed long-range capital-intensive construction programs which purposely avoided detailed and specific alignments and ignored detailed traffic engineering alternatives for coping with local transport problems. These capital programs were typically to be implemented by the state with the major share of funds coming from the federal government. A specific town or jurisdiction was expected to solve its local transportation problems on its own. But a town's ability to handle its own transportation needs without considering its setting within the region and the impacts that regional growth and transportation plans could have on its transportation system was limited at best. It should not seem surprising then that local jurisdictions felt frustrated in a planning process that looked first to the region and only then to the locality. This frustration often sparked opposition to the regional plan when the latter was translated into a specific proposal within the jurisdiction and presented at public hearings.

Originally the regional efforts were spurred by the recognition that if states, counties, and cities all "did their

own thing," chaos would result. However, the past decade has seen many times a public rejection of the elements of the "regional plan" when an element was viewed at the local level in the community in which it would be located. Of course, a large part of this reflects the concern with reducing public expenditures, reducing energy consumption, reducing environmental impacts and improving air quality. Nonetheless, the justification for the regional elements of the plan very often rested on regional benefits and a local case for the facility was not clearly made, if even attempted. The substitutability of TSM actions for other "local" alternatives had not been studied. The "regional good" was just not sufficient to convince the individual jurisdiction of the need for the facility.

Finally, the heart of the methodology of the regional planning process, traffic simulation and assignment, simply was not applicable at the scale or grain required to assess and evaluate alternative TSM actions; the process was just too coarse.

That there is a need for a regional plan is indisputable. The transportation facilities which serve the region must be a system. Major highways have to connect with each other. Public transportation systems must cross jurisdictional boundaries and the service on different lines must be coordinated.

The point is not that the regional plan is *not* needed, but that a regional plan must evolve through a synthesis and integration of local plans which consider regional demand as well as local supply.

This approach has been made possible by the development of simulation software which permits focusing on an area of interest while simultaneously dealing with the remainder of the region. . . . The simulation software has the additional advantage of being able to handle finely detailed networks and very small zones at a sub-area level so that impacts which might be lost in the regional approach may be simulated and evaluated. By applying this approach to all of the sub-areas of an entire region, a set of sub-area plans can be developed. Through a synthesis of these sub-area plans a regional plan can evolve. This synthesis may be iterative but will result in a package of improvements tied not simply to local interests but satisfying regional requirements.

WHY TRAFFIC SIMULATION?

While most planners will concede the need for traffic simulation (spelled traffic assignment) for long-range regional planning, the acceptance of simulation in TSM and traffic engineering studies has been grudging and limited if at all. The arguments against the use of simulation for near-term, low-capital, fine-grained analyses are varied but include too expensive, too time-consuming, not accurate, and not necessary. The response to these arguments is that without simulation of some sort, how can one judge the impact of alternative actions?

One can always "try it and see what happens." Of course, this approach carries some risks. The particular action can have adverse impacts on certain groups of people. For example, if travel is to be prohibited or restricted in certain zones or if parking is eliminated, somebody has to feel cheated. Are the burdens of the action equitably distributed or shared? Can the planning agency admit after a fiasco, "Sorry—it just didn't work. Now we'll try something different."

Often, the planning actions under consideration are not singular but may involve several approaches or packages. Actions that are traffic-related such as bus and carpool lanes may be combined with a carpooling program or staggered work hours. Because they may reinforce each other, two or more actions need to be evaluated simultaneously rather than singly.

Furthermore, one cannot measure the effect of removing parking on a street by measuring the traffic-handling performance of the street before and after the change. The changed operating characteristics of the street may affect the traffic volumes on adjacent streets—i.e., a systems effect. How big an impact depends on the magnitude of changed parking on the street. There might be a slight improvement on several adjacent streets in addition to the slight improvement on the street from which parking was removed. This same kind of systems effect hampers the measurement of emission impacts of vehicles. This results because the emission characteristics of a vehicle vary according to the conditions under which it operates. If we know the number of starts and stops, the idling time, the operating speed, whether or not the engine was warmed up, the type and size of engine, the condition of the engine and emission device(s), one could estimate the emission characteristics of that vehicle or an average vehicle from some mix of vehicles. Now if we remove one such "average" vehicle from the vehicle stream, we can calculate the emission reduction on a yellow pad. However, if we continue to remove vehicles from a congested stream, we will significantly underestimate the emission reduction if we simply multiply the emissions per vehicle mile by the number of vehicle miles removed. This is because, as we remove vehicles from the traffic stream, congestion decreases and this means less idling time, fewer stops and starts, higher running speeds, etc. A significant reduction in emissions results from the improved operating conditions experienced by the remaining vehicles, and, because traffic tends to move toward equilibrium, it is often necessary to measure the whole system or a substantial portion of it.

In sum, almost any TSM or TCM will impact system performance; combinations of actions may have greater or lesser impact when implemented simultaneously than their separate impacts may total. And the actions themselves may range from regional to local in terms of implementation as well as impact. Because of this, we think that simulation is essential to estimating the traffic performance impacts of one or more actions, whatever the scale, time frame, or capital costs of the actions.

UNIFICATION

I suggest that the ingredients for unifying or bringing together all of the different planning actions are now available or within the grasp of the transportation planner. Much of the computer software is written, although some of it is prototypical rather than production programming.

The Right Amount of Data

An essential key to this process is having just the right amount of data for the problem being addressed. It is easier to cartoon

the situations that miss on this account rather than to exactly specify what is required, although this can and must be done.

When planners had finally mastered the art of regional traffic assignment, an art form which George Wickstrom once described as the Glopada-Glopada Machine, they noticed a peculiar characteristic. The greater the number of zones, the higher the cost of an assignment (and not a simple linear cost increase, but an exponential one). They also noticed, to their dismay, that the larger the average zone size (which gave a lower number of zones in total and therefore lower costs), the less the results resembled the traffic volumes that the process was attempting to reproduce. In short, precision seemed to be directly correlated to computer costs and the number of zones. Splendid versions of this approach were marshalled to estimate regional freeway volumes as well as collector volumes in suburban villages. By increasing the zones to 1000 and even beyond, the planner managed to drive the cost of a simple run into the thousands of dollars, sometimes to the \$10,000-\$20,000 range. Of course, at this price they could not be run very often, and the estimated volumes were not very good unless the process restrained the link volumes to the counted or observed volume. That is okay when one knows the answer, but then, why bother?

The lesson that must be learned from this is that the entire region cannot be treated at the level of detail needed to estimate accurately volumes on collectors, minor arterials, and ramps; it is just too expensive. One region, which was simply too big to fit into anybody's computer, was the New York City Metropolitan Area. And it was there, under the direction of Douglas Carroll and Morton Schneider, that the concept of hierarchical zones and networks came to be implemented. Schneider observed that as the distance from a link of interest increased, the exactitude of geographic location of an originating trip and the detail of its surrounding network diminish for a given level of precision on the link of interest. That is, for simulating traffic volumes on a street in Manhattan, adjacent streets needed to be specified and nearby zone sizes needed to be very small. But for trips on that same Manhattan street segment that originate in Newark, the exact location of origin can be generalized to a relatively large zone with little loss in precision of trip length or duration. Also, the detail of the street network surrounding the Newark trip's origin is largely irrelevant. Put in a different part of the country, for trips on the streets of downtown Dallas that come from Fort Worth, the local street system in Fort Worth hardly needs to be in the network, nor does it matter if the zone of origin is 1, 4, 9, or 25 miles in area.

The lesson is not to limit the precision of the assignment process to that resulting from cramming as many zones and links into the computer as one's budget will permit. Do not accept the least common denominator of precision that comes from the regional traffic assignment system of zones and networks. Use flexible (hierarchical) system zones and networks and assemble them in a way that yields the greatest precision for a given cost or meets a prescribed precision level at the least cost.

Hierarchical Treatment of a Unified Data Base

It is not enough to tailor the zone structure and the number, length, and type of transport links that go into making up the

network. There are some other hangovers from the assignment process that need review and revision if the process is to be unified.

Basically, there are three characteristics attributed to a segment of the highway system:

1. Length,
2. Speed or impedance, and
3. Capacity.

Of these, only the first has received treatment adequate to the task of simulation of traffic with precision sufficient for most planning purposes; that is, we have learned to measure the length of transportation segments pretty well.

The limitations of speed and capacity in conventional assignment procedures have been known for many years but largely ignored. Speed is clearly a function of intersection control treatment, posted speed limits, and traffic congestion. Capacity is also a function of intersection controls, turn prohibition, pedestrian and heavy vehicle interference, and traffic congestion. Capacity in fact cannot be defined in terms of vehicles per hour per lane in the absence of knowledge of what is taking place at the intersection. It is in fact dynamic, varying throughout the day according to a host of factors that are knowable but largely ignored in the traffic assignment process.

Algorithms exist for calculating speed and capacity, taking the relevant detailed factors into account. But two problems surface immediately. The first is the fact that the need for precision of speed and capacity specification vary according to the type of study and also with respect to proximity to the area of interest. This problem can be handled by using a process that is flexible in terms of how much detail is required. Intersections within the area of interest can be specified and all of the power of the details of signal timing, turn provisions or proscriptions, opposing traffic volumes, turn interference from conflicting traffic and pedestrian movements, etc., can be brought to bear on the calculation of speed and capacity. At the same time, less detailed specification of more distant links can be used with reductions in the cost of running and little or no reduction in precision within the area of interest. In short, by using a hierarchical description of network detail, regional impacts can be had without the high costs of large-scale assignment but with precise ramp and collector volumes not usually thought possible. The notion of doing it is trivial; yet, if done manually, it is very tedious. A software system of selecting the zone structure, network links, and network detail exists and is being used by the North Central Texas Council of Governments. Such a system will be used in Charlotte, North Carolina, and may be used in Pittsburgh. However, in addition to the software for actually windowing and inserting a micro network, a rich data base needs to be maintained. This requires an information system to both feed the process as well as to maintain a record of what the results were and to evaluate those results.

The notion of 24-hour assignments with 24-hour capacity restraint mechanisms is essentially bankrupt except for the crudest of assignments. But this area is fairly well documented. Moreover, with computers becoming cheaper and more accessible, it seems clear that we should take greater advantage of existing algorithms to provide a more precise and unified approach to traffic simulation that will give inexpensive, timely, and useful answers.

Integration and/or Unification of Highway and Transit Simulation (Mode Split Including Automobile Occupancy)

The biggest shortcoming to transit simulation is our inability to simultaneously represent highway and transit networks and build paths that utilize both automobile and transit. We continue, with a few notable exceptions, to proceed along the notion that a minimum path exists between two points measurable by a single metric—usually time or sometimes weighted time and cost. Yet it was shown in 1957 that there are at least two dimensions to travel that people consider: time and cost. For some people, the least-time path is preferred. For others, the least-cost path is chosen. These paths are usually not one and the same. Moreover, the infamous irrelevant mode issue that has plagued the users of the logit model and single-dimension minimum paths disappears when two-dimensional trees are built and used as a basis for allocating travel to mode.

Zone size and access links also plague the simulation of transit. Walk access and ride access are clumsily handled in most procedures.

The notion that highway times and costs are the same to people making a choice between automobile and transit regardless of car availability seems childlike. Yet only limited attention has been given to the problem of estimating car ownership by small areas.

The automobile occupancy problem, so vital to high-occupancy-vehicle projects, has not proven to be amenable to multinomial logit efforts—but certainly not for lack of trying to calibrate models.

CONCLUSION

There is more that could be said and complaints, regrets, and criticisms that might be spewed forth. But my conclusion is simply that unification of transportation planning is long overdue.

One cannot make local plans without considering the impacts that regional growth, traffic, and transportation facilities will have on the locality. Nor can one plan regional transportation facilities in the absence of local inputs regarding transportation facilities and actions. There must be an integration of planning across time, space, and capital requirements if we hope to get the most out of our planning efforts, not to mention our planning dollars. There is very little standing in the way of such a unification—MPOs were born, painfully, in order to house such a unified approach.

The theoretical concepts necessary are all available for a flexible hierarchical approach to representing transportation systems; representing the spatially detailed settlement pattern of regions (the socioeconomic characteristics of regions); the storage and retrieval of these data at the appropriate level of detail, geography, and time; the models of social interaction that result in travel; the diagnosis of problems; and the evaluation of alternative actions directed to the solution of those problems.

Much of the software for implementing these concepts is in place. A handful of regions are already undertaking the approach. What is needed is to continue this effort and move to a sharing of methods and procedures.

Perhaps out of this conference can be born a user's organization to compare and share techniques and methodologies that can hasten the unification of transportation planning functionally, spatially (local to regional), financially (low-capital to capital-intensive), and temporally (short-term, long-range).

An Outline of the Emerging Urban Transportation Planning Process

Douglass Lee

Transportation planning and the transportation planning process have been severely buffeted from sources both inside and outside the field, primarily throughout the 1970s. To transportation planners who experienced the clear direction and exciting achievements of the previous post-war decades, the prolonged milling about of the current period has been frustrating and distressing. Yet this apparently aimless indecision has permitted a productive review and rethinking of the basic planning paradigm, and a new paradigm is finally taking shape as the fog lifts. This paper is an effort to describe and clarify the new shape.

The slowness of the new pattern to emerge is because its difference is at the most fundamental level. This does not mean that everything must be done over from scratch; on the contrary, many professionals are actively practicing in the new paradigm while thinking of themselves as being forced into an undesirable (and preferably temporary) departure from the old process. New theory, new methods, new concepts, and new professional standards are necessary, of course, but most of the tools are already available and in use by transportation planners. Primarily, it is the framework by which these elements are integrated and synthesized that is changing.

The long-range comprehensive planning model gradually ground to a halt as a result of the changing nature of the problems and the weight of additional requirements placed on the old model. The beauty of a unified approach was lost in the tangle of environmental impacts, citizen participation, procedural requirements, and conflicting objectives, all of which had the effect of reducing the level of clarity, consensus, and closure. A unified approach can be constructed from the rubble of the old model, but not by rejecting the more recent demands placed on it and stripping away those functions. Instead, unity must come from addressing the planning problem at a higher level of abstraction, in a manner that is at least as rigorous as the old one.

POLITICAL AND TECHNICAL SIDES OF PLANNING

Because planning is concerned with decisionmaking in the public sector and because professional planners are necessarily involved in the political process, a workable planning framework must incorporate some concept of the political decision process. It is not adequate, however, to simply say that policymakers determine policy and planners carry it out. The information used by policymakers should come, in part, from planners, and the kinds of decisions that call for both political and technical inputs cover a very wide range. From deciding how much to spend on the national highway system to deciding which streets to sealcoat, the choices have both political and technical elements (Figure 1). Moreover, planners have a professional role to play in facilitating the resolu-

tion of conflicts, both in establishing the terms of debate and in conducting or participating in portions of that debate.

Unfortunately, the realization that planning is inherently political and that planners have a responsibility to serve the needs of the political system has sometimes led to an abandonment of planners' technical responsibilities. Many planners have found it difficult to reconcile their technical contribution with the nature of the political process, seeing them as conceptually incompatible and the resulting compromise as necessarily flawed from a technical perspective. In a proper conception of the planning function, this incompatibility need not arise.

Thus, an essential feature of a suitable planning paradigm is the integration of the political and technical aspects of planning. The professional objective should be to seek, in any given decision, the proper balance between technical and political inputs and to combine them in a way that makes the results of the decision process better than they would be if the process were either more politically or more technically dominated.

NATURE OF THE POLITICAL DECISION PROCESS

Planners must learn to accept certain characteristics of the political process as given and seek to improve the results of the public decisions within those constraints. Policymakers, for example, make decisions in a sequence (not simultaneously), and they are timed so as to take advantage of the relevant factors. Issues are resolved partially, and in many steps, not once-and-for-all. Thus, a comprehensive planning model asks the political process to do things that it will almost never do in a democratic society.

The "old" transportation planning process has been characterized as "long-range, comprehensive, top-down, end state, closed-option planning," in contrast to a process that needs to be "short-range, incremental, politically open, and multi-optioned in the sense of narrowing but not eliminating choice" (D. B. Lee, *Improving Communication Among Researchers, Professionals and Policy Makers in Land Use and Transportation Planning*. U.S. Department of Transportation, March 1977; George Wickstrom). Unless planners have very sound reasons for wanting to alter these characteristics, an ideal planning framework is one that optimizes the planner's contribution within these constraints. Such a framework is feasible and available.

Planners should keep in mind that their major source of impact is in ideas, not in numbers, computers, or expert credentials. The ideas embodied in the traditional planning process have been largely ignored by the political process for reasons that seem valid in retrospect. We should seek to construct and communicate a different set of ideas that will be more productive in dealing with current and future problems.

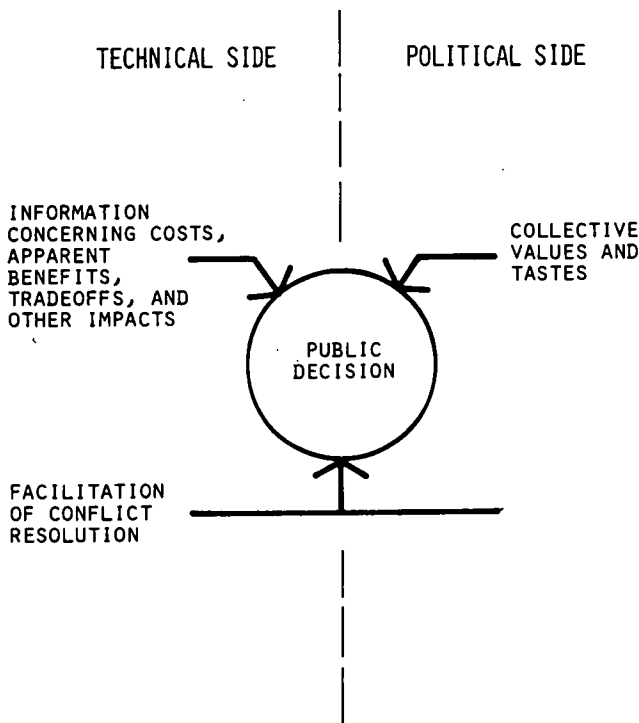


Figure 1. Technical and political inputs to policy decisions.

COMPONENTS OF PLANNING

One way to initially slice the planning problem is into three functions: the generation of alternatives for consideration, the estimation of impacts for each alternative, and the evaluation of which alternative to select (Figure 2). [This trichotomy is closely parallel to Herbert Simon's description of decisionmak-

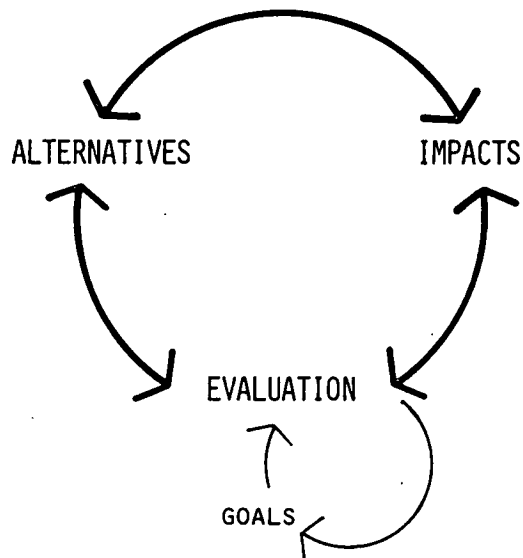


Figure 2. Functions of the planning process.

ing as Intelligence (the scanning of the applicable domain for evidence of problems, i.e., impacts), Design (construction of alternatives), and Choice (selection of the preferred alternative.) The listed order is arbitrary, as the functions have no natural sequence. Evidence about impacts of current policies leads to ideas for alternatives and the basis for evaluating them; debates about goals lead to concern for desired alternatives and means for achieving them. Each function has both technical and political sides. Alternatives are generated by the political process as well as by technical analysis, impacts are continuously articulated through the political process by those perceiving consequences for themselves, and evaluation should ideally combine political values with technical knowledge.

INPUTS TO THE TECHNICAL SIDE OF EVALUATION

As the focus is narrowed to the technical side of planning, attention can be directed at the analytic framework. For evaluation, the information about each alternative should be digested and transformed into two main streams, representing benefits and costs (Figure 3). Although user benefits are not the only source of benefits, they will normally be the major source. All impacts should be recognized in some form, and quantified and valued to the extent that seems warranted. How much this is done depends on professional judgment, but no impact should be excluded simply because it cannot be easily measured. Skills required in this analysis are derived mainly from planning, economics, and engineering.

The traditional urban transportation planning process has been largely consumed with the forecasting of demand over relatively long periods of time. As long as steady growth was the overriding feature of the problem and the direction of public policy was not open for review, a travel forecasting strategy was probably an adequate means of ranking projects within an exogenously determined budget. Current problems, however,

are characterized by the need to obtain better utilization of existing facilities and the competition of numerous claims for the allocation of limited resources.

EVALUATION CRITERIA

In providing information to decisionmakers about a particular project under review, a planner would not offer estimates of how many hours a lazy crew would take, how many hours a productive crew would take, and the prevailing wage rate, leaving the decisionmakers to estimate costs for themselves. Yet, when it comes to evaluation, planners have all too frequently taken the position that their professional obligation is satisfied by presenting all the possibly relevant information and digesting it almost not at all.

With few exceptions, all goals and objectives can be categorized under three headings: efficiency, effectiveness, and equity (Figure 4). The efficiency goal is to maximize net benefits for society as a whole, i.e., make decisions that result in the largest positive difference between incremental benefits and incremental costs. No positive or negative impact should be omitted in this accounting, whether or not it can be quantified and valued. Equity is the concern for the distribution of costs and benefits over subgroups of the population. The equity criterion operates more as a constraint than as a normative guide because transportation projects are seldom very effective means for accomplishing equity ends.

Effectiveness is not really a third dimension, but rather a different perspective on efficiency and equity. Because transportation policies and projects exhibit multiple objectives (or at least produce travel benefits in several metrics), cost-effectiveness analysis is rarely adequate or even applicable. Measures of effectiveness can be constructed along a large number of partial dimensions and used for comparison of alternatives, but only if one output clearly dominates (e.g., passenger trips) and there is no doubt that at least one alternative is worthwhile will cost-effectiveness calculations suffice. Effectiveness measures add to the richness of the information but do not substitute for efficiency or equity evaluation.

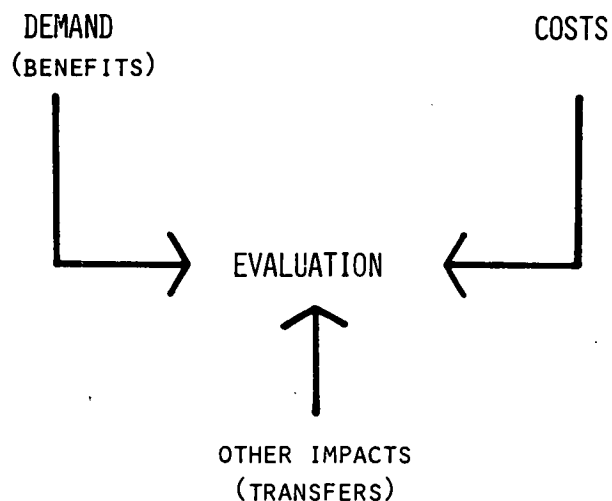


Figure 3. Technical inputs to evaluation.

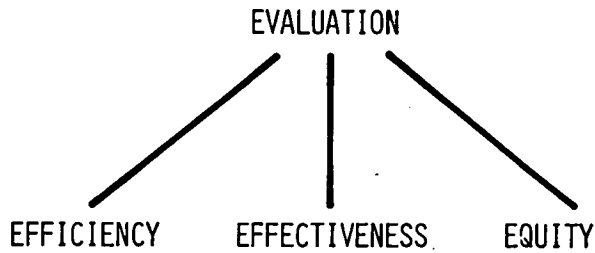


Figure 4. Primary evaluation criteria.

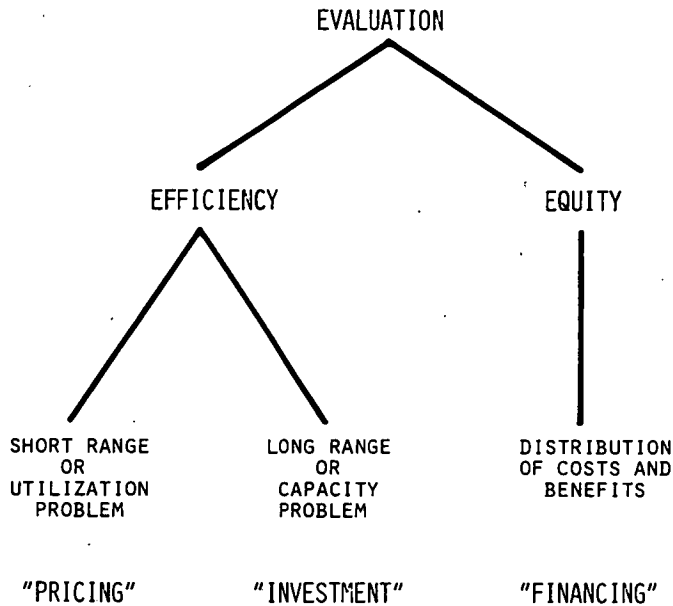


Figure 5. Technical subproblems in evaluation.

A FRAMEWORK FOR EVALUATION

The technical problem of evaluation, then, separates into the two overriding goals of efficiency and equity (Figure 5). Efficiency, in turn, has two subcomponents. The short-run problem assumes that the capacity is fixed and given, and the need is to derive the optimum utilization of that stock. Although the

instruments for achieving the optimum utilization are much more numerous than just charging users the correct price, the relevant normative theory (from microeconomics) portrays the problem in terms of price, and other short-run alternatives can be evaluated within a pricing framework. The long-run problem is to adjust investment in the capital stock over time, and optimization along this dimension relies heavily on the general framework of benefit-cost analysis. Equity goals are realized through the instruments by which the policies or projects are financed.

A virtue of this analytic framework is that the three problems—pricing, investment, and financing—are conceptually separable. They also have a natural hierarchy, which is from pricing to investment to financing. Ideally, all alternatives are correctly "priced", i.e., they make optimal use of the capital stock available under the alternative. This applies to proposed as well as existing alternatives. Then, from among this array of "good" choices, the one that maximizes net benefits is selected. Finally, the efficient investment is financed in a way that satisfies equity criteria.

CONCLUSIONS

Only the faintest glimmer of the strengths, depth, and difficulties of using this framework can be provided in this simplified outline. Despite a terminology that is relatively new to urban transportation planning, the new paradigm retains most of the methods and procedures contained in current practice. The major implication is a shift in emphasis toward evaluation. From the standpoint of evaluation, for example, congestion is seen as a problem of pricing (utilization), not investment (capacity). Additional investment may or may not be warranted, in a particular context. Also, the normative structure of evaluation indicates that pricing (e.g., user charges below marginal cost) is not the best means for securing equity objectives. Second-best comparisons are the reality of professional transportation planning, and their analysis and evaluation present challenging problems, but the framework does not change. Externalities (pollution, noise), indirect impacts (land use), and other factors are incorporated into the framework through theory and empirical analysis that has been developing over a long period of time. With a modest amount of retooling, urban transportation planning can absorb and use the large store of available knowledge, both within the field already and in economics, to respond productively to the problems facing the field.

Social Trends and Their Implications for Transportation Planning Methods

Martin Wachs

Transportation planners devote most of their effort to analyzing data and formulating mathematical models that estimate current and future travel. The appropriateness of models and validity of data chosen to calibrate them depend largely on the wisdom with which planners recognize and forecast social trends. Just as travel is derived from economic, social, and recreational activity, our methods are derived from perceptions of social, demographic, and economic structures. When these foundations of transportation planning change, we must recognize that change and adjust the methods accordingly.

The pioneering regional transportation studies of the 1950s and 1960s invented techniques that evolved into the transportation planning methods used today throughout the world. Those methods no longer seem adequate to the tasks of the 1980s, and that is the major reason for this conference. But we should not lose sight of the fact that early regional transportation studies devoted most of their effort to the discovery, analysis, and forecasting of demographic, economic, and social trends. The mathematical techniques that they fashioned encapsulated current understanding of relationships between those trends and travel. The extent to which we find their methods obsolete today does not merely reflect our greater mathematical and computational capabilities. To a far greater extent, it is a reflection of profound changes in our understanding of the underlying determinants of travel. The effectiveness of new transportation planning methods will depend far more on our understanding of social and economic trends than on statistical elegance or technical finesse.

Transportation planning methods rest first and foremost on an understanding of the phenomena with which they deal. Methods prove inadequate if they do not correctly or completely represent relationships among travel and urban development; household decisions and economic trends; social changes and trip patterns; and political decisions and transportation options. We use simple observation, statistical hypothesis testing, and analytical models to discover relationships that underlie travel. This understanding is elevated to the level of formal theory through replication and the development of models. The applied models that transportation planners use every day reflect theories, which in turn reflect statistical analyses, which in turn reflect conclusions and, ultimately, even hunches about transportation phenomena. At this conference we want to be practical and to concentrate on the planning methods that we use every day. We do not seek conclusions that are too academic, ethereal, or limited to discussions of statistical tests and mathematical formulations. Yet, we must recognize that flaws in our everyday models can ultimately stem from many sources. First, they can be traced to

poor empirical information on which we try to base useful applications of essentially valid theories. Second, they can reflect the fact that some of our theories are outmoded, incomplete, or just plain wrong in their representations of causes and effects. Third, everyday planning methods are often faulty because they apply analytical techniques to the task of projection for which they were not properly designed. Even though they seemed to fit retrospective time series or cross-sectional data very well, analytical models are often quite useless for projection.

I want to discuss several important changes in social and demographic trends rather than to talk directly about planning methods. I do this because I am convinced that these trends are dominating the changes now taking place in travel patterns and transportation policy, while the everyday practical methods of transportation planning are failing to recognize or incorporate them. They fail to recognize these important trends perhaps because of inadequate data, perhaps because of inadequate theory, and perhaps because we keep applying old analytical techniques to the tasks of projecting a new environment for transportation. If we want to concentrate on the trees that constitute transportation planning methods, I want to at least insist that those trees are located in the right forest. In the final analysis, that seems quite practical to me.

Although major social changes are invariably interdependent with one another, it seems useful to describe recent trends in terms of three major themes. These are (a) changes in the American household, (b) the transition to the post-industrial society, and (c) changes in price structure of transportation and housing. Under each of these headings I will summarize major social changes now under way and discuss their implications for travel and transportation. I will close each section by offering personal interpretations of their implications for transportation planning methods.

THE CHANGING AMERICAN HOUSEHOLD

Recent Demographic Trends

The American household is not what it used to be, and the consequences for transportation planners are significant. For more than 20 years, the number of households has been growing more rapidly than the population, and over time the disparity between these growth rates is widening. During the 1970s, the number of households grew at an average rate of 2.2 percent per year, while the population grew by only 0.8 percent per year¹. The rate of household formation was thus

2.75 times as great as population growth, while in the 1960s new households were formed at a rate only 1.4 times that of population growth². Consequently, while in 1940 the average American household consisted of more than 3.6 persons³, today it consists of fewer than 2.8 persons⁴.

There were 10.7 million more households in 1977 than in 1970, but this increase in numbers reflects more dramatic changes in household composition. These changes are so profound that the term "household" itself no longer means what it used to. During those seven years, 44 percent of the growth in households consisted of new single-person households². Single-parent households with children present accounted for another 21.5 percent². By contrast, during the 1960s, single-person households had accounted for 37 percent of the growth in households, while single-parent households had provided 11 percent of the growth². During the 1960s, half of the increase in households was still due to increased numbers of married families, but by the 1970s marriages accounted for only one-quarter of the growth in households. Among households formed in the 1960s, only 1 percent of the growth was due to unrelated individuals living together, but 10 percent of the growth in households during the 1970s was attributed to this mode of living². Today, traditional married families with children constitute a surprisingly small fraction of all households.

There is no simple explanation for these interesting trends. The relative increase in single-person households, for example, is partly due to an increase in the elderly population among whom widowhood creates many single-person households. Between 1960 and 1978, the number of persons over age 65 who lived alone grew by a rate 60 percent higher than the rate of growth in all households¹. Another part of the increase in single-person households can be attributed to the fact that many born as part of the post-World War II baby boom have reached adulthood, and there is a tendency among younger adults to marry at later ages than in previous decades. Many remain single indefinitely, while those who marry have fewer children and at later ages. In addition, divorce has become much more common than it was in previous generations. Many single-person and single-parent families have been formed by the dissolution of marriages. In 1950 there was approximately 1 divorce for every 4.5 marriages; by 1977 there was 1 divorce for every 2 marriages¹. Eventually, a majority of divorced people do remarry. The rate of remarriage among divorced people in 1977 was about two-thirds the rate of first marriage among unmarried people¹. Marriage, divorce, and remarriage are major factors in the dynamics of household formation.

A major social trend clearly related to the changing composition of the American household is the economic independence of women, whether in single-parent and single-person households, or in traditional marriages. During the 1970s, the male labor force grew in size by an average of 1.6 percent per year, while the number of female workers increased by about 2.8 percent per year¹. About one-third of the increase in working women occurred among women who were divorced or never married, but about two-thirds of the increase were attributable to working wives⁵. Today, just about half of the married women who live with their husbands are employed, and among women who have children of pre-school age more than one-third are in the labor force⁶. Until recently, women were more likely than men to hold part-time, clerical, and sales jobs, but

there is now rapid movement into the trades and professions. Women, for example, constituted 4 percent of the enrollment in law schools in 1960, but 19 percent by 1975; they were 6 percent of the medical students in 1960, but 18 percent in 1975⁶.

Another trend of great significance is the aging of the American population. Although life expectancy has not increased dramatically over the last 20 years, birth rates have declined. In 1970 less than 10 percent of the population was over age 65, but today about 11.2 percent of all Americans have passed that milestone¹. Extrapolation of current trends indicates that about 12.2 percent of our citizens can be expected to be older than 65 by the turn of the next century¹.

Implications for Travel

Households are the most basic decisionmaking unit with respect to travel, and changes under way in household structure are having profound effects on travel patterns in the United States. This may be sensed by considering a single dramatic statistical comparison. While Americans in 1979 had, on average, about 0.8 children (under the age of 18) per household, they had about 1.55 automobiles per household, or nearly twice as many cars per household as children⁷. We tend to think of the terms "household" and "family" as synonyms, but in reality only a minority of households consist of traditional families. All, however, make decisions about travel. New automobile registrations correlate more closely with household formation rates than with population growth rates. Similarly, growth in peak-hour commuting, so critical to transportation planning, reflects the economic reality that households—the basic units determining employment and economic consumption—are growing at an increasing rate even as population growth is slowing. The rise of households consisting of single adults, several working adults, and working adults with children is probably the single most important trend influencing travel patterns in America today. It may be the major reason that peak-hour commuting by public transit, carpooling, and vanpooling is increasing in many central cities while automobile commuting volumes hold constant in the face of absolute declines in central-city population.

The increasing economic independence of women, a result of greater entry into the work force, increasing likelihood that they are heads of households, rising educational levels, rising incomes, and fewer children, give rise to the fact that women are now the principal drivers of 42 percent of the country's automobiles⁷. While women still have shorter average journeys to work than men (7.5 miles for women versus 10.5 miles for men) and are more likely than men to commute by public transit, work travel by women is the most important element of growth in peak-hour travel⁸. Numbers and lengths of work trips by women are both likely to continue to increase as women become less transit dependent, less confined to clerical and sales employment, and less likely to work near home in order to be able to conduct childrearing activities.

The graying of the American population is also having profound effects on travel demand and trip patterns. Persons over 70, the age group in our population growing most rapidly, are licensed to drive at the lowest rates of any group over 18 years of age. Today, less than half of the men and less than one-third of the women over age 70 are licensed drivers⁹. And women,

less likely to be drivers, outnumber men quite significantly in these oldest age groups. However, this is a vestige of the fact that many of our oldest citizens, especially women, never drove at all, having grown up before automobile use became as common as it is today. Each year, as many of our oldest citizens die, those reaching retirement age include larger proportions of people who were weaned at the wheel. Thus, we find rapidly increasing use of automobiles by elderly people. Within 15 years, for example, as high a proportion of women of retirement age are expected to be drivers as men, and the elderly will be licensed to drive in nearly the same proportions as middle-aged people¹⁰. The absolute number of transportation-handicapped and transit-dependent elderly people will not necessarily decline, since there will be many more old people and disabilities will surely make it impossible for many of them to drive. But, certainly, the number of elderly drivers and car owners on our roads will increase dramatically in the coming decades.

Implications for Transportation Planning

Household composition, population densities, income, and car ownership have all been treated in transportation models as the most important determinants of trip generation, destination choice, and modal choice. Changes in the meaning of "household" should cause us to question the stability of past estimates of travel and the appropriateness of traditional methods for modeling travel. Some 10-15 years ago, we explained travel in terms of an orderly progression among stages in the family life-cycle. New households were described as composed of single workers; these soon became married couples; they next had children; and after two decades their children formed their own households while the parents remained as older, childless couples. Newly formed households of young adults were often thought to locate in central cities, near employment and entertainment, in smaller, denser housing units. The births of children caused families to move to the suburbs where lower densities and better schools suited the childrearing stage in the family life-cycle. Older couples were thought to return to denser inner cities to take advantage of the services located there. Automobile trip generation rates were highest in the suburbs because of larger household sizes, lower densities, and the higher incomes that were associated with the peak earning years of the heads of households. This picture was neat, understandable, and statistically explainable, but it represented the family of the 1950s and 1960s, which is no longer valid.

The stepwise progression of stages in the family life-cycle has given way to a pattern of much greater diversity. Many single-person households remain intact for decades. Two-person households consist of single adults with children or of unmarried adults living together. Some people have children in their 20s, while other couples defer childrearing into their 30s. Households dissolve, reform, grow in numbers, shrink in size, and shift in location. While suburbs used to mean families with children and a predominance of detached single-family homes, they now as often mean complexes of townhouses and apartments inhabited by singles, couples, or single parents with children. Many single-family units in the suburbs are shared by unrelated individuals, and increasing numbers are

populated by the Levitowners of the 1950s who are now elderly and, in some cases, widowed or divorced.

The traditional variables used by transportation planners to explain travel—income, residential density, household size, automobile ownership, and age—may no longer have the explanatory power they used to have. People now have more choices and fewer constraints. Roles traditionally associated with one stage in the life-cycle are chosen at others; residential environments assumed to be preferred at one stage now characterize many; household income and automobile ownership fluctuate widely as household composition shifts rather than as one progresses up the economic ladder.

A number of transportation planners have grappled with this concept by explaining these changes in terms of the concept of life styles, an analytical construct worthy of much more attention. This concept implies that people make conscious choices of roles and behavior patterns substantially independent of income, educational, and household size variables. Salomon¹¹ recently collected several different definitions of life style in his doctoral dissertation on new ways of explaining travel behavior. Some of the descriptions he compiled are helpful.

James Coleman¹², for example, wrote:

The individual's pattern of assumptions, values, and motives lead to consistent ways of perceiving, thinking, and acting, which together constitute a characteristic modus operandi or life style.

Robert Havighurst¹³ described life style as the allocation of resources among roles:

a characteristic way of distributing one's time, one's interest, and one's talent among the common social roles of adult life—those of worker, parent, spouse, homemaker, citizen, friend, club or association member, church member, and user of leisure time . . . A life style can be described quantitatively as a pattern of performance in these common social roles.

Rainwater¹⁴ further described life styles in this way:

Life style or subculture is conceived as a description of the way of living a group creates out of the resources available to it—material, social, and intellectual—in terms of the tastes and needs of members of the group. Life style is understood to be constrained by the resources of the group and yet to reflect the group's choices in constructing a way of life within these constraints.

Wind and Green¹⁵ saw life style as a latent variable that might be more useful than traditional concepts for explaining behavior, especially travel behavior:

. . . life style research is designed to account for unit of association (individual, family) differences in some kinds of behavior which cannot be accounted for by physiological, demographic, and socio-economic characteristics.

The most comprehensive description of the applicability of life style to transportation planning is provided by Reed¹⁶:

There is clearly a great deal of evidence now which shows that in many instances behavior patterns (life styles) vary as much within income classes as between them. The same holds true for age (or stage in life cycle), education, occupation, regions or neighborhoods, and now even for some ethnic groups. These various social traits, in other words, are insufficient by themselves to account adequately for patterned behavioral variations . . . For some purposes, then, it is conceivable that life style may

have as much or more explanatory value than any of the single variables which help to shape it . . . While the literature is replete with studies using multivariate statistical methods to identify interactive effects of a set of social variables, it is suggested that life style may be an empirically . . . synoptic manifestation of certain social characteristics and conditions acting in concert. If life style is viewed as a composite of role behaviors, distinctively chosen and differentially emphasized and performed, these behaviors must be selected from among the set of those potentially available to persons of specified social characteristics, and life style may be considered to be bounded by, but not otherwise determined by . . . these characteristics and conditions.

If life style can be thought of as the result of choices people make among homemaking, career, social, and recreational roles, and physical environments that they choose, it follows that the statistical measurement of life style differences is promising for the forecasting of travel, automobile ownership, and other variables of interest to transportation planners. Recent research into family time budgets and travel¹⁷, the development of the household activities and travel simulator (HATS) to examine how individuals within households assign and accept responsibilities and activities in space and time¹⁸, and recent applications of space-time geography to transportation planning¹⁹ seek to discover just how life styles differ and how choices of life style influence or explain travel. Salomon¹¹ used life styles in a disaggregate model to successfully explain travel choices, and Wachs¹⁰ used the concept in an aggregate analysis to show that there were dramatic differences between the travel patterns of the elderly of different life styles. It would appear that this concept is worthy of further investigation and testing.

It seems reasonable to hypothesize that a working mother or single parent with household responsibilities would choose work destinations and travel modes on the basis of different priorities than a male worker whose wife is at home. I would contend that our trip generation, destination choice, and mode choice models encapsulate an economic rationale more appropriate to the male worker who is the head of the household than to a single mother. If so, existing models explain travel patterns less well each year, as single mothers and working wives become a larger proportion of travelers, and male heads of households with wives at home decrease even more rapidly as a proportion of tripmakers. Similarly, if the psychological and economic reasons for travel among retired people differ from the determinants of travel among employed people, it might be necessary to develop methods that explicitly recognize these differences. The inclusion of age, sex, and income as independent variables, or as the basis of classification of tripmakers, may be quite inadequate to specify travel demand models in an era of diverse life styles.

EMERGENCE OF THE POST-INDUSTRIAL CITY

The American city, like the household, is not what it used to be, and changes in our urban economy are having profound effects on transportation. We are all aware of the population losses that have occurred in most of the largest cities, but these changes are matched by more profound shifts in the location and mix of employment and capital investment. These shifts are so dramatic that the economic function of the city can

be said to have been transformed. In the past three decades, the traditional American industrial city has given way to the "post-industrial" city. I question whether we have yet recognized the effects of this transformation on urban travel patterns or represented the transformation in transportation planning methods.

Recent Trends in Urban Economic Structure

Half of the standard metropolitan statistical areas (SMSAs) with more than a million inhabitants lost population during the 1970s, and the other half—with only a few exceptions in the sun belt—grew at a generally lower rate than the U.S. population as a whole. We have been conditioned to think that "growth is good," so this phenomenon is usually described as "a decline." Yet, all of the SMSAs, with the single exception of New York, experienced real increases in total personal income during the same period, and, of the 35 largest metropolitan areas, 31 experienced absolute increases in employment²⁰. Economic decline, it would seem, is too simplistic an explanation of what is going on in our cities. Rather, we should be describing these changes as a transition to a different sort of city—the post-industrial city.

Central cities are no longer manufacturing centers. The abandonment of cities by manufacturing industries, reported and measured many times since World War II, accelerated during the 1970s. This trend is so pronounced that in the past decade even the suburbs of our largest cities experienced net declines in manufacturing jobs²⁰. No longer critically dependent on immediate access to ports and railheads, and increasingly dependent on lower wage rates, manufacturers have moved to rural areas, to smaller cities (especially in the South), and, at an accelerating rate, to foreign countries. Our largest cities have become service centers and are now the locations of financial, information processing, communications, and many other white-collar industries.

But that is only part of the transformation. It is now clear that while shifts to the services have more than made up for losses in manufacturing employment in most of the larger metropolitan areas, the bulk of the net growth in service employment has occurred in the suburbs rather than in central cities. For a selected group of 10 metropolitan areas, for example, Black found that suburban service employment increased 10 times as much as central-city employment in this category during the 1960s and 1970s²⁰. Retailing, similarly, has shifted from central cities to suburbs over 30 years. Only a few central cities have maintained their absolute levels of retail sales, while virtually all have lost retailing when measured as a proportion of total metropolitan area retail sales. Growth in retailing has almost all occurred in suburban shopping centers²¹.

While transportation planners continue to think of the suburbs as white-collar dormitories for central-city jobs, it is now clear that for 20 years suburban employment has actually been increasing more quickly than suburban residential population. Footloose white-collar industries have followed their labor markets and retailers have followed their customers to the suburbs. Inner cities have held their own in relatively few areas. Many have experienced absolute increases in office construction, although these rates of increase are far below those of the suburbs. Entertainment, cultural, artistic, educational, and medical activities have also continued to favor

inner-city locations²². But overall, concentrations of office and service employment have shifted to the suburbs while manufacturing capital has gone to rural areas, particularly in the South, and has also left the United States in search of cheaper labor abroad.

I would prefer to describe these changes as a transition rather than a decline in the metropolitan economy. There have been painful consequences, however, that are only now being grasped although the transition has been under way for decades. The shift of capital investment from older urban centers to rural areas and suburbs has simultaneously placed the pressures of growth on some parts of metropolitan America and the pressures of decline on others. Suburbs have had to expand investments in streets, highways, educational and recreational facilities, and public services, just as inner cities have found it infeasible to maintain their aging capital plants and networks of services. On top of this, increasing suburbanization of service and retailing jobs has placed pressure on the suburbs for the development of additional housing. Gradually, suburbs are increasing in density as moderate-density townhouse and garden apartment developments now outnumber traditional single-family developments among new housing starts. Heavy investments of public and private capital have renewed the very central cores of many cities, while inner-city areas outside the central business districts have declined for lack of economic investment. Simultaneously, inner cities have not served their indigenous labor forces very well. White-collar, skilled, and professional labor has suburbanized along with service and retailing jobs. Inner-city populations, increasingly black and Hispanic, have not seen substantial increases in employment for which they are qualified. Thus, while the suburbs are often booming, unemployment and dependency increase in the inner cities, the housing stock there ages, and the quality of education, public, and social services declines in the face of real declines in the municipal tax base²². Metropolitan America remains viable in the large, but New York, Cleveland, St. Louis, Newark, and many other core cities struggle to survive. Collectively, we speak wistfully of the potential renewal of these cities, but in reality we continue to transfer population and capital to the suburbs and to smaller urban areas outside metropolitan centers.

Implications for Travel

As a consequence of the dramatic transformation of the urban economy, the heaviest concentrations of travel are shifting systematically from inner cities to suburbs. A recent report to the U.S. Department of Transportation estimated that vehicle miles of travel (VMT) in the suburbs will increase by more than 40 percent between 1977 and 1990, while central cities can expect increases during the same period of less than 5 percent¹. In part, this enormous disparity in anticipated growth rates is due to the fact that jobs as well as residences have been suburbanizing. For an increasing proportion of Americans, travel to and from work means travel from suburb to suburb. In addition, incomes are higher in the suburbs, and travel continues to be correlated with income. Also, households in the suburbs still have larger average sizes, and larger households generate more trips than smaller ones. Finally, the spatial dispersion of activities in the suburbs requires more VMT to accomplish activities that could be served by fewer

VMT in the inner cities. Thus, the 1977 National Personal Transportation Study showed that the average licensed driver living in the suburbs drove about 10,400 miles per year, while inside the central city the number of miles driven per licensed driver was only about 9400 miles⁹.

In many metropolitan areas, transit service is being expanded in suburban areas and decreased in the inner cities in response to these overwhelming changes in population and employment. But most of the suburban improvements in transit serve peak-hour commuters to and from downtown, while dispersed work sites often depend exclusively on automobile access. Thus, while suburban transit ridership grows, it does so more slowly than travel in the aggregate. Furthermore, maintenance of traditional flat fares makes these transit improvements very costly. Service to lower-density areas involves fewer boardings and alightings per mile of service and longer transit trip lengths. Flat fares produce lower revenues per passenger mile in low-density areas, while operating costs are higher per passenger mile, since in the suburbs the ratio of vehicle miles to passenger miles is higher than in the central city²³. Carpooling and vanpooling are economically efficient alternatives to single-occupant automobiles but they require concentrations of commuters at least at one end of the trip and shared work hours. Ridesharing is growing among work trips between suburban residences and downtown work centers, but, like public transit, ridesharing is growing more slowly for suburban-to-suburban work trips than are trips made by singly occupied automobiles.

Inner-city streets, highways, and bridges are aging quickly and will need enormous maintenance expenditures in the coming years just to maintain service at acceptable levels. But the tax base needed to provide for that maintenance has moved to the suburbs, where competition for funds will be provided by the need to increase highway capacities to accommodate dramatic growth in suburban-to-suburban travel.

Implications for Transportation Planning

Early regional transportation planners looked at the city and theorized about the economic functions they observed. The models they devised encapsulated an understanding of urban form and function appropriate to their day. The Lowry and EMPIRIC urban development models, for example, treated the location of "basic" employment as exogenously determined, and they allocated growth in services and residential areas as functions of accessibility to basic employment. Because of the shifts in urban economies described above, these models now seem incredibly obsolete. Basic employment, largely manufacturing, has abandoned the city and no longer determines its form. Service employment, having taken on the central role once played by manufacturing, is footloose and often follows residential employment, reversing the direction of causality represented in earlier models. Those models allocated growth but paid scant attention to the redistribution of existing employment, capital, and population, which seem to be so much more important today. They were insensitive to the social, economic, and ethnic differences of the populations that they located in different zones, but today these seem to be among the most important policy variables to transportation planners. More recent urban development models have dealt more effectively with redistributive questions and have more

effectively accounted for the differential patterns of growth on different economic and social groups. Still, it seems fair to say that urban development models remain a weak link in the transportation planning process. Transportation planners fail to represent the dynamics of urban economic change in their methods and give far less attention than they should to the shifting nature of urban employment and the shifting economic base that is one of the most critical determinants of travel.

Transportation planners continue to urge huge capital investments in increased capacity for movement between central cities and suburbs. In part, we are operating on the basis of models that were calibrated in an era of growth in travel of this type and have not yet caught up with the reality that the growth in travel is to be concentrated in the suburban-to-suburban pattern. We need methods to deal more explicitly with suburban highway and transit needs and are contributing to further problems by failing to reorient our work in this direction. Proposals for increased capital investment in transportation as a strategy for revitalizing city cores seem naive, politically motivated, and self-serving. They display shocking ignorance of urban economic trends. They continue to be made and, when implemented, contribute substantially to the transportation problems of the next decades. We are creating a huge capital plant that will have to be maintained for decades to come, without reversing economic trends that have a momentum scarcely affected by these investments. At the same time, we are ignoring the growing need for capital investment in transportation facilities in the suburbs and are failing to develop new kinds of transportation options specifically tailored to suburban markets. These might involve different technologies, different pricing structures, and different locational criteria than those employed in planning for radial travel between suburbs and the central business districts.

New theories and causal models must encapsulate an understanding of the current urban economy. Methodologists today focus on disaggregate choice models and multivariate statistics and are seemingly less interested in linking metropolitan economic trends to the demand for travel. Recent equilibrium models contain relatively weak representations of the dynamics of urban economies. Models of destination choice and trip distribution, like urban development models, should reflect the changing relationships between urban form and travel as well as implications for travel of new patterns of household composition. We need a new generation of theories and methods relating urban form and function to travel, and the methods we seek barely resemble the methods of the sixties.

CHANGES IN PRICES OF TRANSPORTATION AND HOUSING

Transportation planners, like most citizens, have taken note of recent price increases in gasoline. It has been claimed that a long-term pattern of cheap fuel has been permanently ended, and that during the rest of the 20th century more expensive fuels will cause major changes in American life. Reduced driving, declining car ownership, burgeoning demand for public transit, and the reversal of suburbanization in favor of more central locations have all been prophesied. Most of these forecasts have been naive, and some even panicky.

Recent Trends in Prices

At the end of May 1981, the Consumer Price Index (CPI) for gasoline stood at 414.8, while the index for all goods and services was 269.0²⁴. Since 1967, the price of gasoline had risen 1.54 times as much as the average for all goods and services. Notably, most of that increase occurred in relatively recent years. It would be a mistake, however, to leap from this single dramatic fact to conclusions about future travel behavior. Gasoline represents only a part of the cost of transportation, and we must also consider the influence of other components of travel cost. Furthermore, travel is so dependent on household location that prices of housing and transportation must be considered jointly in speculations about future travel.

One recent estimate of the total cost of driving showed that a new compact car kept by its owner for 10 years and driven 10,000 miles per year, cost in 1980 a total of 27.9 cents/mile to operate. An intermediate car, kept the same length of time and driven the same yearly mileage, cost 31.0 cents/mile. If the same new cars were kept only 3 years and sold with 30,000 miles on their odometers, the cost per mile driven rose to 39.75 cents for the compact and 43.99 cents for the intermediate car, since depreciation of the resale value of a new car is most rapid in the early years. These figures are averages for 20 large cities²⁵.

Interestingly, of these totals, gasoline, maintenance, and oil represent a very small cost in relation to the fixed costs of depreciation, interest, insurance, and registration fees. If the compact car were to be sold after being driven for 3 years at 10,000 miles per year, gasoline and oil will have cost only 8 cents/mile, and maintenance only 2.3 cents/mile, while the fixed costs amounted to 29.5 cents/mile. Fixed costs then amount to 75 percent of the costs of ownership, if a compact car is kept 3 years and driven 10,000 miles per year. Driving the same car 10 years drops the fixed costs to 60 percent of total cost, still a significant proportion²⁵. In the short run changes in the variable costs of travel can surely have a pronounced effect on travel decisions, but in the longer run the entire price structure of transportation and housing will influence travel patterns through locational decisions and automobile purchase patterns. We have yet to represent the complexity of these price structures in transportation planning methods.

It is difficult to believe that in the long run gasoline price rises will have so great an effect on travel as some people say they will. Table 1²⁴ shows that the price indexes of new cars, used cars, and automobile maintenance all rose much more slowly than the price of gasoline, so that the total index of prices for private transportation stood at 274.7 at the end of May 1981²⁴. This index was virtually the same as the CPI for all goods and services (269.0). Despite rises in gasoline prices, then, the total cost of automobile transportation rose far less dramatically.

We travel because of the spatial separations between homes and workplaces, stores, and recreational facilities, so to a certain extent costs of housing will dictate travel patterns along with the costs of travel itself. It is interesting to note that the CPI for home ownership stood at 345 at the end of May 1981²⁴. This includes mortgage payments, taxes, and maintenance of the structures in which we live, but not the furnishings. Thus, home ownership costs have risen much more in the last 13 years than the costs of private transportation.

Table 1. Consumer price index as of May 1981 (1967 = 100) for selected items.

<i>Item</i>	<i>Index</i>
All	269.0
Shelter	308.4 (includes home ownership, rental rates)
Home Ownership	345.0
Transportation	276.5 (includes all following categories)
Public	297.7
Private	274.7 (includes all following categories)
Used cars	242.3
New cars	190.1
Maintenance and repair	290.2
Gasoline	414.8

Furthermore, Table 2²⁶ shows that housing, depending on family income, accounts for 20 to 25 percent of household budgets, while transportation accounts for only 7-9 percent, and that these percentages have proven remarkably stable over time^{26,27}. They are expected to change slowly in the future and, in fact, home ownership is now rising in cost more rapidly than transportation.

Implications for Travel

In 1979, VMT were 3.5 percent below the levels of 1978⁷, but in 1979 there was a period of several months during which gasoline was in short supply. I find it hard to believe that the price rise was nearly as significant a determinant of the reduced travel volumes as the temporary reductions in supply. During the 1980s, I expect that drivers will be sensitive to the joint price structure of transportation and housing, and not

Table 2. Annual budgets and expenditures for housing and transportation for an urban family of four, 1970 and 1979.

<i>Budget Type</i>	<i>Lower Budget</i>	<i>Inter-mediate Budget</i>	<i>Higher Budget</i>
1970 total annual household budget	\$6,960	\$10,664	\$15,511
Transportation component	7.3%	8.6%	7.6%
Housing component	20.5%	23.3%	24.4%
1979 total annual household budget	\$12,585	\$20,517	\$30,137
Transportation component	8.0%	9.0%	8.0%
Housing component	19.1%	22.3%	23.1%

merely the pump price of fuel. With housing costs rising faster than transport costs and family housing budgets more than three times their travel budgets, we should continue to see households choosing less expensive houses at locations that require more driving rather than more costly houses at central locations.

In the short run, drivers can compensate for the rising variable costs of travel (gasoline and oil) by lowering the fixed costs. This can be done by keeping an older car longer or purchasing a used car rather than a new one and avoiding capital outlays and interest payments. In the longer run, people will reduce both fixed and variable travel costs by purchasing smaller, more fuel-efficient automobiles. This, of course, will allow VMT to increase without necessarily increasing aggregate fuel consumption. A recent opinion survey, for example, showed that about 90 percent of the Automobile Club members in southern California expected the next car they purchase to be smaller than their current one²⁸.

Shoup and Pickrell²⁹ have shown that three-quarters of all cars driven to work in America are parked free in employer-provided spaces, and when free on-street parking is added in, about 93 percent of all commuters park free at work. The influence of free parking is quite dramatic, and indeed it may cause many workers to drive alone to work despite recent increases in the price of gasoline. This is true because the median round-trip journey to work is about 14 miles, so a car that gets the national average of 14 miles/gal of gasoline would use just 1 gal of gasoline for a daily work trip. Thus, according to Shoup and Pickrell, free parking is a larger subsidy than free gasoline for the trip to work for those whose real daily cost of parking exceeds the price of a single gallon of gasoline. In most downtown areas, of course, the market price of daily parking is far larger than the price of a gallon of fuel. Furthermore, if one uses the bus or rides in a carpool, one saves the price of fuel. When switching to another mode, however, one must pay the fare for a bus or train or share the cost of a carpool, while giving up the subsidy derived from the use of a free parking space. It would seem, therefore, that parking routinely provided free or at subsidized rates provides an incentive to drive alone that far outweighs any disincentives resulting from recent gasoline price increases. If parking subsidies can outweigh gasoline prices in the decision to drive, house prices, wage differentials, and the fixed costs of automobile ownership will in combination certainly be more significant determinants of travel than pump prices of gasoline.

Where public transit provides a possible alternative to commuting by automobile, it is also critically important to consider the price of transit in comparison with the price—particularly the variable price—of the automobile. The July 1981 CPI report showed that double-digit inflation had returned and singled out price increases in public transit as among the most critical price increases in recent months²⁴. Public capital and operating subsidies caused transit prices to rise very slowly in real terms during the 1960s and early 1970s, but now they are rising dramatically. The retention of flat fares has caused many makers of short trips to abandon transit and return to their automobiles in the face of fares that approach a dollar, while flat fares continue to favor longer tripmakers. In Los Angeles, a recent increase in the base fare from 65 cents to 85 cents was associated with a decline in daily ridership of 11 percent, approximately twice the decline anticipated³⁰. The fact that this price increase came at precisely the same time as

an oil glut and falling gasoline prices helps to illustrate the importance of the interrelationships among the various elements of the transportation price structure.

Implications for Transportation Planning

Urban transportation planning models are known for their detail and complexity, but they contain surprisingly simplistic representations of the many prices that influence travel. This probably arises from the fact that standard planning methods were perfected when the price of travel was relatively stable. Whether one used time series or cross-sectional models, it was difficult in 1960 to find statistical associations between travel and prices because there was little variance in prices over time or across space. We have recently been forced to discover that price is important, having experienced dramatic shifts in the structure of prices. But, the press and even transportation planners have oversimplified the importance of price variables in determining travel behavior. I hope that my little excursion into a discussion of house prices, free parking, transit fares, and component costs of automobile ownership convinced you that we will continue to misspecify transportation models by hastily adding the price of gasoline as a single independent variable. The price of gasoline is only one component of the complex web of housing and travel costs influencing travel behavior. The structure of relationships among the many components of price is changing constantly, and their associations must be taken into consideration in long-range planning.

Relationships between the price structures and the demand for travel should become critical ingredients in transportation methods not only because they contribute to the traditional objective of forecasting traffic flows by mode. As fuel consumption drops and VMT continues to rise, there are many implications for trust fund economics. Revenues from gasoline, property, and sales taxes will all have to be scrutinized and anticipated in both highway and transit planning during the coming decades, as transportation planning becomes increasingly constrained by limited resources. Here again, home ownership prices, travel expenditures, and disposable income are tied together, since transportation budgets are increasingly drawn jointly from several tax sources and the mix of support changes from time to time as a matter of policy.

CONCLUSION

Three major trends have been highlighted and illustrated in this paper. First, demographic and functional changes in American households are giving rise to the possibility that travel will no longer be statistically associated with traditional predictive variables. More complex notions of life style hold promise as ways of explaining and predicting travel in relation to household structure. Second, urban economies are changing, and the transition to the post-industrial metropolis is transforming the nature of labor markets and urban form from which travel patterns are also drawn. Finally, the price structure of housing and private and public transportation is also changing in ways that have not yet been fully appreciated or understood, but which also are bringing about substantial shifts in travel

patterns. Although I presented these trends individually, they certainly are not independent of one another, and their interaction increases by orders of magnitude the complexity of the phenomena we must confront.

As in the past, transportation planners will continue to be called on to forecast and analyze travel patterns, the social and environmental impacts of travel, and fiscal and economic consequences of alternative transportation programs. Comparing our capabilities today with those of the 1960s, it is clear that we know much more about the applicability of statistical techniques and are much more facile with computer methods and data processing. We may, however, understand the underlying social and economic determinants of travel only a little better than did our predecessors who developed early transportation planning methods. Without greater understanding of these factors, our advanced techniques can fool us with their apparent precision and sophistication.

Transportation planning will continue to be a highly political, emotionally charged, and value-laden area of public policy, as it has always been. In such a setting, technical experts can be supportive of public policymaking only by understanding the social, demographic, and economic determinants of travel.

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